THE UNIVERSITY OF SYDNEY

Contraception, Unintended Pregnancy and Substance Use Disorder

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Statement of originality

This is to certify that to the best of my knowledge, the content of this thesis is my own work. This thesis has not been submitted for any degree or other purposes.

I certify that the intellectual content of this thesis is the product of my own work and that all the assistance received in preparing this thesis and sources have been acknowledged.

Signature:

Name: Dr Kelly McNamara

Date: 12 January 2025

Author Attribution Statement

The work presented in this thesis was carried out by Dr Kelly McNamara, and this thesis is principally her work. It was conducted under the primary supervision of Professor Kirsten Black and co-supervision was provided by Professor Natasha Nassar and Associate Professor Bridin Murnion, and early in the candidature, Professor Nicholas Lintzeris. This thesis contains material that has previously been published, accepted for publication, or is currently under review at peer-reviewed journal. Published articles are available in the appendix, along with statements of relative contributions for each co-author. The following general statement of acknowledgement is made:

Chapter 1 includes a scoping review, published as:

McNamara KA, Murnion B, Fotheringham P, Terplan M, Lintzeris N, Oei JL, Bond D, Nassar N, Black K. Interconnections between unintended pregnancy, alcohol and other drug use, and pregnancy, birth, infant, childhood and socioeconomic outcomes: a scoping review. BMJ Sex & Reproduct Health. 2024 Pages bmjsrh-2023-202140. DOI: 10.1136/bmjsrh-2023-202140

Kelly McNamara conceptualised and designed the study, contributed to and co-ordinated data collection, analysed the data and wrote all drafts of the manuscripts.

Chapter 2 includes a manuscript that has been submitted for publication as:

McNamara KA, Black K, Murnion B, Shand A, Henry A, Ludlow J, Hankins K, Chinoy R, Nassar N. Unintended Pregnancy, and Pregnancy and Birth Outcomes, in Women with Substance Use Disorder: A Retrospective Cohort Study. Acta Obstet Gynecol Scand. Under Review.

Kelly McNamara conceptualised and designed the study, co-ordinated data acquisition, cleaned and analysed the data, and wrote all drafts of the manuscript.

Chapter 3 includes a manuscript that has been published as:

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Kelly McNamara designed the study, cleaned and analysed the data, and wrote all drafts of the manuscript.

<u>Chapter 4</u> includes a manuscript that has been submitted for publication as:

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Kelly McNamara designed the study, contributed to data collection, cleaned and analysed the data, and wrote all drafts of the manuscripts.

The remainder of the thesis, including the narrative review part of Chapter 1, and Chapters 5-9 were written by Kelly McNamara. Unless otherwise cited, she also created and revised all tables and figures.

Dr Kelly McNamara

Faculty of Medicine and Health, The University of Sydney Dated: 12 January 2025

Professor Kirsten Black

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closest friends at the university, including my husband. It's fair to say my association with the university has been pivotal in shaping my adult life.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

ALSWH: Australian Longitudinal Study of Women's Health

AOD: Alcohol and Other Drugs

aOR: Adjusted Odds Ratio

CDC: Center for Disease Control and Prevention

CI: Confidence Interval

ICD: International Classification of Disease

IUD: Intrauterine contraceptive device

LARC: Long-Acting Reversible Contraception

LMUP: London Measure of Unplanned Pregnancy

NSFG: National Survey of Family Growth

NZ: New Zealand

OR: Odds Ratio

OUD: Opioid use disorder

PhD: Doctor of Philosophy

PRAMS: Pregnancy Risk Assessment Monitoring System

SUD: Substance Use Disorder

UK: United Kingdom

USA: United States of America

WHO: World Health Organization

Definitions

Unintended pregnancy

An unintended pregnancy is a pregnancy that occurs at a time when the woman did not desire to be pregnant. A pregnancy that occurs sooner than was desired is termed a mistimed pregnancy and a pregnancy that the woman did not wish to conceive at all is called an unwanted pregnancy.(1) An unintended pregnancy that continues to birth is called an unintended birth. Similarly, a mistimed or unwanted pregnancy that continues to birth is a mistimed or unwanted birth respectively.(1, 2) Unintended pregnancy, particularly in the case of as mistimed pregnancy, does not always mean the woman is unhappy about being pregnant. There are multiple ways to define pregnancy intention, including using a dichotomous measure (intended/unintended) or using measures that capture pregnancy intention as a continuum, with some incorporating ambivalence to pregnancy or happiness about being pregnant.(3) An unintended pregnancy may occur due non-use of contraception or failure of the chosen method of contraception.(4) An unmet need for contraception occurs when a woman who wishes to avoid or defer pregnancy does not use contraception because she is not able to access it.(5) However, non-use of contraception is not always the consequence of an unmet need for contraception, such as in the case of reproductive coercion or sexual violence, or unplanned sex in the setting of risky sexual behaviour associated with intoxication.(6-8)

Alcohol and other drug use, and substance use disorder

Alcohol and other drug (AOD) use, or substance use, refers to all patterns of use of any psychoactive substances, including use that causes harm to the person or others, and use that does not cause harm. This includes use of alcohol, illicit drugs and non-medical use of prescription drugs (9, 10). The WHO uses the term 'drugs' to refer to use of illicit drugs and non-medical use of prescription drugs, but not alcohol or nicotine.(10) Similarly in this thesis, 'alcohol and other drugs' will refer to alcohol, illicit drugs and non-medical use of prescription drugs, but not nicotine. Where information on nicotine use is provided, this will be explicitly stated. In Australia, the term 'alcohol and other drug use' is commonly used, and this will be used interchangeably with 'substance use' in this thesis, in recognition of the Australian setting of much of the work. A small portion of people who use alcohol and other drugs will develop a substance use disorder (SUD).(10, 11) Substance Use Disorder (SUD) is characterised by ongoing use of a substance/substances despite experiencing substance related problems, and can be mild, moderate or severe depending on the extent of symptoms.(12) The work for this PhD commenced in 2017 and, unless otherwise indicated, follows the ICD-10 classification for substance use disorder, which includes two main domains: 1) harmful

patterns of substance use and 2) substance dependence. Whilst the ICD-11 came into effect during this PhD candidature, the change from 'Substance Use' to 'Psychoactive Substance Use" and the addition of the category 'Episode of Harmful Psychoactive Substance Use' are unlikely to be relevant to this work.(10, 13) Whilst most people who use AOD do not have a use disorder, much of the literature, particularly the obstetric literature, uses the terms AOD and SUD interchangeably. Clarification throughout this thesis will be made, where required.

Women and Pregnant Women

The term 'pregnant women' is used throughout this thesis to reference any pregnant person, and the term 'woman' is used to refer to anyone who requires obstetric or gynaecological care. These terms are not intended to exclude transgender or non-binary individuals, recognising that language in this area is evolving, particularly over the duration of this PhD candidature. This approach is consistent with the current approach taken by the Royal Australian and New Zealand College of Obstetricians and Gynaecologists.(14)

Thesis Abstract

Background

Unintended pregnancy and substance use in pregnancy (SUD) are both recognised risk factors for adverse pregnancy and birth outcomes, such as preterm birth and low birth weight, and important other issues including interpersonal violence and abuse and maternal psychosocial wellbeing. However, little is known about how unintended pregnancy intersects with SUD to impact maternal and infant health. Little too is documented on the prevalence of SUD in pregnant women and on their risk of unintended pregnancy given that alcohol and other drug (AOD) use is intrinsically intwined with lack of access to contraception. The root cause for this relates to a high prevalence of adverse socioeconomic factors, such as poverty and education, in women with SUD, and increased sexual risk-taking during intoxication with alcohol and other drugs. At the commencement of this PhD (in 2017) there was little evidence, particularly in the Australian setting, about how to provide effective interventions to increase access to contraception and reduce unintended pregnancy for women with SUD. Women with SUD engage with AOD treatment services, and if pregnant attend maternity services, both of which represent opportunities to provide access to contraception care.

Methods

This PhD is comprised of four main studies. The first is a scoping review that investigated the relationship between unintended pregnancy and use of alcohol and other drugs, and how these factors combine to impact health, economic and social outcomes. The scoping review included all patterns and severities of AOD use to adequately canvass all literature on the topic. This review utilised the Joanna Briggs Institute Methodology for Scoping Reviews and PRISMA reporting guidelines. The second study is a retrospective cohort using maternity datasets from 2017-2020 from five health districts in New South Wales, representing 27.5% of the births in the state. It examined the prevalence of SUD in pregnancy and pregnancy intention in pregnant women with SUD. Using IBM SPSS, univariate and multivariable analyses were undertaken to describe the effect of unintended pregnancy on pregnancy and birth outcomes in women with SUD. The third study is a retrospective cohort study from 2011-2019 from one NSW health district, representing 6.6% of births in the state. It used IBM SPSS to analyse an existing maternity dataset to examine initiation of post-partum contraception, and contraception method of interest, from the birth admission, comparing women with and without SUD. The fourth study undertaken was a prospective interventional pilot cohort study that enrolled non-pregnant women with SUD across two AOD services in New South Wales to test a pathway for facilitated access to contraception and to document contraceptive use at baseline and 12 months.

Results

The scoping review identified only three sources that examined the relationship between unintended pregnancy and AOD use on health, economic and social outcomes, and none which reported on pregnancy and birth outcomes. There were methodological differences between the study populations, outcomes examined, and adjustment for confounders meaning comparison between studies was not possible. Continued drinking into the third trimester of pregnancy was the only association with unintended pregnancy that persisted following an adjustment for confounders. A maternity dataset of 73,064 pregnant women identified 579 women with SUD, equating to a prevalence of SUD of 0.8%. In women with SUD, 73.9% had an unintended pregnancy, which was almost three times higher than women without SUD. Following adjustment for confounders, amongst those with unintended pregnancy there was almost twice the odds of maternal and neonatal length of stay greater than five days, and two-thirds the odds of use of general, spinal or epidural anaesthesia use in labour and birth, compared to those with and intended pregnancy. No other pregnancy and birth outcomes were associated with unintended pregnancy.

Another existing maternity dataset of 59,195 women showed those with SUD had more than six times the odds of initiating contraception during the birth admission compared to women without SUD, although initiation was less than 15% in both cohorts. Women with SUD also had more than six times the odds of expressing interest in highly effective contraception methods, including intra-uterine devices, hormonal implants and male or female sterilisation. This dataset showed a prevalence of SUD in pregnant women of 0.7%. In the women with SUD, unintended pregnancy was almost three times more common compared to those without SUD.

Finally, the intervention project enrolled 100 women, 89 of whom were not planning to conceive within 12 months, who were engaged in care at one regional and one metropolitan AOD treatment services. 28.1% of those not planning to conceive initiated contraception, predominantly intra-uterine devices. Despite this, 14.6% were pregnant by 12 months. There was significantly more initiation of effective and highly effective methods of contraception at the regional AOD service compared to the metropolitan AOD service. This was thought to be due to a range of internal and external study factors, including the presence of clinical champions and care navigators, and differences in the study populations.

Conclusions

The intersection between unintended pregnancy and AOD use on health, economic and social outcomes has not been well researched and represents a substantial gap in the literature. However, amongst women with SUD, our study does not demonstrate an association between pregnancy or

birth outcomes, such as preterm birth or low birth weight, and pregnancy intention, in women with SUD. Differences in outcomes such as maternal and infant length of stay may be explained by the provision of psychosocial support or other elements of clinical care planning, or child protection involvement. This suggests women with intended pregnancies may have less unmeasured psychosocial risk factors than women with unintended pregnancy. This study also indicates the prevalence of known SUD in pregnant women is around 0.8%, however this is likely underreported as women may not disclose their SUD to maternity providers. Almost three quarters of pregnant women with SUD had an unintended pregnancy. The post-partum contraception study showed whilst initiation of post-partum contraception from the birth admission was low in all women, it was elevated in women with SUD, suggesting it may already be optimised in that cohort. Women with SUD demonstrated an increased interest in highly effective methods of contraception, and therefore ensuring they have access to those methods is important. The prevalences of SUD in pregnant women and unintended pregnancy in pregnant women with SUD were comparable to the earlier study. Facilitated access to contraception within Australian AOD treatment services can increase initiation of effective and highly effective methods of contraception, however significant differences between the involved regional and metropolitan AOD services indicate provision of service alone is not adequate to increase initiation. The nature of the pathway, including care navigation and the involvement of clinical champions, as well as the unmet contraception need within the local population, are likely important. Ensuring equitable access to contraception, and ongoing evaluation of the impact of unintended pregnancy, for women with SUD, should be health priorities.

Thesis Roadmap

Thesis aims

Substance use disorder (SUD) and unintended pregnancy are two important public health issues, that both have root causes in social determinant of health, such as poverty, education and trauma. This thesis has two broad aims: 1) to investigate the rate of SUD and unintended pregnancy, and how the intersection of these issues is associated with outcomes following a pregnancy; and 2) investigate contraception use (as a mechanism to prevent unintended pregnancy) and programs to increase access to contraception, in women with SUD.

Setting

The work in this thesis is focused on high-income countries. At times a global context, including low, middle, and high-income countries, is provided. However, the rest of the thesis remains focused on high-income countries. Additionally, all primary research studies in this thesis were conducted in Australia.

The population of interest in this thesis is women with SUD. However, much of the literature, particularly the obstetric literature conflates SUD with alcohol and other drug use (AOD), and therefore at times both terms are used. I have tried to explain throughout the thesis the difference and define which population is discussed.

Orientation of Thesis

This thesis is written in eight chapters, including one peer-reviewed publications, two peer-reviewed manuscripts that have been accepted for publication and are in press, and one publication that have been submitted for peer review (collectively referred to as publications hereafter). In accordance with the University of Sydney Policy: Thesis and examinations higher degrees by research policies (2015), the publications are not included in chronological order, but rather in an order than creates a coherent narrative of the work.

The publications are presented in the chapters in consistent formatting with the larger thesis, and a copy of the published manuscripts are provided in the appendix. Each publication is a discrete research study, with separate aims and methods, therefore the methods are presented within each individual chapter, rather than a separate thesis chapter for methods. Funding details are also provided alongside the publications within each chapter. Each chapter has been edited for publication, and components of the introduction and discussion of the published manuscripts appear in the thesis literature review and discussion, respectively. In particular, the discussion about each study strengths and limitations, and future research directions appears within thesis discussion, rather than the individual chapters. The exception is the scoping review, in which the strengths and

limitations are included in the introduction (Chapter 1:), yet also repeated in the thesis discussion (Chapter 6). It has been presented this way because the scoping review is a key part of the thesis introduction and its strengths and limitations are relevant to the work in other chapters, however it is also relevant to the overall findings of the thesis.

At times, there may be some repetition, particularly between the discussion of individual chapters and the thesis discussion in Chapter 6. References are provided at the end of each chapter, and the numbering system for references is chapter specific.

Chapter 1 is a literature review. It starts with a published scoping review that investigates how unintended pregnancy and alcohol and other drug use are interconnected issues, with common social determinants of disease, and the synergistic impact on a broad range of outcomes from maternal, infant and child outcomes following the pregnancy. The remainder of the literature review is a narrative that reviews the available evidence of 1) epidemiology of both substance use disorder and unintended pregnancy in Australian and international settings. It specifically describes the intersection of these issues by reviewing unintended pregnancy rates in women with substance use disorder; 2) Contraception, generally and in women with substance use disorder; 3) Programs that provide access to contraception for women with SUD.

This literature review was written in 2019, with the scoping review added upon publication in 2024. The remainder of the literature review was updated in 2024, prior to submission of the thesis for examination.

Chapter 2 is a retrospective cohort study that investigates the rate of substance use disorder in pregnant women, compares the rate of unintended pregnancy between women with and without substance use disorders, and examines associations between pregnancy and birth outcomes and unintended pregnancy. To do this, it uses a large maternity dataset from the public maternity hospitals within five New South Wales (NSW).

Chapter 3 is a retrospective cohort study that investigates post-partum contraception plans made during the birth admission, including initiation of contraception in hospital. It also investigates the rate of substance use disorder in pregnant women. To do this is uses a large maternity data set, with eight years of data, from maternity services within a single NSW local health district. It is important to point out that the LHD in this study is one of the five LHDs in the study in chapter 2, and two years of data cross over.

Chapter 4 is a pragmatic clinical cohort study that pilots and intervention to provide contraception to women who attend AOD treatment services. The project involves contraception education for staff

and participants. It identified women who did not wish to conceive within 12 months and tested an intervention package that was designed to remove some of the practical barriers to accessing contraception that women with SUD experience.

Chapter 5 explores lesson learnt throughout the PhD candidature. It explores themes of conducting sexual and reproductive health research in women with SUD, acknowledging there are additional ethical considerations. It explores difficulties recruiting women with SUD for this type of research and the challenges experiences throughout the Covid-19 pandemic.

Chapter 6 provides a summary of the findings of the thesis and a discussion of the results. Strengths and limitations of individual studies, and future directions are also explored here.

Chapters 7 to 9 are appendices. Chapter 7 contains supplementary tables, figures and information for the other chapters. Chapter 8 contains copies of published manuscripts (where available) and author contribution statements for chapter 1 to 4. Chapter 9 is a list of presentations, and other manuscripts that I have worked on during the PhD candidature.

Chapter 1: Literature Review

1.1: Interconnections between unintended pregnancy, alcohol and other drug use, and outcomes from pregnancy

McNamara KA, Murnion B, Fotheringham P, Terplan M, Lintzeris N, Oei JL, Bond D, Nassar N, Black K. Interconnections between unintended pregnancy, alcohol and other drug use, and pregnancy, birth, infant, childhood and socioeconomic outcomes: a scoping review. BMJ Sex & Reproduct Health. 2024 Pages bmjsrh-2023-202140. DOI: 10.1136/bmjsrh-2023-202140

This section of the Chapter 1 was adapted and reformatted for publication. It provides an overview of why unintended pregnancy and alcohol and other drug use in pregnancy are two important, yet interconnected issues. It also examines health, social and economic outcomes following a pregnancy impacted by both unintended pregnancy and alcohol and other drug use.

A copy of the published article and author contribution statements are available in **Appendix B: 8.1 and 8.2.**

1.1.1: Introduction

Unintended pregnancy (UIP) and alcohol and other drug (AOD) use are interconnected issues that potentially impact the lives of pregnant women and their offspring. AOD intoxication is associated with risky sexual behaviour that may lead to UIP.(15-17) AOD use is associated with higher rates of UIP compared to the general population.(18, 19) Worldwide, 44% of all pregnancies are unintended.(1) In women with opioid use disorder, 78-86% of pregnancies are unintended,(20, 21) in women who use cannabis 64.7% are unintended,(22) and in women with binge or heavy alcohol use 67-74% of pregnancies are unintended.(23, 24) Typically, AOD use reduces following recognition of pregnancy,(25) however UIP is associated with delayed recognition of pregnancy.(26) Therefore, UIP results in fetal exposure to AOD during the first trimester.(27, 28)

Disentangling the impact of AOD on adverse pregnancy, birth, infant and childhood outcomes from socio-economic deprivation and social determinants of disease, is complex.(29) Nevertheless, there are outcomes that are substance use specific, such as the association between low and higher level use of alcohol and fetal alcohol spectrum disorders.(23) Preterm birth and low birth weight are associated with opioid use disorder, although access to integrated obstetric and AOD care, and maintenance on an opioid treatment program (with methadone or buprenorphine) substantially reduces the risk.(30-32) Amphetamine use is associated with pre-eclampsia and low birth weight.(33, 34)

UIP is associated with similar types of adverse pregnancy, birth, infant and childhood outcomes to AOD use. These include preterm birth, low birth weight and small for gestational age neonates, although the strongest reported associations have been with unadjusted data and unwanted pregnancy.(35, 36) A range of psychosocial issues are linked to UIP including a higher risk of interpersonal physical, sexual, and emotional abuse, as well as psychological morbidity.(37-39)

AOD use encompasses low level use as well as use within the context of a substance use disorder (SUD).(40, 41) To identify and understand all available evidence, this review takes a broad approach examining all AOD use in pregnancy. The objective of this scoping review is to investigate the relationship between UIP and AOD use, and how they interact to affect pregnancy, birth, infant, childhood, social and economic outcomes in high income countries. The purpose of this scoping review is to identify research gaps, and to inform policy development and practice in maternity and reproductive health settings.

1.1.2: Methods

Protocol, search strategy, eligibility criteria

Development of this scoping review used the Joanna Briggs Institute (JBI) Methodology for Scoping Reviews.(42) An *a priori* protocol was registered on Open Science Framework.(43) The reporting of the review adhered to the PRISMA extension for scoping reviews.(44)

The main search included Medline (via Ovid), Embase, Scopus, CINAHL, Google Scholar, Cochrane Database of Systematic Reviews and TRIP electronic databases. The key search terms were: unplanned pregnancy; unwanted pregnancy; Substance-Related Disorders; Addiction Medicine; Alcohol Drinking; Illicit Drugs; Designer Drugs; Drug Misuse. The search strategy for all included databases has been included in **Appendix A:Table 7-1**. An internet search was also included to identify any relevant international guidelines, including from the World Health Organization, US Center for Disease Control and Prevention (CDC), the European Centre for Disease Prevention, and national guidelines from Europe, Australia, and North America.

Studies were eligible for inclusion if they were:

- published from January 2000 to June 2023.
- conducted in high income countries (as defined by World Bank- **Appendix A: Table 7-2**).(45)
- written in, or translated into, English.(The initial protocol excluded studies not written in English language, however the search strategy did not apply this limit and Google Translate was used to review journal articles written in languages other than English.(46))

- primary research studies, including quantitative and descriptive epidemiological studies, prospective and retrospective cohort studies, case control studies and analytical cross-sectional studies, or health economic analyses.
- conducted in pregnant women who use alcohol, illicit or illegal drugs and non-medical use of prescription drugs, including, but not limited to, pregnant women who are engaged in alcohol and other drug treatment, including any pattern of AOD use.
- reported on interactions between AOD use and unintended pregnancy.

Studies were excluded if:

- there was no comparison to intended pregnancy.
- they were case series, reviews, audits, or qualitative research.
- tobacco was the only drug used.

Search

The search was conducted in February 2021, in accordance with the developed search strategy. Due to the interval between the search and publication, an updated search was conducted in Medline (via Ovid) in June 2023.

Screen

All identified studies were uploaded into Endnote.(47) A pilot title and abstract screen was conducted of 25 citations by two authors (KM and KB) to define the process for screening. All identified citations were uploaded into Covidence Systematic Review Software and duplicates were removed.(48) The titles and abstracts were screened according to the eligibility criteria by two reviewers (KM, KB, BM, and/or PF). For the updated search in June 2023, title and abstract screening was performed by one author (KM). Selected full texts were assessed for eligibility by two reviewers (KM, and KB, PF, or DB). Conflicts at both the title and abstract stage and full text review were resolved by discussion between the screening reviewers, or a third reviewer.

Following the selection of studies for inclusion, reference lists of included sources were screened; authors from two included sources were contacted, and an international expert in AOD use and UIP was contacted to identify additional evidence sources. Additional sources were then screened by 2 reviewers (KM, and KB, PF, or DB).

Data extraction

The data extraction template was adapted from JBI template source of evidence detail, characteristics and results extraction instrument and modified for input into Covidence Systematic

Review Software.(48, 49) The template included information on the type of evidence sources; countries of research; time-period, participant characteristics; classification of outcomes (maternal/fetal/neonatal/childhood, health/social/economic); the measure of frequency of UIP in the source population; the measure of effect on UIP on the outcomes of interest. The data domains for extraction were defined in the protocol *a priori*, however two additional domains were added prior to the extraction (type of publication; frequency of outcome(s) in the study population). **Appendix A: Figure 7-1** shows the data extraction template. A quality assessment tool was developed using the JBI Critical Appraisal Checklist for Cohort Studies and imported into Covidence Systematic Review Software.(48, 50) Data extraction and quality assessment for included sources was performed by two reviewers (KM, KB), with conflicts resolved by discussion. A pilot data extraction was unnecessary as only three articles were identified for inclusion in the study.

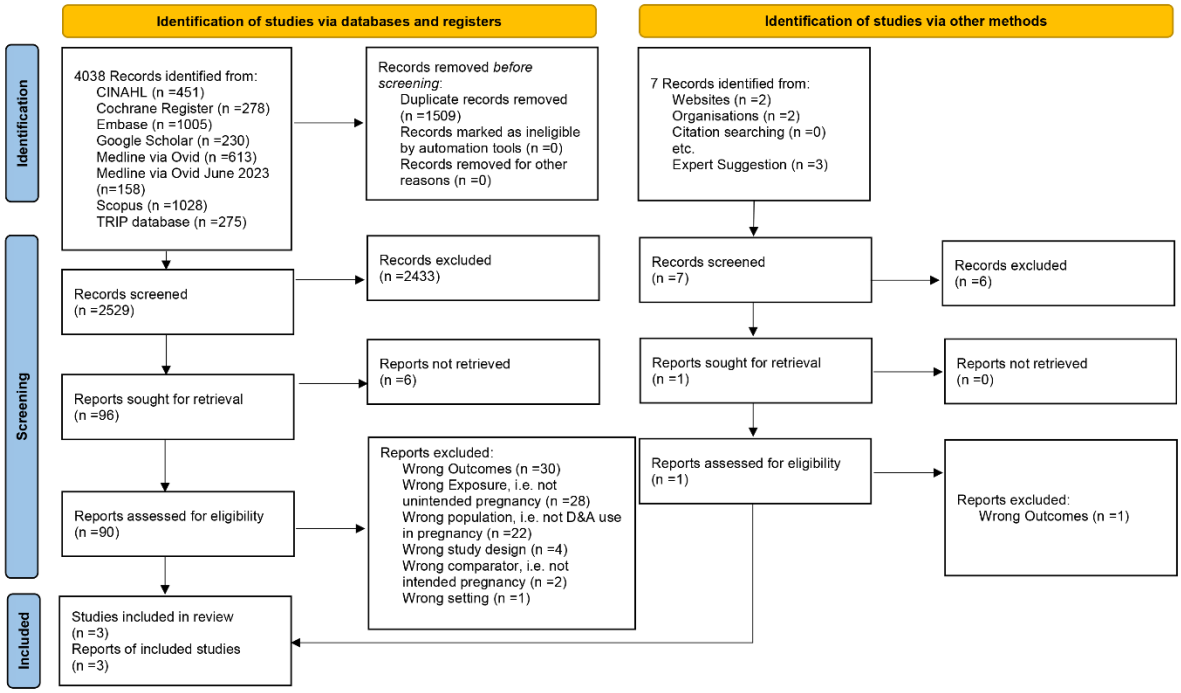
Data collation and summary

Extracted data were summarised into tables and given the limited number of studies identified and heterogeneity of findings, results were summarised and reported descriptively. A systematic synthesis of results was not possible due to the heterogeneity of measured outcomes .The PRISMA reporting checklist for scoping reviews is provided in **Appendix A: Figure 7-2.(**44)

1.1.3: Results

The search identified 4046 citations. Following the removal of duplicates, the titles and abstracts of 2,536 evidence sources were screened, 97 full texts were identified for full text review and three studies selected for inclusion in the scoping review. **Figure 1-1** shows the PRISMA 2020 flow diagram for study selection.(51)

Figure 1-1: PRISMA 2020 Flow Diagram for Scoping Review



The three included studies varied in terms of methodology, population characteristics, measured outcomes, and results (**Table 1-1)**. The first study was a secondary analysis of prospectively collected cohort data from a randomised controlled trial of opioid treatment therapies in pregnancy (52, 53); the second a retrospective cohort study using antenatal and paediatric datasets of women with known AOD use in pregnancy (54); and the third a sub-analysis of the Pregnancy Risk Assessment Monitoring System (PRAMS) survey data limited to women with alcohol use in pregnancy.(55) The studies were conducted in the late 1990s and early 2000s with the first two involving data collection during pregnancy and the third requiring retrospective recall.(52, 54, 55) Studies were conducted across North America and Europe and included 175 to 95,728 participants.

Table 1-1: Methodology of Included Studies in Scoping Review

General Information	**Study**		
	1[a]	**2**	**3**
	Martin et al.(52)	**Sarkola et al.**(54)	**Terplan et al.**(55)
Type of Publication	Peer reviewed publication	Peer reviewed publication	Peer reviewed publication
Research Question(s)	To compare treatment continuation and duration [in opioid treatment programs] before delivery of a live infant in women with UIP vs IP.	To identify risk factors for children being placed into out of home care.	To examine the relationship between pregnancy intention and continued drinking, or binge drinking, in last 3 months of pregnancy.

Population	Pregnant women in opioid treatment program.	Pregnant women in specialised drug and alcohol antenatal care services (mix of types of AOD).	Post-partum women who drank alcohol in the 3 months prior to pregnancy.
Methodology			
Study Design	Prospective cohort study	Retrospective cohort study	Retrospective cohort study
Study Setting	Recruited in antenatal period from Drug and Alcohol Clinics	Antenatal datasets and paediatric datasets	Recruited in post-partum period from PRAMS telephone survey
Geographical region	North America (USA and Canada) and Europe (Austria)	Europe (Finland)	North America (33 USA states)
Time period of recruitment	May 4, 2005 to October 31, 2008	1992 to 2001	2004 to 2008
Timing of recording of pregnancy intention	During pregnancy	During pregnancy	Retrospective (after pregnancy)
Reporting of AOD use/SUD	Addiction severity index as a measure of impairment. Overall AOD intake not reported.	AOD use recorded in maternal records pre-conception, during pregnancy and post-partum. Alcohol use recorded as daily, weekly, less than daily. Opioid use recorded as 'regular' (daily or weekly). Urine toxicology results recorded	Self-reported using retrospective recall during the 3 months prior to pregnancy and final 3 months of pregnancy for: • Average number standard alcohol drinks per week drinking • Any binge drinking episodes (5 or more standard drinks at a time)
Tools used to assess UIP	Non-validated screening questionnaire. Categorised: intended/unintended. Unintended subgroups: mistimed, ambivalent or unwanted.	Dichotomous: Intended/Unintended	4-point questions. Re-classified into intended/mistimed, or unwanted.
Total number of participants	175	626	95728

[a]Demographic data obtained from primary study (this study is a secondary analysis).(53)
UIP: Unintended Pregnancy; IP: Intended Pregnancy; AOD: Alcohol and Other Drugs

The first study was small, but otherwise of high quality.(52) The second study had no discussion of the reliability of pregnancy intention measurement (obtained from retrospective datasets) and did not present demographic factors according to the exposure groups (intended/unintended

pregnancy) or adjust for confounders.(54) The third study was a population-based study that required retrospective recall of alcohol use during pregnancy, which is likely to under-estimate alcohol use.(55-57)

Assessment of pregnancy intention during pregnancy varied across the three studies. The first used a non-validated screening questionnaire and then re-classified responses as intended/unintended pregnancy (52); the second used dichotomous responses (intended/unintended pregnancy) as recorded in a maternity dataset (54); the third study retrospectively assessed pregnancy intention in the post-partum period using a 4-point question, then re-classified responses as intended, mistimed (unintended but would have liked the pregnancy to occur later than it did), and unwanted (unintended and did not want the pregnancy to occur at all). The differences between unwanted and intended/mistimed pregnancies were reported.(55)

Table 1-2 presents the population characteristics of the included studies, with the first study limited to women with opioid use disorder,(52) the second to women with known SUD and a mix of types of AOD,(54) and the third included women who used alcohol in the three months prior to pregnancy.(55) Unemployment rates of up of 81-96% were reported in the first study,(52) and 72.9% in the second.(54)

Table 1-2: Population Characteristics of Included Studies in Scoping Review

Population Characteristics	**Study**		
	1[a]	**2**	**3**
	Martin et al.(52)	**Sarkola et al.(**54)	**Terplan et al.(**55)
Age	18-41	Mean: 27 years (SD+/-6) 12% teenage.	≤19: 6.2% 20-39: 91.1% ≥40: 2.7%
Education level	Mean no. years in education: ~11	Completed secondary education or vocational training: 25.2%;	Less than high school: 10.6 High school only: 26.1 Greater than high school: 63.2
Employment	Employed: 4-19%	Unemployed at time of birth: 72.7%	Not reported
Out of home care: Mothers as children	Not reported	9.4%;	Not reported
Out of home care: previous child	Not reported	17.3%	Not reported
Other Socio-economic characteristics	Criminally unencumbered: 71-88%	Homeless or living in institution: 21.6%	Annual Income (USD) <10,000: 14.1%

			10,000 -14,999: 7.5% 15,000 -24,000: 12.0% 25,000 - 50,000: 20.1% ≥$50,000USD: 46.3%
Ethnicities	• White 83% • Black 14% • Other 2%	Not reported	• White: 74.9%, • Black: 11.9%, • Hispanic: 7.9%, • Other: 5.3%
Gravidity	Not reported	Not reported	Not reported
Parity	Not reported	Not reported	Not reported
Gestational age at recruitment	16-20 weeks	Not reported	Post-partum
Tobacco smoking	~95%	78.4%	Not reported
Principal drug(s) of choice	Opioids: 100% Multidrug use common - including heroin, cocaine, alcohol, benzodiazepines.	• Alcohol: 25% before pregnancy, 11% during pregnancy, • Opioids: 12% before pregnancy, 6% during pregnancy, • 15%: anxiolytics/hypnotics	Alcohol
Pattern of drug use	Not reported	Not reported	Mixed - reports on binge and non-binge drinking
Severity of drug use	Mean addiction severity index 0.29-0.34	14% have a history of regular D&A health care	All alcohol use reported, subset of heavy use

[a]Demographic data obtained from primary study (this study is a secondary analysis).(53)
USD: United States of America Dollars

There were limited and selected outcomes reported by pregnancy intention, which differed for each study (**Table 1-3**). The first study examined retention in AOD treatment during pregnancy (52); the second focused on placement of the child into out of home care (54); and the third study focused on continued and binge drinking during the last 3 months of pregnancy.(55) No included studies examined pregnancy and birth outcomes, childhood health outcomes, post-partum or long-term maternal health; and no economic evaluations were included.

Table 1-3: Results of Included Studies of Scoping Review

Results	Study		
	1[a]	2	3
	Martin et al.(52)	**Sarkola et al.(**54)	**Terplan et al.(**55)
Outcome types	Health: maternal	Social	Health: maternal
Outcome:1	Mean duration in prenatal AOD treatment duration (crude): UIP: 16.3 weeks vs IP: 21.3weeks (p=0.01)[a]	Cumulative placement into out-of-home care at less than 2 years of age UIP: 42.5% vs IP: 24.1% (no p-value provided)[b] Crude OR 1.76 (1.25–2.48: p=0.01)	Continued drinking during pregnancy [during the last 3 months of pregnancy] aOR[c] 1.15 (0.99-1.33)
Outcome:2	Treatment continuation before delivery of a live infant UIP: 72% vs IP: 82% (p=0.28) Cox proportional hazard ratio(adjusted) 0.73, p = 0.21	Cumulative placement into out-of-home care for more than half their life UIP: 23% vs IP: 11.2% (no p-value provided)[c] Crude OR 2.06 (1.19-3.45, p=0.021)	Binge drinking during pregnancy [during the last 3 months of pregnancy] aOR[c] 1.40 (1.07-1.83)
Summary			
Association between outcome and UIP	In pregnant women in opioid treatment programs, UIPs are associated with: • A 5-week reduction in the duration spent in opioid treatment programs[c] • No difference in the likelihood of staying in opioid treatment programs until birth	In pregnant women with AOD use, UIPs are associated with: • 1.76 the odds of the child being placed into out of home care by the age of 2 years[b] • Twice the odds of the child being placed into out of home care for more than half their life[b]	In women who drank alcohol in the 3 months prior to pregnancy, unwanted pregnancy, compared to intended and mistimed pregnancies, is associated with: • 1.4 the odds of binge drinking, in the final 3 months of pregnancy • No difference in continued drinking in the final 3 months of pregnancy

[a]Demographic data obtained from primary study (this study is a secondary analysis).(53)
[b]Adjustment for confounders not provided.
[d]Unwanted vs intended/mistimed pregnancies
UIP: Unintended Pregnancy; IP: Intended Pregnancy; AOD: Alcohol and Other Drugs

For women who were engaged in an opioid treatment program, women with an UIP had an average 5-week shorter duration in antenatal AOD treatment compared to those with an intended pregnancy (16.3 vs 21.3 weeks, p=0.01). However, analysis showed that after adjusting for confounders there

was no association between pregnancy intention and likelihood of remaining in an opioid treatment program until the birth of a live baby (72% for UIP, 82% for IP, p=0.28).(52)

For women who received antenatal care in specialised AOD services, those with an UIP had an almost 2-fold higher rate of a child being placed into out of home care by the age of 2 years (42.5%) compared to an IP (24.1%) (crude odds ratio [OR] of 1.76 (95% confidence interval [CI] 1.25–2.48: p=0.01).(54)

For women who drank alcohol in the 3 months prior to pregnancy, compared to women with an intended or mistimed pregnancy, women with an unwanted pregnancy showed no difference in the likelihood of continued drinking into the final 3 months of pregnancy (adjusted OR [aOR] 1.15, 95% CI 0.99-1.33). However, they did show an increase in binge drinking, defined as any episode of drinking 5 or more standard alcohol drinks at a time, in the final 3 months of pregnancy (aOR 1.40, 95% CI 1.07-1.83).(55)

1.1.4: Critical Analysis

Main Findings

AOD and UIP are both important public health issues and this scoping review shows there is very limited data available examining the intersection between the two issues. There were only three studies identified and these included women using different types and patterns of AOD use, used different tools to assess pregnancy intention, and focused on disparate outcomes. Importantly, no study assessed or reported on birth outcomes. Although there were unadjusted associations between UIP and remaining in AOD treatment during pregnancy,(52) UIP and children entering out of home care,(54) and adjusted associations between UIP and persistent binge drinking into third trimester of pregnancy, data overall was limited.(55) Where studies adjusted for confounders, the size of effect either substantially reduced or disappeared altogether, indicating that social determinants of disease may be more influential than UIP and AOD use on outcomes.

Strengths and Limitations

This main strength of this scoping review is that it identified a research gap that had not been previously identified. The methodology involved a comprehensive, systematic search of scientific literature across multiple databases and facilitated a broad search of all possible short-term and long-term outcomes, including pregnancy, birth, infant and childhood health outcomes, as well as social and economic outcomes. The broad criteria of all AOD use and UIP, and the search across databases of multiple disciplines, means there is unlikely to be a substantive body of literature on

this topic that has not been identified. The search was restricted to the 21st century to ensure only contemporaneous concepts relating to AOD use and pregnancy intention were included.
The limitations of this scoping review are the overall paucity of studies, heterogeneity in sample size, methodology, assessment of pregnancy intention, and variation in AOD use definitions and patterns, making it difficult to draw general conclusions. Another limitation is that no study assessed the role of underlying factors, such as poverty, education, or access to healthcare, in the development of SUD and UIP. Additionally, the first study was likely underpowered to detect an association between UIP and remaining in AOD treatment during pregnancy.(52) The second study did not adjust for social determinants of health and therefore was not able to demonstrate a causative pathway between UIP and children entering into out of home care.(54) The third study assessed alcohol consumption during pregnancy using retrospective recall in the post-partum period, which may have biased the results.(55) Finally, the purpose of this study was to examine outcomes from pregnancy, which are typically assessed using quantitative data. Whilst the exclusion of qualitative studies represents a limitation and review of the qualitative literature would be interesting, it was beyond the scope our review.

Interpretation

This scoping review was not able to clarify the relationship between UIP and AOD use. There was a lack of consistency of the populations examined, with some studies examining all women who use AOD, and others focusing specifically on women with SUD. The effects of social determinants of health are likely very different between those with low level AOD use and SUD, and the impact of differences were not assessed in this study. The factors that contribute to UIP in women with SUD include a perception of low risk of pregnancy, sexual coercion, poor reproductive health knowledge, cost and access to services, and mental illness.(58) People who use illicit drugs are more likely to live in poverty,(59) and women living in poverty are more than twice as likely to experience an UIP.(60) Previously, a comprehensive model found almost all the effect of illicit drug use on low birth weight can be attributed to psychological, physical and behavioural factors. These factors include unwanted pregnancy, finances, nutritional status, and exposure to violence.(29) SUD and UIP are likely intrinsically linked by shared causative pathways, involving social determinants of health such as poverty, and access to healthcare and education, which have not been examined in any study.

This scoping review identified no studies that reported on associations between UIP and long-term health problems in the offspring of women who use AOD during pregnancy. However, there were two other studies, excluded from the scoping review after full text review, that examined the effects of alcohol following an UIP. The Avon Longitudinal Study of Parents and Children (ALSPAC) cohort

study reported that children born following an UIP pregnancy were more likely to have FASD compared to children born following an intended pregnancy. However, it was excluded as the analysis was not limited to children of women who consumed alcohol during pregnancy.(61) The Growing Up in New Zealand cohort study reported changes in infant and childhood behavioural scores for those whose mothers drank alcohol in pregnancy and had a UIP. Although this study did stratify the effects according to the quantity and pattern of alcohol use, the comparison group was to mothers who did not drink alcohol, not mothers with an intended pregnancy, and therefore it was not suitable for inclusion in the scoping review.(62) These and other cohort studies indicate that existing datasets may contain information that could be analysed to assess interconnections between AOD use and UIP on pregnancy, birth, infant and childhood outcomes.

Next Steps

Following on from this scoping review, **Chapter 2** of this thesis examines the association between unintended pregnancy and pregnancy and birth outcomes in women with substance use disorder, in five New South Wales local health districts.

1.2: Frequency

1.2.1: Global Prevalence of AOD use and SUD

Globally, the lifetime prevalence of alcohol use is 80% and the annual prevalence of an alcohol use disorder in those who drink alcohol is 2.2%.(11) 5.5% of the global adult population use illicit drugs each year, however only 0.7% have a use disorder, although some of those with a use disorder will be using prescription drugs for non-medical purposes.(10)

1.2.2: Rate of AOD use and SUD in Pregnant Women

The rate of AOD use in pregnancy varies across populations, according to the drug used, and according to awareness about the pregnancy. Whilst the rate of SUD in pregnant women is less reported, there does also appear to be variation amongst populations and over time. In Australia, the National Drug Strategy Household Survey records AOD use in pregnancy. In the 2019, 55% of pregnant women drank prior to recognition of pregnancy, dropping to 14.5% after recognition. 5.4% used cannabis, and 1.8% for other illicit drugs, and data was not published on use following recognition of pregnancy.(63) However, in 2016 3.1% of pregnant women used illicit drugs prior to recognition of pregnancy, dropping to 1.8% following recognition of pregnancy. In 2016, 1.9% used a prescription medicine for non-medical purposes.(40). Additionally, in 2019 22% used tobacco prior to recognition of pregnancy, which had risen from the 15.7% in 2016. In 2019, 10.8% used tobacco after recognition of pregnancy. No information on the rate of substance use disorder in pregnant women was contained in these surveys.(40, 63) Similar rates of AOD use in pregnancy were reported in the Triple-B cohort study.(64) At the commencement of this PhD in 2017, no comprehensive and contemporaneous studies were identified that reported the rate of SUD in pregnant women in Australia. A 2005 study used maternity datasets from South Australia reported a rate of substance use during pregnancy of 0.8%, although this study did not include alcohol use. It is not known what proportion of women in this study had a SUD.(65) A 2006 Australian study reported 1.1% of pregnant women had hospital presentations for cannabis, opioid, or stimulant use during pregnancy, although other substances, including alcohol, were not included, and the study was based on hospital admission data only.(66) In 2021, a New South Wales study was published that linked data from maternity datasets, inpatient admissions and death records showed a rate of SUD in pregnant women of less than 1%. 0.27% of pregnant women had hospital presentations related to opioid, 0.3% related to cannabis, 0.09% related to stimulants, 0.1% related to alcohol, 0.09% related to polysubstance use. The main focus of this study was neonatal outcomes rather than rate, and unfortunately, it did not provide an overall estimate of the rate of SUD, and some drug categories were not included.(67)

Globally, rates of AOD use and SUD in pregnancy vary. In United States of America (USA) national studies of pregnant women disclose AOD use during pregnancy in 31.5 to 36.5%. Of these, 47.5 to 61.9% disclose tobacco use, 6.2 to 26.8% disclose alcohol use, 4.7 to 14.8% disclose illicit drug use, with use typically falling as the pregnancy advances (68) In Denmark, 35% of women binge drink alcohol prior to recognition of pregnancy, falling to 3% following recognition.(69) In Scotland, 92% of women drink alcohol around the time of conception, dropping to 5.5% following recognition of pregnancy.(70) In one USA study from 2016 to 2018, the rate of SUD in pregnant women was reported as 2.7%, however only 0.1% was due to alcohol, which is substantially below the global rate of alcohol use disorder. 1.4% of pregnant women had a cannabis use disorder, and 0.9% had an opioid use disorder, whilst the remaining had another form of illicit drug use disorder.(71) In another USA study from 2016 to 2020, the rate of SUD in pregnancy was reported as 6.0%.(72) In the Cheque Republic, a data linkage study identified just 505 pregnant women with SUD, from a dataset of 1.5 million pregnancies, which is a rate of 0.03%.(73) In Sweden, a linkage study of existing health datasets identified the rate of SUD in pregnancy as 0.24%, whilst age matched controls had a rate of 0.35%, which is also substantially below the global rate.(25) Several of these international studies use linkage with hospital admission data to report a rate of SUD in pregnant women well below global rates of SUD, and it is possible the linkage methodology underreports SUD in pregnancy.

Chapter 2 of this thesis includes investigation of the epidemiology, including prevalence, of substance use disorders in pregnant women using maternity datasets.

1.2.3: Frequency of Unintended Pregnancy and Birth

1.2.3.1: Measurement of Unintended Pregnancy

Although not a focus of this thesis, accurate assessment of the incidence of unintended pregnancy is important when drawing conclusions about unintended pregnancy or its associations with maternal, infant or child outcomes. Whilst there are several measurement tools available to assess pregnancy intention, these have mostly not been used in populations with SUD. The available measurement techniques and tools are summarised in **Table 1-4**. Pregnancy intention can be assessed prospectively, before conception, or retrospectively, after conception. Traditionally, pregnancy intention has been dichotomised into 'intended' or 'unintended', and many studies and datasets still use this classification. However, a dichotomous classification lacks the depth to explore subcategories within unintended pregnancy (mistimed or unwanted), or that women are ambivalent to pregnancy, meaning a pregnancy is neither intended nor unintended. Self-reported pregnancy intention may change over time, meaning that a woman who was not intending to become pregnant may subsequently report post-conception that a pregnancy was intended, particularly if she happy to be pregnant.(3) Much of the AOD literature reports unintended pregnancy as a dichotomous

outcome and may underreport unintended pregnancy, or not capture nuances that can be elucidated using validated tools.(20) Audits of maternity datasets or medical records similarly report pregnancy intention as a dichotomous outcome.(74)

Three prospective assessments of pregnancy intention include the 'Desire to Avoid Pregnancy Scale', 'Attitude Toward Potential Pregnancy Scale' or 'One Key Question®'. Only the Desire to Avoid Pregnancy Scale has been evaluated in women with SUD. In this study, 17% of women reported ambivalence to pregnancy in at least one domain.(75) There are also several tools for the retrospective measurement of pregnancy intention. These include Demographic and Health Survey (DHS), National Survey of Family Growth (NSFG), Pregnancy Risk Assessment Monitoring System (PRAMS), and the London Measure of Unplanned Pregnancy (LMUP).(76-80) The LMUP can be used during pregnancy or the post-partum period, and has been shown to less vulnerable to recall bias at 12 months post-partum than the Demographic and Health Survey.(81) The LMUP approach has been shown to provide consistent results on pregnancy intention on repeat testing when compared to questions about decisions and actions after the pregnancy is confirmed. It is reliable regardless of the outcome of the pregnancy, and acceptable to women.(79) The LMUP has been validated in an Australian population.(82) Of these retrospective tools, PRAMS and NSFG asks questions about alcohol use. PRAMS has been used to examine associations between alcohol use during pregnancy and pregnancy intention, and NSFG has been used to examine associations between alcohol use before conception and pregnancy intention.(83, 84) The LMUP has not been evaluated in a population of women with substance use disorder.

Measurement tools of unintended pregnancy use the unintended pregnancy framework, which assumes all pregnancies fall somewhere on a spectrum from intended to unintended. There has been growing commentary about the appropriateness of the unintended pregnancy framework, which places responsibility for pregnancy intention on the woman and fails to incorporate factors outside a woman's control that impact access to contraception, such as poverty education and health service availability.(85) The research contained within this thesis was developed using the unintended pregnancy framework, however the limitations of this framework are reflected upon in the discussion.

Table 1-4: Pregnancy Intention Tools

Tool	Prospective or Retrospective Assessment of Pregnancy Intention	Description
Desire to Avoid Pregnancy Care.(86, 87)	Prospective	14-point, psychometrically evaluated research tool to assess non-pregnant women's pregnancy intentions over the next 12 months, although it has not been validated for use in clinical practice. It asks women a range of questions relating to how they would feel if they were to become pregnant and correlates well with the likelihood of conceiving a pregnancy within 12 months.
Attitude Toward Potential Pregnancy Scale.(88)	Prospective	Five-point psychometrically evaluated tool asking non-pregnant women a range of questions about wanting to become pregnancy, avoid pregnancy, and positive and negative feels associated with a pregnancy.
One Key Question®.(89)	Prospective	A single item question asking non-pregnant women "Would you like to become pregnant in the next year?" that has been implemented in clinical settings as a screening tool. It is designed to commence a conversation about preconception care or contraception, according to the woman's response. It also allows for an ambivalent response, which can be explored during the clinical consultation.
Demographic and Health Survey.(76)	Retrospective	A household survey conducted in low- and middle-income countries. Included in the survey is a single question about whether pregnancies in the past five years were intended, mistimed, or unwanted, which are then typically recategorised as intended or unintended.
National Survey of Family Growth.(77)	Retrospective	A survey that includes a series of questions about wanting a baby, and the timing of a pregnancy to categorise pregnancies as unwanted, mistimed or intended. This survey can also incorporate questions on contraception use and cessation, which can be used in a secondary model for pregnancy intention.
Pregnancy Risk Assessment Monitoring System.(78)	Retrospective	An annual survey in the USA that is conducted at approximately eight weeks post-partum. It asks women about their feelings about becoming pregnant right before they conceived, and the ideal timing of that pregnancy. The answers to these questions can also be recategorized as intended, mistimed, or unwanted

London Measure of Unplanned Pregnancy (LMUP) (79, 80)	Retrospective	A validated, ordinal pregnancy intention scale that assesses women's thoughts, feelings, and actions taken prior to pregnancy. It is a six-point scale, with scores from zero to 12. It may be recoded into the categorical variables: 'unintended'; 'ambivalent'; or 'intended' or dichotomised into 'intended' and 'unintended'.

1.2.3.2: Unintended Pregnancy and Unintended Birth Rates in the General Population

Worldwide

The Guttmacher Institute provides estimates of global and regional unintended pregnancy. The most recent data available from the 2015-2019 report states there were 121 million unintended pregnancies annually, equating to a global unintended pregnancy rate of 64 unintended pregnancies for every 1000 women aged 15-49. During 2015-2019, 48% of all pregnancies were unintended and 61% of these ended in abortion.(90) The global unintended pregnancy rate was stable from the 2010-2014 study, but there had been steady decline prior to that since 1990.(1, 2, 91) There is regional variation with higher rates of unintended pregnancy in low income countries as compared to high-income countries.(1, 90, 91) The Guttmacher Institute studies also report unintended births. In 2010 to 2014, 23% of all births worldwide were unintended, a figure that has also been stable since 1990, but was not reported in 2015-2019.(1) **Table 1-5** shows estimates for unintended pregnancy, abortion, and birth.

Table 1-5: Global Estimates of Unintended Pregnancy and Birth

Population	Year	Marker of Pregnancy Intention	Rate or Number
Global	2015-2019	Absolute Number of unintended pregnancies	121 million
Global	2015-2019	Annual global rate of unintended pregnancy per 1000 women, aged 15-49	64
Global	2015-2019	Annual global rate of abortion per 1000 women, aged 15-49	39
Global	2015-2019	% of all pregnancies that are unintended	48%
Global	2010-2014	% of all births that are unintended	23%

Australia

Telephone based retrospective surveys conducted from 2014 to 2016 report 26-27% of previous pregnancies in Australian are unintended.(92, 93) There are also studies conducted in pregnancy, which likely underestimate the population unintended pregnancy rate as they may not include women seeking an early abortion or experiencing an early pregnancy loss. Studies commonly group unintended pregnancies and ambivalence to pregnancy together to report a dichotomous outcome (unintended/intended). Such studies conducted in early pregnancy or antenatal services show

unintended pregnancies rates of 30-57%. However, when separated into unintended and ambivalent, 2-15% were unintended and 26-39% were ambivalent to pregnancy.(94-96) Pregnancy intention can also be assessed retrospectively, after birth. A study conducted in 2005 reports 35% of Australian women report their most recent birth was unintended.(97) Demographic factors are likely associated with unintended pregnancy as studies involving young Australian women (aged 18-23 years) report of 84.6% of their pregnancies are unintended, which is much higher than in other studies.(98) Younger maternal age, socio-economic status, and parity were all associated with higher unintended pregnancy rates in the antenatal setting.(96) **Table 1-6** shows Australian estimates for unintended pregnancy and birth.

Table 1-6: Australian Estimates of Unintended Pregnancy in Different Populations

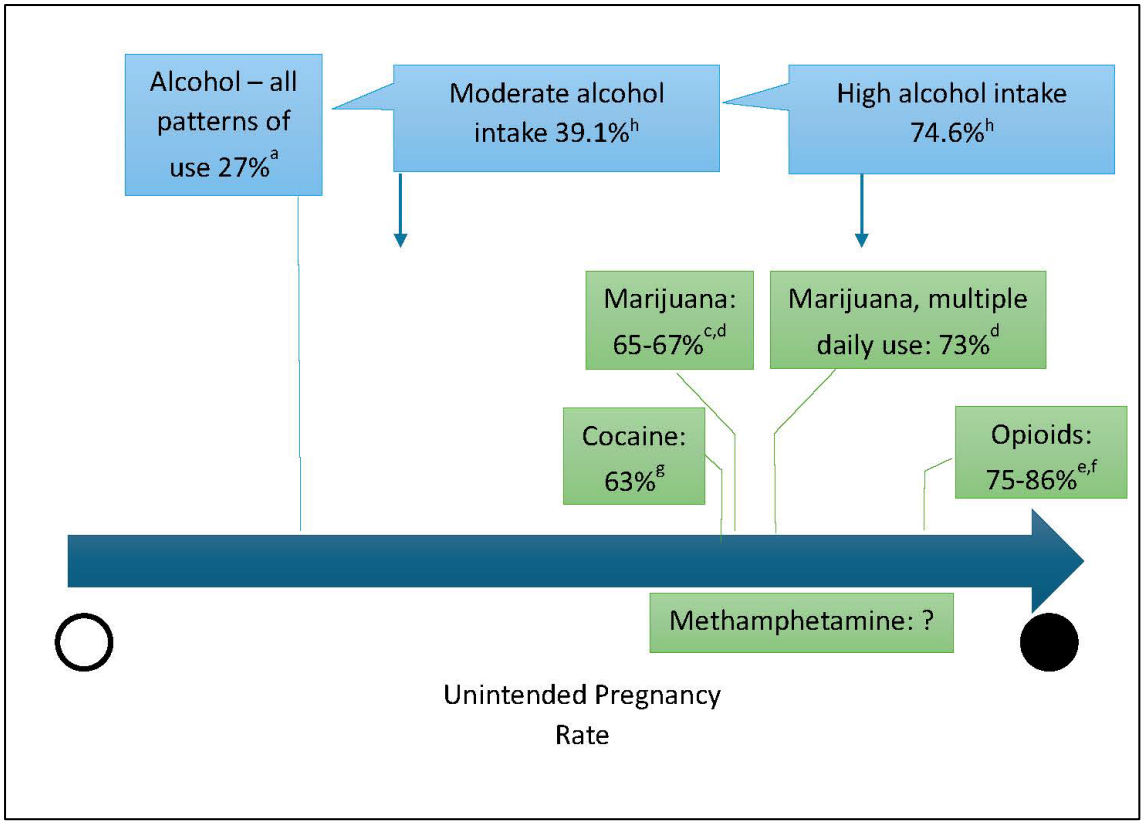
Population	Year	Marker of Pregnancy Intention	Rate or Number
Pregnant women at the booking antenatal appointment	2019-2020	% of all pregnancies that are: 1. Unintended 2. Ambivalent	 1. 2.6% 2. 26.8%
Retrospective Telephone Survey of reproductive aged women and men (93)	2016	% of all 1st pregnancies that are unintended	27.3%
Retrospective Telephone Survey of reproductive aged women (92)	2014-2015	% of all pregnancies that are unintended within past 10 years	26%
Pregnant women in an early pregnancy service (<20 weeks gestation) (95)	2013-2015	% of all pregnancies that are: 1. Unintended 2. Ambivalent	 1. 15% 2. 39%
Pregnant women in an antenatal service (94)	2010-2011	% of all pregnancies that are: 1. Unintended 2. Ambivalent	 3. 2% 4. 30%
Retrospective survey – most recent birth (97)	2005	% of most recent birth that are: 1. unintended i. Mistimed ii. Unwanted	 1. 35% i. 18% ii. 17%
Australian women aged 18-23 (98)	2012-2013	% of pregnancies that are unintended	84.6%

1.2.3.3: Frequency of Unintended Pregnancy and Birth in Women Who Use Alcohol and Other Drugs

The rates of unintended pregnancies vary substantially according to drug of concern. The rates of unintended pregnancy with alcohol use have substantial geographical variation and also vary according to pattern of use, timing of use and other demographic factors. Amongst drugs other than alcohol, there is also variation particularly between drugs of concern. All identified studies in populations of women that use drugs other than alcohol report an increase in unintended pregnancy above that of the general population. However, data are limited, methodology varies, the available

studies are generally small or utilise retrospective datasets. Data identified in a literature search are described below and depicted in **Table 1-7**. **Figure 1-2** demonstrates the variation in the rate of unintended pregnancy, according to the drug used.

Figure 1-2: Unintended Pregnancy Rates According to the Drug Used



Source: a) McCormack, Hutchinson et al. 2017 (27); b) Bearak, Popinchalk et al. 2020 (90); c) Short, Hand et al. 2020 (22); d) Lundsberg, Peglow et al. 2018 (17); e) Heil, Jones et al. 2011; f) Black, Stephens et al. 2012 (21); g) Queensland Clinical Guidelines 2016 (99); h) Mullally, Cleary et al, 2011 (23).

Worldwide

There are several studies conducted across the globe assessing unintended pregnancy rates in women with AOD use. Studies either do not specify the principal drug of concern, or are limited to alcohol, opioid, and marijuana use.

Drug of Concern not specified

In the USA in 1989, amongst a study of 36 pregnant women who injected intravenous (IV) drugs 67% were found to have had an unintended pregnancy. Women were recruited prior to 24 weeks gestation and, although abortion rates were high, this was attributed largely to women receiving a diagnosis of HIV in pregnancy.(100) Whilst this study is one of the few available on the topic, it is over 30 years old and may not be relevant to modern settings. Unpublished research from Hong

Kong found 84% of pregnancies were unintended in pregnant women who used alcohol and other drugs.(101) Postpartum evaluation of pregnancy intention has been reported. A New Zealand (NZ) study conducted in 2011 found 65% of postpartum women who had preconception drug use (other than alcohol), had an unintended pregnancy.(24) The 2009 to 2011 Tennessee Pregnancy Risk Assessment Monitoring System (PRAMS) is an analysis of retrospective cohort data from 3042 mothers in Tennessee, USA. It showed 65.5% of women with alcohol and other drug use in pregnancy had unintended pregnancies, compared to 48.4% in women who did not use alcohol and other drugs. A separate question in the same survey indicated that prior to pregnancy 69.7% of women who use AOD had been ambivalent to pregnancy, whilst only 7.8% were "trying hard to keep from getting pregnant". In the control group this was 46.2% and 13.3% respectively. This study did not provide sub-analyses according to drug of choice.(102) Retrospective assessment of pregnancy intention, beyond the post-partum period, has also been reported. In the USA in 2019, a retrospective study of study 96 women who inject drugs, predominantly heroin and methamphetamine, found 50% reported a previous history of unintended pregnancy.(103)

Alcohol

In Ireland in 2011 a retrospective cohort study of 61,241 women stratified unintended pregnancy rates according to volume of alcohol consumed in the periconception period. The study analysed maternity records and showed high alcohol intake in pregnancy to be associated with high rates of unintended pregnancy, but this association was not seen with lower levels of alcohol intake. The unintended pregnancy rate was 74.6% of with high alcohol intake (> 20 units of alcohol per week); 39.1% with moderate alcohol intake (6-20 units of alcohol per week); 33.6% with low alcohol intake (0-5 units of alcohol per week); and 38.5% in women with no alcohol intake in pregnancy.(23) Studies from other settings include a study from New Zealand (NZ) and another from Canada, both with alcohol use measured prior to pregnancy. The NZ study was conducted in 2011 using a retrospective survey of 968 post-partum women. It found 67% of women who were binge drinking alcohol prior to pregnancy had unintended pregnancies.(24). The Canadian study was conducted between 2005 and 2006 and involved a cohort of 6421 reproductive aged women who had birthed. It found comparable unintended pregnancy rates in women who used alcohol before pregnancy compared to women who did not (27.5% vs 26.4%, OR 1.06, 95% CI: 0.93-1.20).(18) When interpreted together, the Irish, NZ and Canadian studies, suggest that women with binge alcohol use and higher rates of alcohol intake are at increased risk of unintended, but that women with low-level use are not.

Opioids

The largest study is from the USA, was conducted in 2010, and is a cross-sectional survey of 946 pregnant women who used opioids. It found 86% reported their pregnancy was unintended. This is

the largest prospective study on unintended pregnancy in any population with AOD use. Its main limitation is that does not report the gestation at which women were surveyed about pregnancy intention, and intentions are known to change over time.(3, 104). However, smaller retrospective studies in the USA have found similar results. In 2018, a study of 42 women who use opioids reported 75% of all previous or current pregnancies were unintended.(105). In 2019 a study of 98 women who used opioids reported 84% of prior pregnancies were unintended (106).

A systematic review brought together 12 studies on unintended pregnancy in women who use opioids, including some of those abovementioned. There were two categories of included studies: studies during pregnancy, and retrospective studies reporting on prior unintended pregnancies. The first group showed 84.9% of pregnant women who use opioids report their pregnancy is unintended. The latter group showed 79.2% of past pregnancies were unintended, and all these studies were in women with opioid use disorder. One of the retrospective studies, and none of the within pregnancy studies, were conducted in Australian populations (20). Overall, data from individual studies and the systematic review indicate women who use opioids, predominantly women with opioid use disorder, experience very high rates of unintended pregnancy.

Cannabis

Studies in women who use cannabis are uncommon, however two studies demonstrate higher than background unintended pregnancy. One study, using PRAMS data from 2016, found that amongst 5676 women from six USA states (Louisiana, Main, New Mexico, Vermont, Wisconsin and Wyoming) 64.7% of pregnancies were unintended in women with preconception marijuana use, compared to 40.5% in women without pre-conception marijuana use.(22)

Australia

There are a limited number of Australian studies that examine the frequency of unintended pregnancy in populations of women who use alcohol and other drugs. Whilst many studies seem to be conducted in populations of women with SUD, the difference between SUD and AOD is frequently not well established in the available literature. The studies that have been conducted include retrospective surveys outside of pregnancy, cross-sectional surveys during pregnancy and retrospective audits of medical records conducted in women with known alcohol and other drugs use. Studies conducted in the general population do not provide a subset analysis on women with AOD use and are unlikely to be applicable. Drug and alcohol dependency is an exclusion criterion from at least one hallmark Australian study on pregnancy intention.(107). Only one study specifies the principal drug of choice (21). The available Australian studies generally report a rate of unintended pregnancy of 65-75% for women with SUD or AOD use, however the sample sizes in all studies are small (largest 204 women).(21, 74, 108). Only one small study (88 women) provides a

comparison with women who do not have a SUD.(108) No Australian studies utilising large existing maternity datasets have been conducted on unintended pregnancy in women who use alcohol and other drugs.

Chapter 2 of this thesis examines the prevalence of unintended pregnancy in women with SUD using existing maternity datasets from five New South Wales local health districts. It compares the prevalence to women who do not have SUD.

Drug of Concern not specified

Small prospective and retrospective cohort studies in pregnant women with alcohol and drug use have been conducted in Australia. A 2011 cross-sectional survey of 88 pregnant women found 71% reported the pregnancy was unintended in women who use AOD compared to 21% in the control group that did not use AOD. This study also reported 22% of women with AOD use had unwanted pregnancies, compared to 0% in the control group.(108) In 2021 a retrospective audit of 210 pregnant women who use alcohol and other drugs, conducted within a tertiary maternity service, found 64% had an unintended pregnancy.(74)

Alcohol

A cohort study in Australia reported 26.6% of pregnancies are unintended in women who drink alcohol, compared to 21.4% in women who do not drink alcohol.(27)

Opioids

In 2012, a retrospective survey of 302 reproductive aged women with SUD (and attending a metropolitan AOD treatment service) reported 20% had been pregnant within the past year. Of these, 75.5% reported the pregnancy was unintended.(21)

Table 1-7: Global and Australian Estimates of Unintended Pregnancy and Birth in Women Who Use Alcohol and Other Drugs

Population	Recruitment Time Frame	Country	Marker of Pregnancy Intention	Rate or Number in Women Who Use AOD
Pregnant women who inject IV drugs (100)	1985	USA	% of index pregnancies that are unintended	67%
Pregnant Women with Preconception Alcohol Use (stratified by weekly intake) (23)	2000 - 2007	Republic of Ireland	% of index pregnancies that are unintended, stratified by alcohol consumed per week: 1) >20 units 2) 6-20 units 3) 0-5 units 4) None	 1) 74.6% 2) 39.1% 3) 33.9% 4) 35.8%

Women Who Use Opioids (21)	2009	Australia	% of all pregnancies within the previous 12 months that were unintended	75.5%
Pregnant women with opioid use disorders (104)	Not stated	Multicountry inc. USA	% of index pregnancies that are: 1) unintended a) Mistimed b) Unwanted c) Ambivalent	1) 86% a) 34% b) 27% c) 26%
Pregnant Women with SUD (108)	Not stated	Australia	1) Unintended Pregnancy Unwanted Pregnancy	1) 71% 22%
Postpartum Women with AOD Use during Pregnancy (102)	2009 - 2011	USA	% of index pregnancies that are: 1) Unintended <u>Separate question:</u> 2) Ambivalence to pregnancy 1) Trying hard not to conceive	1) 67.9% 2) 67.9% 3) 7.8%
Retrospective review of birth records of women with opioid use (106)	2009-2015	USA	% of pregnancies that are unintended	84%
Pregnant Women with AOD Use (101)	2010 - 2014	Hong Kong	% of index pregnancies that are unintended	84.1%
Postnatal Women with preconception AOD use (24)	2011	New Zealand	% of index pregnancies that are unintended 1) Other drug use 2) Binge alcohol use	2) 65% 3) 67%
Pregnant Women with Preconception Marijuana Use (22)	2016	USA	% of pregnancies were unintended	67.4%
Women Who Inject Drugs (103)	2017	USA	Lifetime prevalence of unintended pregnancy	50%
Women Who Use Opioids (105)	Not Stated	USA	% of all previous or current pregnancies that were unintended	75%
Pregnant Women with AOD use	2018	Australia	% of index pregnancies that are unintended	64%

Disorders(Best, Lokuge et al. 2021)				
Systematic Review: Women who use Opioids (20)	2021	Worldwide (including one Australian study)	% of all unintended pregnancies: 1) lifetime pregnancies 2) current pregnancy	1) 79.2% 2) 84.9%

1.2.3.4: Associations between Unintended Pregnancy and Use of Alcohol and Other Drugs

There are several studies that report an association between unintended pregnancy and use of AOD, however these do not report the frequency of unintended pregnancy. The RAND Adolescent/Young Adult Panel Study is a longitudinal cohort study with participants enrolled in through schools in the USA in 1985 at the age of 12. It reported that women who had used cannabis and illicit drugs prior to the age of 18 were more likely to experience an unintended pregnancy between 18 and 29 years, compared to those who had not used drugs (standardised path co-efficient: 0.15 for cannabis; 0.19 for other illicit drugs). Alcohol use prior to age 18, however, was not associated with unintended pregnancy later in life.(109) Several other international and USA studies support these findings. A 2013 British study showed women who used drugs (excluding cannabis) were almost 3.5 times more likely to have experienced an unintended pregnancy in the previous 12 months compared to women who did not use drugs.(110) In Belgium in 2016, a study of postpartum women found LMUP scores were significantly lower in women with a history of illicit drug use, but this association was not present in women with a history of alcohol use.(111). Analysis of 2016-2017 PRAMS data showed unintended pregnancy was associated preconception use of illicit drugs other than cannabis (OR 2.6, 95%CI: 1.6-2.8) although the effect was attenuated following adjustment for sociodemographic factors (aOR 1.7, 95%CI: 1.2-2.4). However, a similar effect was seen with preconception tobacco use (OR 2.0, 95%CI: 1.9-2.2), which also reduced following adjustment (aOR 1.4, 95%CI: 1.3-1.5), implicating at least a partial role for social determinants of disease.(19)

There are multiple studies that report associations between pregnancy intention and use of an individual drug, and these are discussed in the following section, with often a dose dependent effect. However, it is important to consider causality when reporting on associations between AOD use and unintended pregnancy. It possible that use of AOD has a causal relationship with unintended, via increased sexual risk taking with intoxication. It is also possible social determinants of health, such as poverty and access to contraception, play an important role in the causal pathway with unintended pregnancy. This concept is supported by an association also demonstrated between tobacco and unintended pregnancy, which does not have a plausible direct biological pathway.

Alcohol

The association between alcohol use in pregnancy and unintended pregnancy likely depends on the pattern and amount of alcohol consumed. The available data is disparate and does not always look at pregnancy intention. Some research examines related concepts of happiness to be pregnant, or pregnancy wantedness. Alcohol use can be measured at different times: during pregnancy, periconception and preconception. In 2011, a Canadian study reported women who were unhappy or very unhappy to be pregnancy had 2.5 times the odds of drinking alcohol during pregnancy compared to women who were happy or very happy to be pregnant.(112, 113) A 2014 study from USA reported women with unwanted pregnancies had 1.15 and 1.40 times the adjusted odds of continued drinking and binge drinking during pregnancy respectively.(83) Whilst these studies did not stratify risk according to patterns of alcohol consumption, other research has sought to do so. In Mexico in 2016, a study of adolescent women demonstrated higher rates of alcohol use in pregnant women with unintended pregnancies compared to intended pregnancies.(114) Associations with low level use have also been reported, a 2015 Canadian study reported increased odds of unintended pregnancy in women with low or moderate level drinking after recognition of pregnancy, compared to those who did not drink at all (aOR 2.15, 95% CI:1.67-2.78).(115)

In the periconception period, studies from the USA and international studies from Mexico, Ireland and The Netherlands have found that women have increasing risk of an unintended pregnancy with increasing alcohol consumption in the periconception period. In Ireland in 2011, high consumption of alcohol in the periconception period (>20 drinks per week) was associated with 5.8 times the odds of unintended pregnancy compared to women who did not drink alcohol. Low and moderate intake of alcohol was not associated with unintended pregnancy.(23) In The Netherlands in 2015, binge alcohol drinking in early pregnancy was associated unintended pregnancy with any degree of pregnancy planning less than 'very planned'. Women with a 'very unplanned' pregnancy had 2.87 times the odds of binge drinking in early pregnancy (95% CI: 1.70-4.84).(69) In Australia in 2017, a cohort study of pregnant women demonstrated women who drank any alcohol prior to recognition of pregnancy had 1.33 times the odds (95% CI: 1.027-1.726) of an unintended pregnancy, compared to those who did not drink. However, in the subset who binge drank alcohol, or drank alcohol at heavy levels, the effect was stronger (OR 1.76, 95% CI 1.25-2.57).(27) 2016-2017 PRAMS data also suggest dose dependent associations between preconception alcohol use and unintended pregnancy. Heavy alcohol use (aOR1.9, 95%CI:1.5-2.2) had a stronger association than moderate alcohol use (aOR 1.4, 95% CI 1.3-1.5), which in turn was stronger than binge alcohol use (aOR 1.2, 95% CI: 1.04-1.4).

There is other research links alcohol use to future pregnancy intention. One study from the USA in 2016 showed reproductive-aged women were less likely to report they were intending to conceive if they engaged in binge (OR 0.8) or heavy drinking (OR 0.68), compared to women who did not drink.(116) Another US study from 2018 supports this, reporting the odds of unintended pregnancy was 1.68 times higher in women who had engaged in binge alcohol drinking in the month before pregnancy, however no associations between unintended pregnancy and other patterns of alcohol use were seen.(17) Analysis of 2016-2017 PRAMS data reported increasing rates of unintended pregnancy as preconception alcohol consumption increased: moderate alcohol use (aOR 1.4, 95% CI 1.3-1.5); heavy alcohol use (aOR1.9, 95%CI:1.5-2.2).(19) This contrast with the results from another USA study from 2015. This showed the risk of an alcohol exposed pregnancy was greatest (36.7%) in women intending to become pregnant, compared to women not intending to become pregnancy (4.2%). The authors suggested this is because women intending to become pregnant are more likely to deliberately cease using contraception in order to achieve a pregnancy but may not cease drinking alcohol until after recognition of a pregnancy.(84)

Opioids

Additional to the forementioned substantial increase in the rate of unintended pregnancy in women who use opioids. found 2.87 times the odds the pregnancy was poorly timed in women who opioid used in the month before pregnancy, compared to those who did not.(17)

Cannabis

There are several studies from the USA that support an association between cannabis use and unintended pregnancy. Analysis of 2016-2017 PRAMS data showed unintended pregnancy was associated with preconception cannabis use (aOR 1.9, 95%CI: 1.5-2.3).(19) In Unpublished work from 2016 also demonstrated women with preconception cannabis use were 1.22 times as likely to report their pregnancy as unintended, compared to those without preconception marijuana use.(117) In 2018, one study also found the odds of unintended and poorly timed pregnancy were 1.78 and 1.79 times higher with cannabis use in the month before pregnancy respectively.(17) Another study from 2018 found adolescent women aged 12 to 18 were significantly more likely to be pregnant if they had used marijuana in the previous 3 months, compared to those who had not.(118) Whilst not specifically documented, it is reasonable to assume the majority of those pregnancies were unintended as it has previously been demonstrated that 91% of pregnancies are unintended in adolescent women aged 15-17 in the USA.(60)

1.2.4: Types of Contraception and Frequency of Use

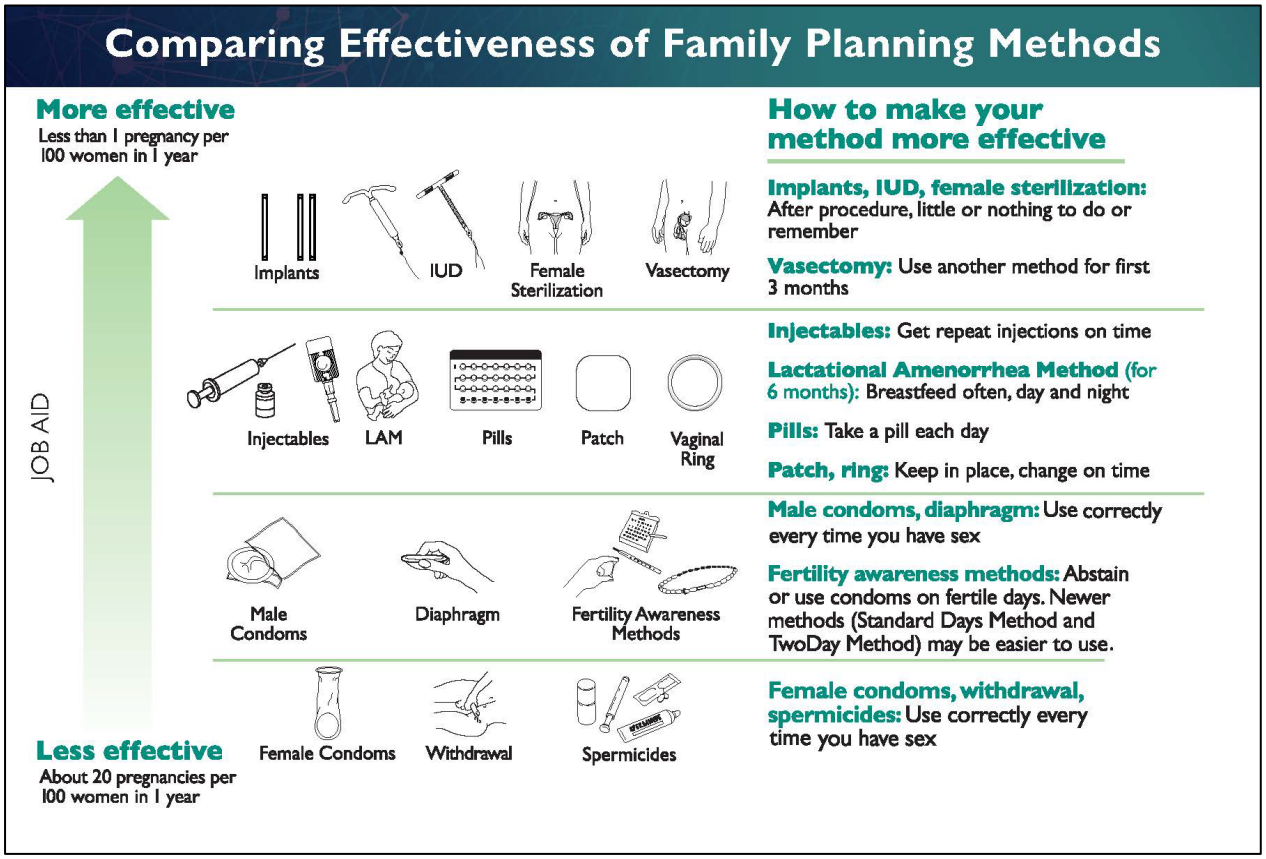
1.2.4.1: Contraception Definitions

The World Health Organization defines the following methods as modern contraception methods: "oral contraception pills, implants, injectables, contraceptive patch and vaginal ring, intrauterine device, female and male condoms, female and male sterilisation, vaginal barrier methods (including the diaphragm, cervical cap and spermicidal agents), lactational amenorrhoea method, emergency contraception pills, standard days method, basal body temperature methods, TwoDay methods and sympto-thermal method".(119) There is disagreement with this definition as other organisations, including the Guttmacher Institute, classify some natural methods, including lactational amenorrhoea, standard days, basal body temperature, TwoDay and sympto-thermal, as non-modern methods.(120)

1.2.4.2: Contraception Methods

There are methods of contraception that require daily or regular use or use every time a woman has intercourse; methods that are long lasting and need to be administered or changed infrequently; and methods that are permanent (121). **Figure 1-3** shows a visual representation of different methods of contraception, and the effectiveness of each, and instructions on how to maximise effectiveness.

Figure 1-3:World Health Organization Model for Comparing Contraception Effectiveness.



Source: WHO.(121)

Natural methods include the withdrawal method which involves withdrawing the penis from the vagina prior to ejaculation; fertility awareness methods; and the lactational amenorrhoea method. Natural methods require regular use and strong compliance with the protocols.

Barrier methods include male condoms, female condoms, female diaphragms and spermicides. Barrier methods require use every time sexual intercourse occurs.

Short-acting hormonal methods include the hormonal injections, combined oral contraception pill (COCP), progesterone only pills (POP), emergency contraception pill, combination oestrogen and progestogen hormonal vaginal ring or transdermal patches. The hormonal injection available in a 1-monthly or 3-monthly progestogen only injection (1-monthly is not available in Australia), and hormonal injections may be considered long acting if taken reliably without missed doses (122). The COCP and POP require daily use; the vaginal ring needs to be changed every 3 weeks; and transdermal patch needs to be changed every 3 weeks (not available in Australia). The emergency contraceptive pill is taken within to 5 days of unprotected sexual intercourse (123, 124).

Long-acting reversible contraception (LARC) include intrauterine devices (IUDs) and subdermal implants. The subdermal implant contains progestogen only and it requires changing every three to

five years depending on the device. Hormonal IUDs contain progestogen and requires changing every three to eight years, depending on the device. Non-hormonal IUDs are made from copper and require changing every 5 to 10 years, depending on the device. Non-hormonal IUDs may also be inserted as emergency contraception within 5 days of unprotected sexual intercourse (123, 124).

Permanent methods of contraception include vasectomy for men and tubal ligation or bilateral salpingectomy for women (123). Hysterectomy also provides permanent contraception for women but should only be performed in the case of an additional indication such as abnormal uterine bleeding (125).

Where contraception is provided as part of the research in this thesis, it focuses on short-acting hormonal methods, hormonal injections, LARC and male condoms. Access to female permanent methods is available, via referral to gynaecological services. However, where questionnaires or existing datasets are used to investigate the epidemiology of contraception use within the population, other methods are also included.

Methods that can be used in the post-partum period.

Immediate post-partum contraception are methods that can be initiated during the birth admission. This includes barrier methods, withdrawal method, lactational amenorrhoea, and progestogen only contraception (POP, progestogen injections and progestogen subdermal implants). IUDs (progestogen containing or copper) may be inserted within 48 hours of a vaginal birth, at the time of caesarean section, or anytime from 4 weeks postpartum. Oestrogen may impair the initiation of breastfeeding and increase the risk of venous thromboembolism. Previously, it was recommended the oestrogen containing contraception, such as the COCP, be avoided until six weeks post-partum in non-breastfeeding women, and six months post-partum in breastfeeding women. More recently, the UK Faculty of Sexual and Reproductive Health has advised the COCP can be commenced from three weeks in women who are not breastfeeding but should be delayed until six weeks postpartum in breastfeeding women or women with additional risk factors for venous thromboembolism. The WHO still recommends avoiding in breastfeeding women until six months post-partum.(121, 126) Fertility awareness methods are not possible until return of menstruation. Female sterilisation can be performed at the same time as a caesarean section, however, is usually arranged later following a vaginal birth. Male sterilisation may also be used (121, 124, 127).

1.2.4.3: Contraception Effectiveness

The World Health Organization categorises contraception methods according to the number of pregnancies that occur whilst using that method per 100 women in one year.(121, 122) Methods that result in:

1. Fewer than three are 'more effective'. These include intrauterine devices, hormonal subdermal implants, vasectomy or female sterilisation with tubal occlusion or tubal removal.(122)
2. Three to nine are 'effective'. These include progestin injections, oral contraception pills, and the lactational amenorrhoea method.(122)
3. 10 to 30 are 'less effective'. These include male and female condoms, fertility awareness methods, and withdrawal methods.(122)

The effectiveness of a contraception method may be reported as 'perfect use' meaning how effective the contraception is if there is complete compliance; or 'actual use' meaning how effective the method is according to how compliant women usually are. 'Actual use' generally provides a better real-world assessment of contraceptive effectiveness.(121) **Table 1-8** show the effectiveness of different methods with actual use. This information is also depicted in **Figure 1-3**.

Table 1-8: Effectiveness of Contraception Methods with Actual Use

Category of Effectiveness	Annual Number of Unintended Pregnancy per 100 women Using the Method	Method of Contraception
More Effective	<3	Intra-uterine devices Hormonal Implants Female sterilisation Vasectomy
Effective	3-9	Pills Injections Vaginal Rings Transdermal Patches Lactational Amenorrhoea
Less Effective	10-30	Male condoms Diaphragms with spermicide Calendar method Withdrawal Ovulation methods Female Condoms Spermicide
No Contraception	85	n/a

Source: WHO (121); Steiner et al (122)

1.2.4.4: Unmet Need for Contraception

The unmet need for contraception refers to reproductive aged women who are capable of conceiving, sexually active, not wanting to have a child within two years, but not using a modern method of contraception. Whilst the unmet need for contraception has been used for some time as a marker for access to contraception, and is supported by the World Health Organization, there is

recent commentary that it is too simplistic. It does not to capture the nuance of whether a particular method is acceptable to a woman, which is likely to increase the chance of method discontinuation.(128, 129) Method acceptability and satisfaction are not the focus of this thesis, but where the individual studies allow, information about specific methods of use are included.

1.2.4.5: Contraception Use in the General Population

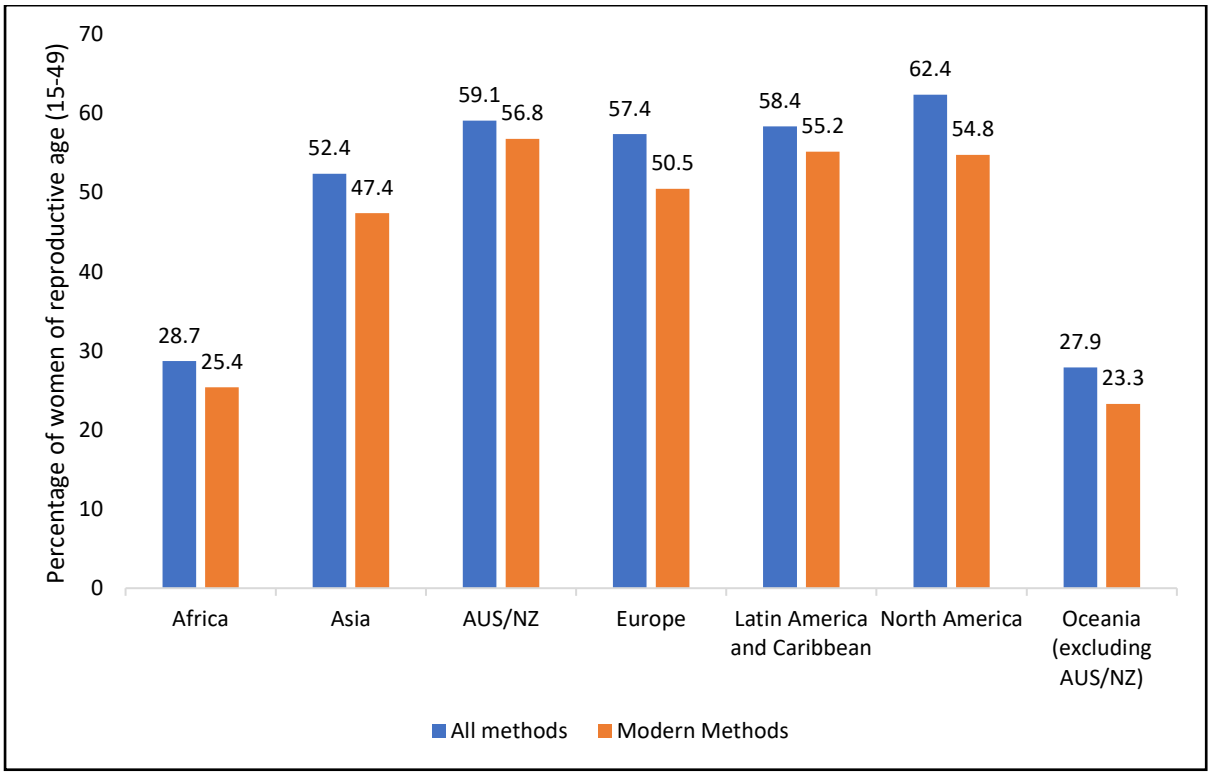
Frequency and Patterns of Contraception Use

The contraceptive prevalence rate is the percentage of reproductive aged women (or partners) who use any form of contraception. The unmet need for contraception is the number of reproductive aged women who are not wanting to conceive but are not using any method of contraception. In both of these definitions contraception refers to all forms previously described and all forms of modern and non-modern contraception.(130)

Global Contraception Prevalence Rates

The United Nations Population Division provides global data on contraception use, contraceptive prevalence, and the use of modern methods (using the United Nations definition as previously described).(131, 132) Table 5 shows the contraceptive prevalence rates for all methods and any methods of a selection of countries. **Figure 1-4** shows the contraception prevalence of all methods and modern methods for different global regions.

Figure 1-4: Median Estimates of Contraception Prevalence Rates for Global Regions



AUS: Australia; NZ: New Zealand. Source: United Nations Department of Economic and Social Affairs: Population Division.(132)

There is substantial regional variation in the contraception prevalence rates, with the highest reported for any method in 2019 at 80.5% (Brazil) to 5.3% (South Sudan). Australia sits in the top half (66.9%) in Australia but is lower than other high income countries including Austria (79.0% and the UK (71.9%). Overall, 91% of women who are using contraception are using modern methods.(131) **Table 1-9** provides country specific contraception prevalence rates for a range of countries.

Table 1-9: Contraception Prevalence Rates, Any Methods and Modern Methods, in a Selection of Countries and Regions

Country	Contraceptive Prevalence: Any method (%)	Contraceptive Prevalence: Modern method (%)
Argentina	70.1	68.2
Australia[a]	66.9	64.7
Austria	79.0	-
Bangladesh	62.7	59.1
Brazil	80.5	79.5
Chad	8.1	6.7
Cuba	69.0	67.9
Germany[b]	67.0	-
India	66.7	56.5
Kenya	43.7	42.2
Nepal	46.7	44.2
New Zealand[c]	64.5	60.6
South Sudan	5.3	4.9
Spain[b]	62.1	59.9
Sweden[d]	70.3	68.1
Thailand	73.0	71.3
Tonga	17.8	15.2
United Kingdom[e]	71.9	65.4
United States of America[d]	61.4	53.5

Source: United Nations Department of Economic and Social Affairs: Population Division (131) *Most recent available data is from: a) 2015; b) 2018; c)2014; d) 2017; e) 2010. All other data is from 2019.

Method Specific Patterns of Contraception Use

Global

There are many factors that influence the choice of contraception methods: side effect profile, effectiveness, ease and frequency of use, impact on sexual intercourse, effects on menstruation, cost and accessibility, autonomy over decision making, and the ability to use the method discretely. The importance of these factors varies in different geographical and sociocultural populations of women. Therefore, it is important women have access to a range of contraception methods so they may choose a method that is acceptable to them.(133) This section describes the types of contraceptive methods used by women in different settings worldwide, acknowledging the reasons for these differences are complex and not solely related to access. Given that contraceptive

effectiveness varies substantially according to the method, the method specific pattern of use is an important factor in the differing unintended pregnancy rates in different countries. Use of pills is common in many high-income countries. Data collection tools for contraception use differ between countries, however this section describes patterns of contraception use amongst a selection of high-income countries, using the most contemporaneous data identified in a search of the literature. It is possible other data is available in unpublished reports or in languages other than English. Additionally, some data has been impacted by the Covid-19 pandemic, as access to contraceptive services was restricted in some jurisdictions.(134, 135) Therefore, data from 2020 and 2021 may not be representative of usual contraception use.

Countries with a higher use of pills include France, Spain, Sweden and Canada. The National Contraception Survey in Spain in 2020 reported 78.7% of reproductive aged women use contraception. However, the 21.3%% that do not use contraception include women who are not sexually active. Of those who use contraception, 47.5% use condoms, 33.3% use a pill, vaginal ring or transdermal patch, 0.5% use hormonal injections, 2.2% use implants, 12.5% use intrauterine devices, 1.6% have had a female sterilisation procedure, 0.9% report their partner has had a vasectomy, and 0.9% use natural or other methods.(136) The FECOND national surveys on contraception use in France was conducted in 2010. This shows 2.4% of women have an unmet need for contraception, 16.1% use IUDs or subdermal implants, 35.1% use hormonal pills, transdermal patches or vaginal rings, 8.7% use condoms, 2.4% use male or female sterilisation and 4.8% other methods such as natural methods and spermicides.(137) A 2012 study of prescribed contraception in France also showed a predominance (67.6%) of the oral contraceptive pill.(138) A nationally representative internet survey of reproductive aged women was conducted in Sweden in 2021. It reported around 22% of women use pills, patches or rings, around 19% use IUDs or subdermal implants, less than 5% use permanent methods, around 17% use other methods, and almost 40% do not use any method. Whilst use of use IUDs or subdermal implants increased with age, women across all ages who did not use contraception predominantly cited not being sexually active or seldomly having sex, as the reasons for non-use sex. This study reports the unmet need for contraception in Sweden is 17.2%.(139) A survey of a nationally representative sample of Canadian women in 2016 reported 48.4% use condoms, 33.2% use oral contraceptive pills, 8.8% use intrauterine devices, and 16.6% withdrawal.(140) Subdermal implants were not available in Canada at the time of the survey.(141)

Countries with a lower reliance on pills include the UK and USA. The British Natsal-3 study was conducted between 2010 and 2012. It shows 19.4% of reproductive aged women have unmet contraception needs, 11.3% use IUDs or subdermal implants, 13.2% use contraceptive pills or

hormonal injections, 12.9% use barrier methods, 18.5% male of female sterilisation and 24.8% are not at risk of an unintended pregnancy.(142) The Natsal-Covid study is a Covid-19 pandemic specific study. This study reported that 54.1% of reproductive aged women who were wishing to avoid pregnancy used more effective or effective methods of contraception, 33.1% used fewer effective methods and 12.8% used no method. It is not clear if Natsal-Covid represents post-pandemic contraception prevalences in the UK, as 16.4% of respondents indicated they had experienced difficulty accessing contraception during the pandemic.(143) Natsal-4 is likely to provide this information, for which data was collected in 2022-2023 and thus far has not been published. The 2017 – 2019 National Survey of Family Growth assessed contraception use in the USA. It shows 65% of reproductive aged women use contraception. Although the findings do not clearly report the percentage with unmet contraception needs, it appears to be approximately 10% (when accounting for women not sexually active, pregnant, postpartum, or seeking pregnancy). 10.4% use IUDs or subdermal implants, 14.0% use contraceptive pills, 3.1% use hormonal injections, patches or rings, 8.4% use male condoms, 18.1% use female sterilisation, 5.6% use male sterilisation, and 5.7 use other forms of contraception.(144)

Australia

In Australia, use of contraception is common. Similar to France, Spain, Sweden and Canada, contraceptive pills are the predominant method used.(145) In 2016, 81% of sexually active women used a method of contraception. About half of those not using contraception reported they were planning a pregnancy. 33% of women use a contraceptive pill, 30% use condoms, and 19% use sterilisation (either male or female), 6.1% used IUDs, 4.9% used hormonal implants and 1.5% used injections, as their primary form of contraception.(146)Over the longer term, use of LARC has increased in Australia. Between 2003 and 2016 use of IUDs a primary form of contraception increased from 1.2% to 6.1%; hormonal implants increased from 1.1% to 4.9 %. Use of progestogen injections remained stable over the same time at 1.5% (146, 147). However, method-specific patterns of contraception use vary between cohorts of women and contraception methods of choice changes over time in the same cohorts of women.

The Australian Longitudinal Study on Women's Health (ALSWH) is a cohort study that is broadly representative of the Australian population of women and compares different cohorts of women, based on their year of birth. It examined changes in contraception use over time. It measures contraception prevalence of different methods, although excludes women who are pregnant, who are unable to conceive (e.g. had a hysterectomy), who had undergone tubal sterilisation or had a partner had undergone vasectomy. In 2018, 34% of women aged 24-29 used pills, whilst 64% of these women used pills in 2013 (then aged 18-23 years). In 2018, 27% of women aged 40-45 years

used pills, whilst use of pills in this cohort peaked at 55% in 2000 (then aged 20-27). For the younger cohort, use of condoms decreased from 45% to 31% between 2013 and 2018, and from 27.5% to 23.6% from 2000 to 2018 in the older cohort. The hormonal implant use was relatively stable in the younger cohort between 2013 and 2018, ranging between 9.5% and 11.6%. Hormonal IUD in the younger cohort increased from 2.2% to 13.3% from 2013 to 2018. Use of 'other' forms of contraception, including non-hormonal implants and injections, was relatively stable from 3.4% to 5.5% between 2013 and 2018. In the older cohort, all LARC was categorised together and as injections, hormonal implants and IUDs, and all forms reported together. Use of these methods increased in this cohort from 10.5% to 24.5% from 2009 to 2018. The proportion of women who did not use any contraception was lowest in the younger cohort and increased over time from 8.8% to 20.9% from 2013 to 2018. The proportion of women not using contraception was more stable in the older cohort, ranging from 17.6% to 26.1% from 2000 (aged 22-27) to 2018 (aged 40-45). Whilst pills were the most commonly used method amongst all groups, the pattern of use of methods changed as women aged, and also varied in different generations of women. Some of this may reflect variations in pregnancy.(145)

ALSWH also compares patterns of contraception use between cohorts of women from different socio-economic groups. Women with higher levels of education, managing on their available income, had never married and spoke English were more likely to use pills and less likely to use no contraception than their counterparts. The use of implants and hormonal IUDs were highest in women who live in remote area, although non-use of contraception was also high in these women.(145)

Post-Partum Contraception

Women are at risk of unintended pregnancy within a month postpartum, particularly if they are not breastfeeding. Ovulation may occur as early as 27 days postpartum and up to 60% of women resume intercourse within 6 weeks postpartum, although there is considerable variation across populations (148, 149). In a US study only half of women who resumed intercourse by 6 weeks postpartum were using any form of contraception (150).

The unmet need for post-partum contraception is documented in international research in low-, middle- and high-income countries (149, 151, 152). In the 18 months following a birth, women are particularly susceptible to unintended pregnancy. 76% of these repeat pregnancies are unintended.(153) This highlights the importance of ensuring women have the opportunity to formulate postpartum contraceptive plans and initiate contraception when desired. Postpartum contraception helps prevent a short interpregnancy interval, defined as less than 6 months between a birth and the next conception. A short interpregnancy interval is associated with increased risk of

pre-term birth, small for gestational age neonates, low birth weight, fetal death in utero and premature rupture of membranes.(154) The birth admission represents an opportunity to overcome some of the barriers to access and improve initiation of postpartum contraception.(155, 156)

1.2.4.6: Contraception Use in Women with Substance Use Disorder

Frequency and Patterns of Contraception Use

There are a number of socio-demographic factors linked to lower contraceptive use; the strongest consistent associations are with low education and poverty.(157) Women with SUD often experience these circumstances in addition to a range of complex issues, including violence and trauma.(158) Unsurprisingly then compared to the general population, women who have a SUD access contraception at lower rates, and report experiencing barriers to accessing contraception services.(159, 160) When women with SUD use contraception it is more likely to be a less effective method. This is demonstrated by an international meta-analysis of 24 studies reported women with SUD showed lower utilisation of contraception, including long-acting reversible contraception (LARC).(161) Barriers to access of LARC include poor patient understanding of the benefits and a lack of health practitioners' knowledge and experience of LARC methods (130, 162). These barriers are likely to disproportionately affect women with SUD. **Table 1-10** shows the proportion of women with SUD who use each contraception method in the meta-analysis.(161)

Australian research also demonstrates low used of highly effective methods, including LARC, in women with SUD. One Australian study shows one-third of women with SUD are not planning to conceive and report sexual intercourse in the previous month. Of those at women, only 54% used any form of contraception and only 20% used a highly effective method of contraception (21). Qualitative interviews from another Australian study in injecting drug users also demonstrated a high risk of unintended pregnancy. In the latter study, less than 1% were planning a pregnancy, 60% were not using any contraception, 23% were using a less effective method such as a pill or condoms and only 20% were using a highly effective methods such as LARC or sterilization (163).

Table 1-10: Contraception Use, According to Effectiveness, in Women with Substance Use Disorder

Method Effectiveness	Method	Median % of women using method	Range % of women using method
Very Effective	Intrauterine devices	7	2 - 29
	Implants	15	One study only
	Tubal Ligation	17	6 - 40
Effective	Oral contraceptive pills	17	6 - 58
Moderately effective	Condoms	62	3 - 87

	Other (Diaphragms, sponges)	10%	2-18%
Less Effective	Withdrawal, douching	23%	One study only

Frequency and Patterns of Contraception Use in the Post-Partum Period

Contraception is generally part of the six-week postpartum appointment, however few women with SUD attend that visit.(164, 165) Additionally, women with SUD are less likely to exclusively breastfeed, putting them at increased risk of ovulation and hence unintended pregnancy in the early postpartum period.(166) There are only two small Australian studies on post-partum contraception in women with SUD, however international researchers have investigated the use of postpartum contraception in women with SUD, with disparate methodologies, sample sizes and results. Use of postpartum contraception, at three months in two studies and not specified in the third, in women with SUD from the United States of America ranged from 25% to 71.3%, with the largest study restricted only to women with opioid use disorder.(167-169) Comparison to women without SUD was not provided in any of the international, or the two small Australian studies.(74, 170) Hence these studies cannot assess whether the women are appropriately identified as high risk, or the usual underlying postpartum contraception practices within the area. **Chapter 3** of this thesis aims to assess postpartum contraception plans among all women in a New South Wales local health district and compare the data between women with and without SUD.

1.2.5: Factors that Contribute to High Rates of Unintended Pregnancy in Women with Substance Use Disorder

The factors that contribute to high rates of unintended pregnancy in women with SUD are complex; can be difficult to illicit; and involve patient, social and health systems factors. These factors consistently reported include relationship factors, perception of infertility, contraception knowledge, although much of the research focuses on women who use opioids (171-173). Whilst women who use opioids report their knowledge about contraception is low, their knowledge is actually similar to women from the general population.(172) Women with SUD report avoiding contraception due to previously experiencing adverse effects and concerns about perceived long-term effects on fertility (163, 171). A common misconception is that the amenorrhoea associated with long term opioid use results in infertility.(171, 174) There is an increased likelihood of risky sexual behavior and lower use of condoms whilst intoxicated with alcohol or other drugs.(175, 176) Some women have ambivalent feelings towards pregnancy, or report they do not prioritise contraception whilst using drugs.(174) The availability of services varies as a factor, with some studies reporting women have good access to services and some studies reporting insufficient access (105, 163, 173). Cost of contraception is identified as a factor in some studies, but not others and likely depends on the health setting (160,

163, 177). There is one small study from the US that shows improved use of contraception by implementing a program that includes cost free contraception (178).

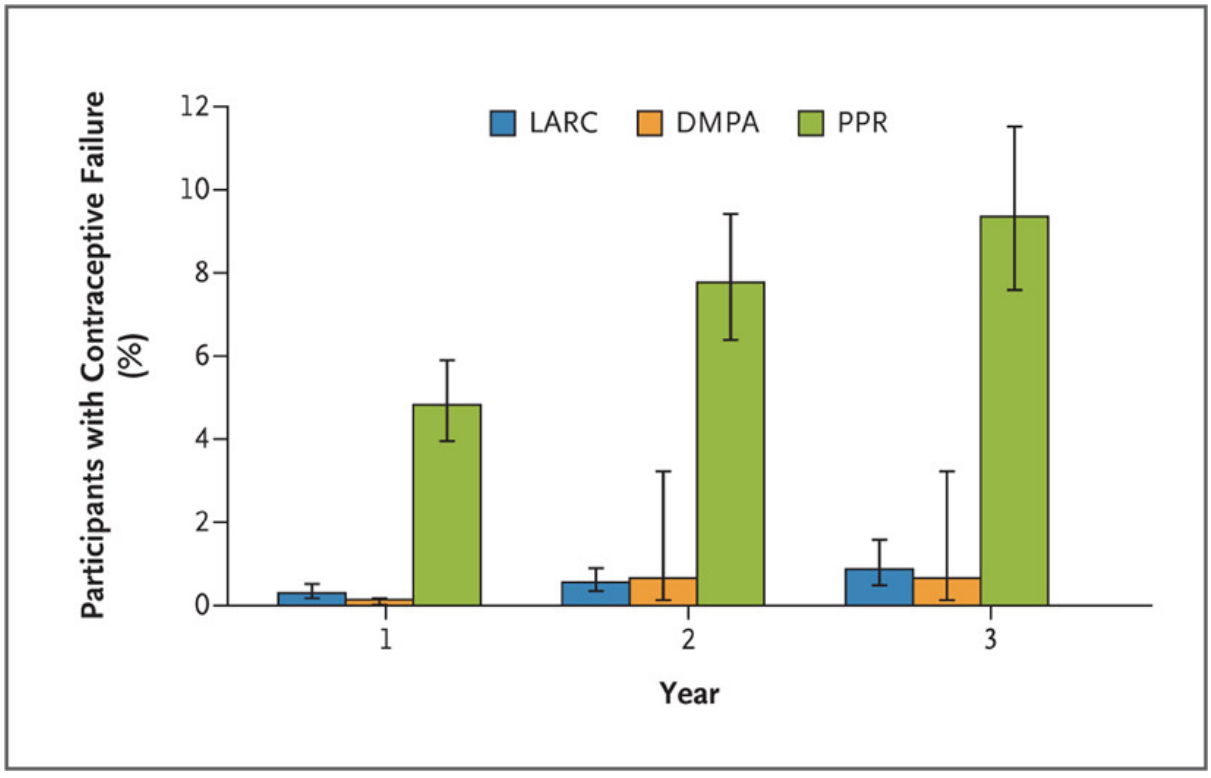
Intimate partner violence and reproductive coercion is also an issue. A large, multinational study by the World Health Organization reported intimate partner violence is associated with unintended pregnancy (aOR 1.69,95% CI: 1.53-1.86).(38) Women with SUD experience high rates of interpersonal and sexual violence, although the downstream impact on unintended pregnancy rates have not been demonstrated.(103) However, women with an alcohol use disorder are more likely to experience reproductive coercion compared to those without an alcohol use disorder (aOR 1.89,95%CI: 1.20-2.96).(179)

1.3: Interventions

1.3.1: Programs That Aim to Increase Uptake of Contraception in the General Population

Programs that reduce barriers to access to contraception for women demonstrate an increase in contraception and use, with women choosing methods of contraception with higher effectiveness, although these programs generally focus on LARC rather than access to a choice of contraceptive options. The Choice contraception project provided cost free contraception and facilitated access to contraception counselling. A range of contraception options were available, however 67% of participants had LARC inserted. In the three years following enrolment in the study, unintended pregnancies were lowest in women who initiated and continued IUDs, hormonal implants and injections as compared to pills (<1% vs 4.8%, p<0.001).These results are graphically depicted in **Figure 1-5** (180, 181).

Figure 1-5: Failure Rates of Various Contraception Methods in The CHOICE Contraception Project.



Reproduced with permission from Winner et al (181), Copyright Massachusetts Medical Society.
LARC: Long-acting reversible contraception; DMPA: Depot medroxyprogesterone acetate; PPR: Pills, patches and rings.

In the Australian setting, the ACCORd project provided a rapid access pathway for LARC from general practice to outpatient gynaecology settings. LARC use rose from 12% to 47% in 12 months for those who accessed the pathway.(182)

1.3.2: Programs That Aim to Increase Initiation and Continuation of Contraception in Women with Substance Use Disorder

Pathways that provide facilitated access to women who use AOD have also demonstrated and increase in contraception use. A systematic review on interventions to increase contraception usage in women who use AOD, identified 22 papers, 19 of which were conducted in the US, one in Hong Kong, one in Canada, and one in South Africa. However, the review was not limited to women with SUD, rather it included women with all patterns of AOD use. There was diversity in findings, however studies that involved contraceptive counselling, free contraception, and mechanisms to change behaviour were more likely to result in increased uptake of contraception compared to those that only provided written information. Face to face contraception counselling had a greater effect than other methods of delivery. Case management, that included peer navigation to access family planning clinics, was also found to be helpful.(183)

The largest of the studies included in the systematic review was a Center for Disease Control and Prevention (CDC) led randomised controlled trial called Project CHOICES. This study was not exclusively conducted in a population of women with SUD, rather it included women who were deemed to be at risk of having an alcohol exposed pregnancy. However, 56% of women in the study met the criteria for alcohol dependency. The inclusion criteria were that women were not planning to conceive within 9 months; were not consistently using effective contraception; and had frequent drinking, defined as consuming more than eight standard drinks per week, or binge drinking, defined as consuming than five standard drinks in a day. 830 women were randomised to receive an intervention package that included contraception counselling, motivational interviewing and contraception information, verses a control group that received contraception information only. At 9 months the intervention group were 1.45 times more likely to be using effective or more effective forms of contraception (OR 2.4, 95% CI 1.1–1.9), indicating contraception counselling and motivational interviewing increase initiation and continuation of contraception.(184)

A similar smaller project conducted in women engaged in an opioid treatment program. The intervention in this study included contraception counselling, shared decision making using a validated tool on contraception choices, and cost-free access to contraception. This study also provided financial incentives for participating in the program, but that was independent from the decision to initiate or continue contraception. In this study, 100% of women in the intervention group initiated contraception, whilst 94% continued use to 6 months. This compared to 29% and 13% respectively, in women in the control group who were provided information brochures on contraception and local providers.(178) It has also been demonstrated that antenatal counselling

for contraception choices is associated with 6.7 times the odds a woman with opioid use disorder will access post-partum contraception.(185)

Whilst not included in the systematic review, a program conducted within an Australian AOD service did not demonstrate an increase in initiation of contraception. This study facilitated referral for subdermal implants and intrauterine devices, and did not provide contraception education for clinic staff and study participants.(186) This thesis hypothesises that within an Australian setting, a program that provides access to a range of free contraception options, including on-site options at AOD services, and contraception education for study participants and AOD services staff, will improve initiation and continuation of contraception. **Chapter 4** of this thesis tests the introduction of a facilitated pathway for contraception services within two Australian AOD services.

1.3.3: Economic Evaluation of Programs that Change Contraception Use

Programs that increase contraception use generally achieve cost neutrality or are cost savings**,** however most of these analysis focus on programs that promoted access to LARC rather than a range of contraception options. **Table 1-11** shows economic analyses conducted in the general population and populations that use AOD. There is only one known economic evaluation in populations that use AOD.

Table 1-11: Economic Evaluations of Program that Change Contraception Use

Source	Setting	Sample Size	Factors Examined	Findings
Concepcion et al, 2020 (187)	Australian modelling on general population	n/a – Savings modelled for Australian population	Costs of contraception (LARC compared to no contraception; LARC compared to OCP) Costs of miscarriages and abortion (analysis does not include avoided costs of pregnancy care)	Over 5 years in Aust: 1. switch from pill to LARC* saves AU$74.4M (mostly to consumer) 2. Switch from no contra to LARC* saves AU$2.4M (mostly to govt.) *Based on 14.8% use of LARC
Botfield et al, 2020 (188)	Australian modelling on general population – determine	As above	As above + increased uptake LARC (to 20%) with nurse-led insertions	Addition AU$2.7M saving to Australian govt.

	increased uptake and cost savings with nurse led insertion			
Black et al, 2015 (189)	Canadian population modelling	n/a – Savings modelled for Canadian population	1. Costs related to unintended pregnancies 2. Proportion of unintended pregnancy attributed to imperfect adherence to contraception 3. Cost of contraception 4. Cost of intrauterine device* (note: subdermal implants not available in Canada)	Direct cost unintended. Preg C$320 M. 10% switch from pill to intrauterine device saved C$35M. Cost neutrality achieved within 12 months.
Trussell et al, 2015 (190)	USA population modelling		Costs associated with: 1. Contra method acquisition 2. Contra administration/insertion 3. Unintended pregnancy	Cost neutrality for LARC achieved within 3 years.
Madden et al, 2018 (191)	CHOICE contraception project. Women with Medicaid insurance Women from St Louis, Missouri, USA)	5061 (of total 9256 participants in CHOICE – the rest were non-Medicaid). Note: At enrolment, participants must have either not been using reversible contraception or been willing to try a new method.	Costs of Choice Contraception Project included: Provision of contraception counselling inc. salaries of staff; initiation of contraception costs 2. Costs of unintended pregnancies – inc. live birth, miscarriage, abortion	US$5 M savings over the duration of the program (45 months) and compared to a comparison group (study was not an RCT, comparison group was estimated from data from a family planning service in the area)
McNeely et al, 2019 (192)	County Jails, Tennessee, USA	921 (91% have AOD use)	Voluntary LARC provision, incl. education for participants. Examined outcomes:	921 offered LARC → 794 received LARC → 270-460 unintended

			• Unintended pregnancies • Neonatal abstinence syndrome	pregnancies prevented in 12 months → 40-52 NAS cases prevented in 12 months → US$1.4 – 1.8 M cost savings (cost of NAS infant over first 12 months of life estimated at US$35,000).

1.4: Conclusions and Rationale for this PhD Thesis

There are key gaps in the literature regarding substance use disorder, unintended pregnancy and contraception, which subsequently form the rationale for conducting the research in this PhD thesis. The scoping review identified gaps in the literature regarding the impact unintended pregnancy has on pregnancy and birth outcomes in women with SUD. Another identified gap is the limited data available on of the rate of SUD in pregnant women in Australia, with no comprehensive or contemporaneous studies available. The studies that do exist were either conducted decades ago, limited to certain drugs, and/or included only those requiring a hospital admission during pregnancy related to their SUD. There are similar gaps in the available literature on the rate of unintended pregnancy in women with substance use disorder. The available studies were small in size, and usually did not compare to women without a SUD. Whilst the birth admission was identified as an opportunity to provide access to contraception, only two small observational studies are available in the Australian setting, and neither compares to women without SUD. There are also gaps in effective interventions to increase access to contraception for women with substance use disorder. Evidenced based interventions are available in the general population, and there are several interventions in women with SUD available internationally. However, within the Australian setting, there is only one study available, which did not result in an increase in contraception initiation.

I recognise that women with SUD are a marginalised, and often disempowered, cohort and that care must be taken to ensure all research conducted aligns with ethical principles and retains the central objective of contributing towards improving the lives of women with SUD. Additionally, much of the work within this thesis was conducted during the Covid-19 pandemic, and at times, involved a modified research plan. Specifically, I planned to:

1) Investigate the epidemiology of substance use disorders in pregnant women using maternity datasets, including the rate of substance use disorder, and the rate of unintended pregnancy in those with substance use disorder.
2) Examine associations between unintended pregnancy and pregnancy and birth outcomes in women with substance use disorder, in five New South Wales local health districts.
3) Assess the use of the birth admission to formulate and initiate postpartum contraception
4) Test a pathway to provide contraception through AOD services.

The work in this thesis will contribute to a better understanding contraception and unintended pregnancy, and pathways to improve access to contraception and hence pregnancy planning, in women with substance use disorder in Australia.

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Chapter 2: Unintended Pregnancy, and Pregnancy and Birth Outcomes, in Women with Substance Use Disorder: A Retrospective Cohort Study

K. A. McNamara, K Black, B Murnion, A Shand, A Henry, J Ludlow, K Hankins, R Chinoy, N Nassar. Unintended Pregnancy, and Pregnancy and Birth Outcomes, in Women with Substance Use Disorder: A Retrospective Cohort Study. Acta Obstet Gynecol Scand. Under Review.

Chapter 2 was adapted and reformatted for publication. This study uses existing maternity datasets from five New South Wales local health districts (LHD) from 2017 to 2020 to evaluate the prevalence of substance use disorder in pregnant women. In the cohort identified as having a substance use disorder, associations between unintended pregnancy and maternal and neonatal outcomes are investigated. As identified in the scoping review in **Chapter 1**, it is the first known study worldwide to evaluate these associations.

Author contribution statements are available in **Appendix B**: **8.3**.

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2.1: Background

The rate of SUD in Australian women is 2.1%, although specific data for reproductive aged women is not available.(1) Whilst there are no recent Australian studies examining the rate of SUD in pregnancy, some studies report on use or use disorder of specific types of drugs. Australian studies from the mid-2000s report a rate of SUD in pregnancy between 0.8 and 1.1%.(2, 3) A 2021 New South Wales (NSW) study reports a rate of less than 1%, although not all drug types were included.(4) Australian population surveys report the rate of cannabis and illicit drug use in pregnant women is 7%, and any alcohol use is 55%, although many women cease upon recognition of pregnancy, and most who use alcohol and other drugs (AOD) do not have a SUD.(5)

UIP and SUD are commonly linked, and both associated with social determinants of health.(6-11) UIP and SUD are both associated with poor maternal and neonatal health, including low birth weight and preterm birth.(12, 13) However, the synergistic impact of UIP and SUD on pregnancy and birth outcomes is not well understood. Whilst there are no Australian studies comparing the rate of UIP in women with and without SUD, associations have been reported internationally.(10, 14, 15) There

are no available studies that investigate whether adverse pregnancy and birth outcomes were further exacerbated by UIP in women with SUD.(16)

We hypothesised that an UIP amplifies the risk of adverse pregnancy and birth outcomes in women with SUD. In this study, we aimed to determine the rate of SUD in pregnant women, and amongst these women, compare the characteristics and the association between UIP and pregnancy and birth outcomes.

2.2: Methods

Study design, setting and timeframe

Retrospective cohort study utilising existing data collected by midwives and pregnancy care providers during antenatal care or the birth admission and entered into public hospital maternity databases. Maternal and neonatal data were obtained from five NSW local health districts (LHD), which used one of two maternity databases (A and B). Births were included if they occurred between January 1st 2017 and June 30th 2020. Although the time period varied amongst LHDs, all datasets overlapped from November 1st, 2017, to 30th September 2019. The variations occurred as both databases underwent a transition or major modification during the research period, which limited data availability. **Table 2-1** shows the differences in the database and data ranges across LHDs.

Table 2-1: Date range, based on neonatal date of birth, for data set according to Local Health District (LHD)

LHD	Minimum	Maximum	Database
1. (n=9795)	01.04.2017	30.06.2020	A
2. (n=15523)	01.04.2017	30.06.2020	A
3. (n=19679)	01.11.2017	30.06.2020	A
4. (n=8896)	01.11.2017	30.06.2020	A
5. (n=17966)	01.01.2017	30.09.2019	B

The included LHDs are all on or close to the eastern coastline of NSW, three are within metropolitan Sydney and two outside, and include 13 public hospital maternity units. In 2019, births from these hospitals accounted for 27.5% of all NSW births.(17) There is a mix of capabilities of neonatal and maternity services across the hospitals, categorised into levels of care using the NSW Ministry of Health Maternity and Neonatal Service Capability guidelines (Levels 1 to 6).(18) These levels were combined with the hospital location to define hospital type, including: i) Tertiary: all level 6 hospitals with a neonatal intensive care unit (NICU), that care for women of all risk, including high risk; ii) Metropolitan Peripheral: non-level 6 hospitals (without NICU) within metropolitan Sydney; iii) Regional: level 5 units outside of metropolitan Sydney (hospitals with a special care nursery that

generally cares for women birthing from 32 weeks, including high risk but excluding some complex conditions, such as known placental accreta spectrum disorder); iv) Rural: all level 1-4 units outside metropolitan Sydney.

Study procedures

Data were extracted and standardised across the maternity databases (Cerner and eMaternity). Data included maternal demographics, medical history, substance use and involvement with AOD treatment services, pregnancy intention, psychosocial factors, pregnancy birth and neonatal outcomes. Births were excluded if there was missing or implausible data on required key variables, such as infant date of birth, or if there was duplicate neonatal data.

Substance use disorder (SUD) was defined as current involvement in, or identified need for referral to, AOD treatment, and dichotomised as women with or without SUD. Pregnancy intention was dichotomised, as intended or unintended.(**Table 2-2**).

Table 2-2: Dataset variables used to define substance use disorder and pregnancy intention.

To create a dichotomous variable for substance use disorder data were extracted from i) a single variable from database A, ii) six variables from database B, which were combined.

To create a dichotomous variable for pregnancy intention data were extracted from i) a single variable from database A, in which conception method was grouped as 'unplanned', 'planned spontaneous', or a range of fertility therapies. The 5.7% of women who had conceived after using fertility therapies were assumed to have an intended pregnancy. ii) A single variable from database B, in which pregnancy intention was grouped as 'Planned/Happy', 'Unplanned/Happy', 'Not stated' or free text. 'Not stated' was recoded to missing, and free text responses (<1% of all cases) were recoded into planned, unplanned or missing by author 1 based on wording within the free text.

	Variables used from Database A	**Variable used from Database B**
Substance Use Disorder Variables	Drug Support	Reason for referral W&C Drug Intervention Required W&C Drug Treatment Service W&C Drug Treatment Required Now Antenatal Problem Latest Antenatal Problems During Pregnancy
Pregnancy Intention Variables	Estimated date of birth (EDB) Conception Method	W&C Response to Pregnancy

W&C: Women and Children

Study outcomes and factors

Maternal and neonatal outcomes assessed for this study included: 1) Maternal: new medical problems, new mental health problems, gestational diabetes, antepartum haemorrhage, preterm prelabour rupture of membranes, antenatal admissions, administration of antenatal steroids, post-partum haemorrhage, anaesthesia used in labour and birth, mode of birth, genital tract trauma, postnatal length of stay; 2) Neonatal: birth weight, small for gestational age (calculated using Australian centiles, stratified by sex),(19) gestational age at birth, five-minute Apgar score, neonatal congenital anomaly, admission to nursery, stillbirth, length of stay, child protection services (CPS) involvement.

Study factors comprised maternal sociodemographic (maternal age, first nations woman, having a partner, Australian Socio-Economic Indexes for Area: index of relative socio-economic disadvantage, hospital type, neonatal year of birth),(20) maternal social factors (domestic violence issues, having a child living away from home), maternal lifestyle and health factors (parity, history of previous caesarean, body mass index at booking, history of mental illness, history of medical illness, up to date cervical screening, smoking during pregnancy, alcohol use during pregnancy, cannabis use at booking, other drug use at booking, gestational age at first antenatal visit), pregnancy factors (number of antenatal visits, plurality, infant sex, Edinburgh Postnatal Depression Score).(21)

Data Analysis and ethical approval

Data from database A and B were extracted and collated in Microsoft Excel and imported into SPSS 29.0.1.0 for analysis.(22, 23) The rate of SUD and UIP were calculated. To assess regional and temporal variations, birth year, LHD, and hospital type were compared between women with and without SUD using Pearson Chi Squared Test. The dataset was then limited to women with SUD who had data available on pregnancy intention. In women with SUD, maternal, neonatal and sociodemographic factors were compared using a Pearson Chi Squared Test, or if the numbers were less than five in any group, a Fisher's Exact test, between women with intended and unintended pregnancies. Association between UIP and maternal and neonatal outcomes were assessed using univariate analysis. For those where crude association was found based on P value < 0.2, multivariate binomial regression, adjusting for potential confounding by study factors was conducted. Only study factors that were considered relevant to individual outcomes were included. Where missing data was greater than five percent, it was accounted for in the model, otherwise it was excluded. Pregnancy factors were not considered as they were on the causal pathway.(**Table 2-3**). Odds ratios and 95% confidence intervals were calculated based on significance level that was set to less than 0.05, where confidence interval did not include one. Model fit was evaluated using

Hosmer-Lemeshow Test and all were valid. The most parsimonious model was presented for each outcome. STROBE reporting guidelines were adhered to.(24)

Ethics approval was granted by South Eastern Sydney Local Health District Human Research Ethics Committee (2019/ETH11539). Site-specific governance approval was gained from each site.

Table 2-3: Study factors included in multivariate model for each outcome

Outcomes associated with unintended pregnancy	Potential confounding study factors considered in the multivariate binomial regression
Neonatal length of stay	Maternal age, history of mental illness, child living away from home, First nations woman, Hospital Type, smoking during pregnancy, other drug use at booking, gestational age at first antenatal visit, index of relative socio-economic disadvantage
Child protection services involvement	Maternal age, history of mental illness, child living away from home, First nations woman, other drug use at booking, domestic violence issues, index of relative socio-economic disadvantage, parity
Maternal postnatal length of stay	Maternal age, history of mental illness, First nations woman, other drug use at booking, gestational age at first antenatal visit, index of relative socio-economic disadvantage, parity
General, Spinal or Epidural Anaesthesia in labour	Maternal age, body mass index at booking, history of mental illness, First nations woman, Hospital Type, other drug use at booking, gestational age at first antenatal visit, index of relative socio-economic disadvantage, parity, having a partner

Factors were considered in the model, and the most parsimonious model was presented for each outcome (as shown in Table 2-9)

2.3: Results

During the index period, there were 73,064 babies born to 71,859 mothers. The rate of SUD was 0.8% (n=579) and ranged from 0.4% to 1.9% across LHDs ($p<0.001$). There were no changes in the rate of SUD over time ($p=0.54$). Characteristics of women with SUD and those without were

compared by LHD, hospital type, year of birth (**Table 2-4)**. Three-quarters (73.9%) of pregnancies in women with SUD were unintended, compared to 27.1% in women without SUD (p<0.001). For those with SUD, 97.9% (n=567) had data available on pregnancy intention, and there was no change in the UIP rate over time (p=0.18) (**Table 2-5**).

Table 2-4: Local health district of birth, hospital type and year of birth, in women with and without substance use disorder

	Women with SUD	Women without SUD	P value
	N=579	N=71,280	
Local Health District			
1. (n=9795)	127 (1.3%)	9668 (98.7%)	<0.001
2. (n=15523)	56 (0.4%)	15467 (99.6%)	
3. (n=19679)	85 (0.4%)	19594 (99.6%)	
4. (n=8896)	172 (1.9%)	8724 (98.1%)	
5. (n=17966)	139 (0.8%)	17827 (99.2%)	
Type of hospital			
Tertiary (n=23418)	97 (0.4%)	23321 (99.6%)	<0.001
Metro Peripheral (n=29750)	183 (0.6%)	29567 (99.4%)	
Regional (n=15129)	227 (1.4%)	15902 (98.2%)	
Rural (n=2562)	72 (2.8%)	2490 (97.2%)	
Neonatal Birth year			
2017 (n=15003)	107 (0.7%)	14,896 (99.3%)	0.54
2018 (n=25518)	211 (0.8%)	25,307 (99.2%)	
2019 (n=22634)	191 (0.8%)	22,443 (99.2%)	
2020 (n=8704)	70 (0.8%)	8634 (99.2%)	

SUD: Substance use disorder

Table 2-5: Neonatal Year of Birth and Pregnancy Intention, in Women with Substance Use Disorder

	Women with unintended pregnancy (n=419)	Women with intended pregnancy (n=148)	P value
Neonatal Birth year			
2017 (n=103)	76 (73.8%)	27 (26.2%)	0.18
2018 (n=205)	157 (76.6%)	48 (23.4%)	
2019 (n=189)	130 (68.8%)	59 (31.2%)	
2020 (n=70)	56 (80.0%)	14 (20.0%)	

In women with SUD, those with an UIP differed from women with an intended pregnancy on a range of maternal demographic characteristics. A higher proportion of women with UIP were aged less than 35 years (78.3% vs 67.6%, p=0.03), birthed at a regional or rural hospital (55.4% vs 45.2%, p=0.001), presented for the first antenatal appointment after 13 completed gestational weeks (40.5% vs 26.0%, p=0.005), had a body mass index less than 19kg/m^2 at the booking antenatal appointment (15.3%% vs 7.4%, p=0.016), had another child living out of their care (32.2% vs 20.9%, p=0.027), had pre-existing mental illness (85.0% vs 73.1%,p=0.001), and used drugs other than alcohol and cannabis at booking (25.1% vs 13.9%, p=0.018). The factors associated with the largest differences between those with unintended and intended pregnancies in women with SUD were exposure to domestic violence (31.9% vs 12.9%, p<0.001), tobacco smoking during pregnancy (80.4% vs 59.5%, p<0.001), and not having a partner (34.0% vs 15.5%, p<0.001).(**Table 2-6**).

Table 2-6: Sociodemographic, social, lifestyle, health and pregnancy factors in women with Substance Use Disorder, according to pregnancy intention

Maternal sociodemographic and social, health, lifestyle and pregnancy factors	**Women with unintended pregnancy (N=419)**	**Women with intended pregnancy (N=148)**	**P values**
Sociodemographic factors			
Maternal age at birth			**0.030**
24 or younger	106 (25.3%)	35 (23.6%)	
25 to 34	222 (53.0%)	65 (43.9%)	
35 or older	91(21.7%)	48 (32.4%)	
Partnered			**<0.001**
Yes	276 (66.0%)	125 (84.5%)	
No	142 (34.0%)	23 (15.5%)	
2016 SEIFA IRSD Quintile			0.18
1	76 (18.2%)	36 (24.5%)	
2	112 (26.8%)	29 (19.7%)	
3	93 (22.2%)	28 (19.0%)	
4	61 (14.6%)	28 (19.0%)	
5	76 (18.2%)	26 (17.7%)	
Type of hospital			**0.001**
Tertiary	76 (18.1%)	20 (13.5%)	
Metro Peripheral	111 (26.5%)	61 (41.2%)	
Regional or Rural	232 (55.4%)	67 (45.2%)	
Social factors			
Domestic violence issues*			**<0.001**

Yes	108 (31.9%)	13 (12.9%)	
No	207 (61.1%)	81 (80.2%)	
Missing	24 (7.1%)	7 (6.9%)	
Child living away from home			**0.027**
Yes	135 (32.2%)	31 (20.9%)	
No	222 (53.0%)	95 (64.2%)	
Missing	62 (14.8%)	22 (14.9%)	
Lifestyle and Health Factors			
Parity			0.07
0	163 (38.9%)	70 (47.3%)	
1 or more	256 (61.1%)	78 (52.7%)	
Previous caesarean section			0.31
Yes	67 (16.0%)	21 (14.2%)	
No	352 (84.0%)	127 (85.8%)	
Body Mass Index at booking (kg/m2)			**0.016**
≤19	64 (15.3%)	11 (7.4%)	
20-34	282 (67.3%)	114 (77.0%)	
≥35	22 (5.3%)	12 (8.1%)	
Missing	51 (12.2%)	11 (7.4%)	
Past history of mental illness			**0.001**
Yes	351 (85.0%)	106 (73.1%)	
No	62 (15.0%)	39 (26.9%)	
Past history of medical illness*			0.90
Yes	320 (94.4%)	95 (94.1%)	
No	19 (5.6%)	6 (5.9%)	
Cervical screening up to date*			0.28
Yes	174 (51.3%)	58 (57.4%)	
No	165 (48.7%)	43 (42.6%)	
Any tobacco smoking in pregnancy			**<0.001**
Yes	377 (80.4%)	88 (59.5%)	
No	82 (19.6%)	60 (40.5%)	
Any alcohol use in pregnancy			0.53
Yes	51 (12.2%)	21 (14.2%)	
No	367 (87.8%)	127 (85.8%)	
Cannabis use at booking*			0.96
Yes	162 (47.8%)	48 (47.5%)	

No	177 (52.2%)	53 (52.5%)	
Other drugs use at booking*#			**0.018**
Yes	85 (25.1%)	14 (13.9%)	
No	254 (74.9%)	87 (86.1%)	
Gestational age at first antenatal assessment			**0.005**
<13 weeks	244(59.5%)	108 (74.0%)	
13-27 weeks	139 (33.9%)	29 (19.9%)	
28+ weeks	27 (6.6%)	9 (6.2%)	
Pregnancy/Infant factors			
Number of antenatal visits*			0.07
8 or more*	215 (63.5%)	74 (73.3%)	
Less than 8	124 (36.6%)	27 (26.7%)	
Plurality			1.00**
Singleton	411 (98.1%)	146 (98.6%)	
Multiple	8 (1.9%)	2 (1.4%)	
Total EPDS			0.06
≥13	78 (18.6%)	26 (17.6%)	
< 13	306 (73.0%)	118 (79.7%)	
Missing	35 (8.4%)	4 (2.7%)	
Infant Sex	N=427	N=150	0.66
Male	216 (50.6%)	79 (52.7%)	
Female	211 (49.4%)	71(47.3%)	

SEIFA IRSD: Socio-Economic Indexes for Areas, Index of Relative Socio-economic Disadvantage
EDPS: Edinburgh Postnatal Depression Score
Numbers do not add to total due to a small amount of missing data. Missing data is provided where it accounts for >5% of all data.
* Data not available for database B (127 women)
** Fishers exact test
# Amphetamines, Opioids, benzodiazepines, cocaine, gamma hydroxybutyrate, other stimulants, non-medical use of antidepressants, and all other illicit drugs not specified, excluding alcohol, tobacco and cannabis.

For maternal outcomes, in the univariate analysis, women with an UIP had increased odds of a postnatal length of stay greater than five days (Odds ratio (OR) 1.74; 95% Confidence Interval (CI) 1.10-2.76) and reduced odds of having received a general, spinal or epidural anaesthetic during labour or birth (OR 0.66, 95%CI 0.45-0.97). After adjusting for relevant confounders, these results persisted for maternal length of stay, with a more than two-fold increase (adjusted odds ratio (aOR) 2.27; 95%CI 1.11-4.67). However, the precision was reduced for general, spinal or epidural anaesthetic (aOR 0.69, 95%CI 0.46-1.03). UIP was not associated with other maternal outcomes,

including pregnancy complications, mode of delivery, postpartum haemorrhage or perineal trauma (**Table 2-7)**. Stillbirth was not associated with UIP compared to intended pregnancy, although absolute numbers may have been too low to show an effect (1.0% vs 0.4%, p=0.68).

Table 2-7: Associations between pregnancy intention and pregnancy and birth outcomes of women with Substance Use Disorder

Maternal outcomes	**Unintended pregnancy (N=419)**	**Intended pregnancy (N=148)**	**Crude Odds Ratio**
Antenatal: any new medical problem[##]*			
Yes	256 (78.4%)	73 (72.3%)	1.39 (0.84-2.31)
No	73 (21.6%)	28 (27.7%)	Reference
Antenatal: new mental health problem*			
Yes	259 (76.4%	71 (70.3%)	1.39 (0.83-2.24)
No	80 (23.6%)	30 (29.7%)	Reference
Gestational diabetes			
Yes	45 (10.7%)	13 (8.8%)	1.25 (0.65-2.39)
No	374 (89.3%)	135 (91.2%)	Reference
Antepartum haemorrhage*			
Yes	15 (4.5%)	4 (4.0%)	1.15 (0.37-3.55)
No	316 (95.5%)	97 (96.0%)	Reference
PPROM*			
Yes	22 (6.6%)	7 (6.9%)	0.95 (0.39-2.29)
No	312 (93.4%)	94 (93.1%)	Reference
Antenatal admissions*			
Yes	75 (22.7%)	20 (20.0%)	1.18 (0.68-2.05)
No	255 (77.3%)	80 (80.0%)	Reference
Post-partum haemorrhage (≥500 mls)			
Yes	88 (21.0%)	39 (26.4%)	0.74 (0.48-1.15)
No	331(79.0%)	109 (73.6%)	Reference
General, Spinal or Epidural Anaesthesia			
Yes	227 (54.2%)	95 (64.2%)	**0.66 (0.45-0.97)**
No	192 (45.8%)	53 (35.8%)	Reference
Mode of birth			
Caesarean section	122 (29.1%)	56 (37.8%)	0.67 (0.44-1.00)

Instrumental	45 (10.7%)	15 (10.1%)	0.92 (0.48-1.73)
Spontaneous	252 (60.1%)	77 (52.0%)	Reference
Genital tract trauma			
Yes	217 (51.8%)	73 (49.3%)	1.10 (0.76-1.61)
No	202 (48.2%)	75 (50.7%)	Reference
Postnatal length of stay > 5days			
Yes	121 (28.9%)	28 (18.9%)	**1.74 (1.10-2.76)**
No	298 (71.1%)	120 (81.1%)	Reference

New Medical Problems includes autoimmune, cardiac, endocrine, haematological, infectious diseases, neurological, gastrointestinal and liver, musculoskeletal, renal, respiratory and other conditions acquired during pregnancy.
Specific diagnoses for new medical or mental health problems were not available.
Numbers do not add to totals due to a small amount of missing data. Missing data is provided where it accounts for >5% of total.
* Data not available for database B (127 women: 80 unintended, 47 intended)

In the univariate analysis for neonatal outcomes, UIP was associated with increased neonatal length of stay greater than five days (OR 1.96; 95%CI 1.30--2.94) and CPS involvement (OR 1.76; 95%CI 1.11 -2.78) only (**Table 2-8**). After multivariate analysis, these results persisted for a neonatal stay greater than five days with an almost-two-fold increased odds (aOR 1.96; 95%CI 1.09-3.55), but not for CPS (aOR 1.22; 95%CI 0.69-2.16) (**Table 2-9**).

Table 2-8: Associations between pregnancy intention and neonatal outcomes of women with substance use disorder

	Unintended pregnancy (N=427)	**Intended pregnancy (N=150)**	Unadjusted Odds Ratio (95% CI)
Birth weight (grams)			
2499 or less	86 (20.2%)	25 (16.7%)	1.20 (0.73-1.97)
2500 to 3999	318 (74.6%)	111 (74.0%)	Reference
4000 or more	22 (5.2%)	14 (9.3%)	0.55 (0.27-1.11)
Small for Gestational Age at Birth (below 10th centile)			
Yes	68 (16.1%)	17 (11.4%)	1.49 (0.84-2.62)
No	355 (83.9%)	132 (88.6%)	Reference
Gestational age at birth (weeks)			
<37	93 (21.8%)	25 (16.7%)	1.450 (0.866-2.426)
37+0 to 38+6	139 (32.6%)	49 (32.7%)	1.106 (0.727-1.682)
≥39+0	135 (45.7%)	76 (50.7%)	Reference

5-minute Apgar score			
Less than 7	21 (5.0%)	10 (6.7%)	0.73 (0.34-1.59)
7 or more	400 (95.0%)	139 (93.3%)	Reference
Newborn discharged with congenital anomaly*			
Yes	18 (5.2%)	8 (7.8%)	0.65 (0.28-1.55)
No	328 (94.8%)	95 (92.2%)	Reference
Infant admitted to nursery			
Yes	166 (39.7%)	48(32.2%)	0.65 (0.28-1.55)
No	252 (60.3%)	101 (67.8%)	Reference
Length of stay			
> 5 days	179 (42.6%)	41 (27.5%)	**1.96 (1.30-2.94)**
≤ 5 days	241 (57.4%)	108 (72.5%)	
Child protection services involvement*			
Yes	170 (53.0%)	39 (39.0%)	**1.76 (1.11-2.78)**
No	151 (47.0%)	61 (61.0%)	Reference

Numbers do not add to totals due to a small amount of missing data. Missing data is provided where it accounts for >5% of total.

* Data not available for database B (128 neonates: 81 unintended, 47 intended), and therefore has been excluded from the analysis.

Table 2-9: Multivariate analysis examining association between maternal and neonatal outcomes, and unintended pregnancy

	Unintended Pregnancy aOR (95% CI)
Maternal and Neonatal outcomes	
Post-partum Length of Stay > 5 days	2.27 (1.11-4.67)
General, Spinal or Epidural Anaesthesia	0.69 (0.46-1.03)
Neonatal Length of Stay	1.96 (1.09-3.55)
Child protection services involvement	1.22 (0.69-2.16)

aOR: Adjusted odds ratio; CI: Confidence Interval; Reference= intended pregnancy

Each multivariable model was adjusted for relevant factors associated with the outcome of interest, as per the following:

Maternal length of stay > five days: Adjusted for maternal age, gestational age at first antenatal visit, use of illicit drug during pregnancy (excluding cannabis), SEIFA, parity.

General, Spinal or Epidural Anaesthesia: Adjusted for: hospital type, SEIFA, parity.

Baby length of stay > five: Maternal age, child living away from home, hospital type, smoking during pregnancy, use of illicit drug during pregnancy (excluding cannabis), gestational age at first antenatal visit, SEIFA.

Child Protection Services Involvement: Adjusted for history of maternal mental illness, child living away from home, first nations woman, use of illicit drug during pregnancy (excluding cannabis), parity.

2.4: Discussion

The rate of SUD in pregnant women in our study was 0.8%. Three-quarters of the women with SUD had an UIP. Women with SUD who experienced an UIP differed from those with an intended pregnancy in a range of social determinants of health, including higher rates of tobacco smoking in pregnancy, exposure to domestic violence, regional or rural location and lower rates of having a partner. For women with SUD, those who had an UIP had around twice the odds of a maternal and neonatal inpatient stay of more than five days, compared to those with intended pregnancies. Conversely, those with an UIP had reduced odds of having received a general, spinal or epidural anaesthesia during labour or birth. Whilst involvement with CPS was associated with UIP on univariate analysis, the association did not persist following adjustment for confounders. There was no association between UIP and most maternal and neonatal outcomes including pregnancy complications, maternal blood loss, mode of delivery, preterm birth, low birth weight, neonatal Apgar scores, or admission to adult or neonatal ICU.

The rate of SUD in this study (0.8%) is comparable to existing Australian data, although comprehensive and contemporaneous studies are not available. Whilst a 2005 South Australian study using comparable data collection also reported a rate of 0.8%, the data was collected over 20 years ago.(2) A 2006 Australian study which reported a rate of 1.1% of pregnant women used hospital presentation data, meaning only women who presented to hospital during pregnancy for harms associated with SUD were included. Additionally, alcohol was not included.(3) A 2021 NSW study used data linkage from maternity datasets, inpatient admissions and death records. That study reported 0.27% of pregnant women had hospital presentations related to opioid, 0.3% related to cannabis, 0.09% related to stimulants, 0.1% related to alcohol, 0.09% related to polysubstance use, equating to an overall SUD rate of less than 1%. However, some women may have been counted in multiple drug categories. Some drug categories were not included at all.(4) Although the rate of SUD in pregnancy reported in this study is comparable to the other Australian studies, it is lower than background rate (2.1%) reported in Australian women.(1) This suggests underreporting of SUD in pregnancy in this study, and more generally in studies that use existing Australian datasets. There are several possible reasons for this. Australian women typically reduce or cease AOD use following pregnancy recognition, and subsequently may not report their SUD.(25) Women may be fearful of the child protection implications of disclosing SUD, have not been asked about SUD, or not asked in a manner conducive to obtaining accurate information.(26, 27) The rate of UIP in women with SUD in this study is similar to a prior retrospective study conducted in NSW.(28)

In this study, the longer maternal and neonatal lengths of stay associated with UIP may be for the provision of increased psychosocial support for women, or requests by CPS to facilitate child

protection orders during the birth admission. Women with more complex psychosocial environments and unmet AOD treatment needs are likely at increased risk of an UIP.(29) Possibly the psychosocial environment relates to unmeasured social and lifestyle factors. Alternatively, UIP is associated with psychosocial distress and may cause deterioration in maternal functioning.(30, 31) Although psychosocial support at the birth admission were not reported, there was no difference association between other maternal and neonatal outcomes reported, including new antenatal mental health issues, to account for the longer lengths of stay. Whilst data for neonatal abstinence syndrome were not available, this would impact on length of stay. The finding that women with an UIP were less likely to receive a general, spinal, or epidural anaesthetic may be explained healthcare provider lack of knowledge and stigma, which is known to reduce access to epidural anaesthesia.(32, 33) Other possible pathways, may relate to unmeasured factors such as late presentation to the birth unit, or induction of labour. However, after assessing for antenatal care visits and mode of birth in the analysis, these had little effect.

Whilst there are no other available studies examining associations between UIP and birth outcomes in women with SUD, UIP is associated with ongoing AOD use in pregnancy, and worse AOD treatment compliance, with psychosocial factors accounting for most of this effect.(16) In a New Zealand study, the increased rate of UIP in women with heavy episodic drinking did not persist following adjustment for sociodemographic factors.(34) The known association between illicit drug use and low birth weight can be predominantly explained by socio-economic disadvantage, rather than direct drug toxicity.(35)

2.5: Conclusion

This is the first known study to examine associations between pregnancy and birth outcomes and UIP in women with SUD. It found the rate of SUD in pregnant women in NSW is 0.8%, using retrospective review of routinely collected data. This is likely underreported, despite being comparable with other Australian studies using maternity datasets. Three quarters (73.9%) of women with SUD had an UIP, consistent with prior research. Despite the low rates of SUD reported, UIP does not appear to amplify associations between SUD and pregnancy and birth outcomes, except for maternal and neonatal length of stay, and intrapartum anaesthesia use. Whilst the causative pathway for this has not been established, it is likely social determinants of health play a role.

2.6: References

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Chapter 3: Planning Postpartum Contraception for Women with Substance Use Disorders: Utilisation of the Birth Admission

McNamara KA, Black KI, Bond O, Murnion B, Gordon A, Ludlow J, Nassar N. Planning Postpartum Contraception for Women with Substance Use Disorders: Utilisation of the Birth Admission. Aust N Z J Obstet Gynaecol. Accepted for publication on 6th September 2024. DOI:10.1111/ajo.13887

Chapter 3 was adapted and reformatted for publication. This study uses a maternity dataset from a single New South Wales local health district (LHD) to compare postpartum initiation of contraception from the birth admission. It also investigates the prevalence of substance use disorder in the same population.

Author contribution statements are available in **Appendix B**: **8.4**.

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3.1: Background

Women who use alcohol and other drugs (AOD), particularly those with substance use disorder (SUD), experience higher rates of unintended pregnancy than women from the general population.(1, 2) Related to this they have high rates of unmet need for contraception.(3) Reported barriers to accessing contraception for women with SUD include stigma, cost, and knowledge.(4, 5) Unintended pregnancy can lead to abortion and indeed 57% of women with SUD report a prior abortion.(2) Women who continue with a pregnancy but report that it is unwanted, experience increased psychological distress compared to women who report wanted pregnancies.(6) It is important that all women, including those with SUD, have the opportunity to prevent unintended pregnancies in the post-partum period through the provision of access to contraception.

The birth admission represents an opportunity to overcome some of the barriers to access and improve initiation of postpartum contraception.(7, 8) There are only two Australian studies that investigate post-partum contraception initiation from the birth admission in women with SUD, and neither compares to women without SUD.(9, 10) Such comparison is also not available in international research studies.(11-13) In this study, we aimed to assess postpartum contraception plans among all women in a local health district and compare the data between women with and without SUD.

3.2: Materials and Methods

Study Design, Setting and Time frame

This was a retrospective cohort study using existing midwifery-collected, hospital maternity datasets. Maternal and neonatal maternity data were obtained from a single metropolitan local health district in New South Wales of all births from January 2011 to September 2019. Within the local health district, there are two maternity units. One unit has a neonatal intensive care and the maternity service caters for all births, including high risk pregnancies; the second unit has a special care nursery and is a general maternity service that mostly caters for births above 34 weeks gestation. In 2019, births in hospitals within this local health district accounted for 6.6% of all births in NSW.(14) The local area has the fifth highest rate of illicit drug use in Australia but does not fall within the fifth highest or lowest are for lifetime risky alcohol use.(15)

Study procedures

Data were extracted from the maternity database and included maternal demographics, medical and social history, pregnancy, birth and neonatal outcomes, and postpartum contraception. Births records were excluded if the infant date of birth listed was prior to 2011, if duplicate maternal and/or neonatal records, or the required data recorded in the birth record were missing or implausible. Duplicate maternal data, with unique neonatal data was assumed to represent a multiple pregnancy.

Women with SUD were the main study factor of interest and defined based on information involving current engagement, or the need for engagement, with AOD services. Data on SUD were extracted from six different variables, then combined into one variable representing SUD, with women with SUD dichotomised into those 'with SUD' or 'without SUD' (**Table 3-1**).

Table 3-1: Dataset variables that were contained information on substance use disorder.

Data on substance use disorder were extracted from each variable then combined to create a single variable for substance use disorder.

Name of original variable
Reason for referral
W&C Drug Intervention Required
W&C Drug Treatment Service
W&C Drug Treatment Required Now
Antenatal Problem Latest
Antenatal Problems During Pregnancy

Study Outcomes

The study outcomes included: i) the plan for contraception initiation made during the birth admission; and ii) the primary method of postpartum contraception in which women expressed an interest.

The plan for contraception initiation was categorised into: i) Initiated contraception in hospital: representing that a method of contraception was enacted, inserted, or supplied e.g. tubal ligation performed, hormonal implant inserted (commonly known as immediate postpartum contraception), or if supplied, this typically represented the method was dispensed from hospital pharmacy on discharge, e.g. contraceptive pills; ii) Referred/prescribed: involved referral to another provider on discharge, e.g. GP, specialist, or a prescription was written for contraception e.g. for contraception pills; or iii) No plan/Not Discussed. **Figure 3-1** shows a flow chart of the coding process.

A range of maternal and neonatal characteristics were included extracted and assessed, including maternal socio-demographic, social and medical history, antenatal visits and birth outcomes, and neonatal outcomes at time of birth. One specific maternal factor of interest, pregnancy intention was also identified. Responses in the maternity data were recorded as 'Planned/Happy', 'Unplanned/Happy', 'Null', 'Not Stated' or free text. These were dichotomised as 'Intended' or 'Unintended', with free text responses recoded by author 1.

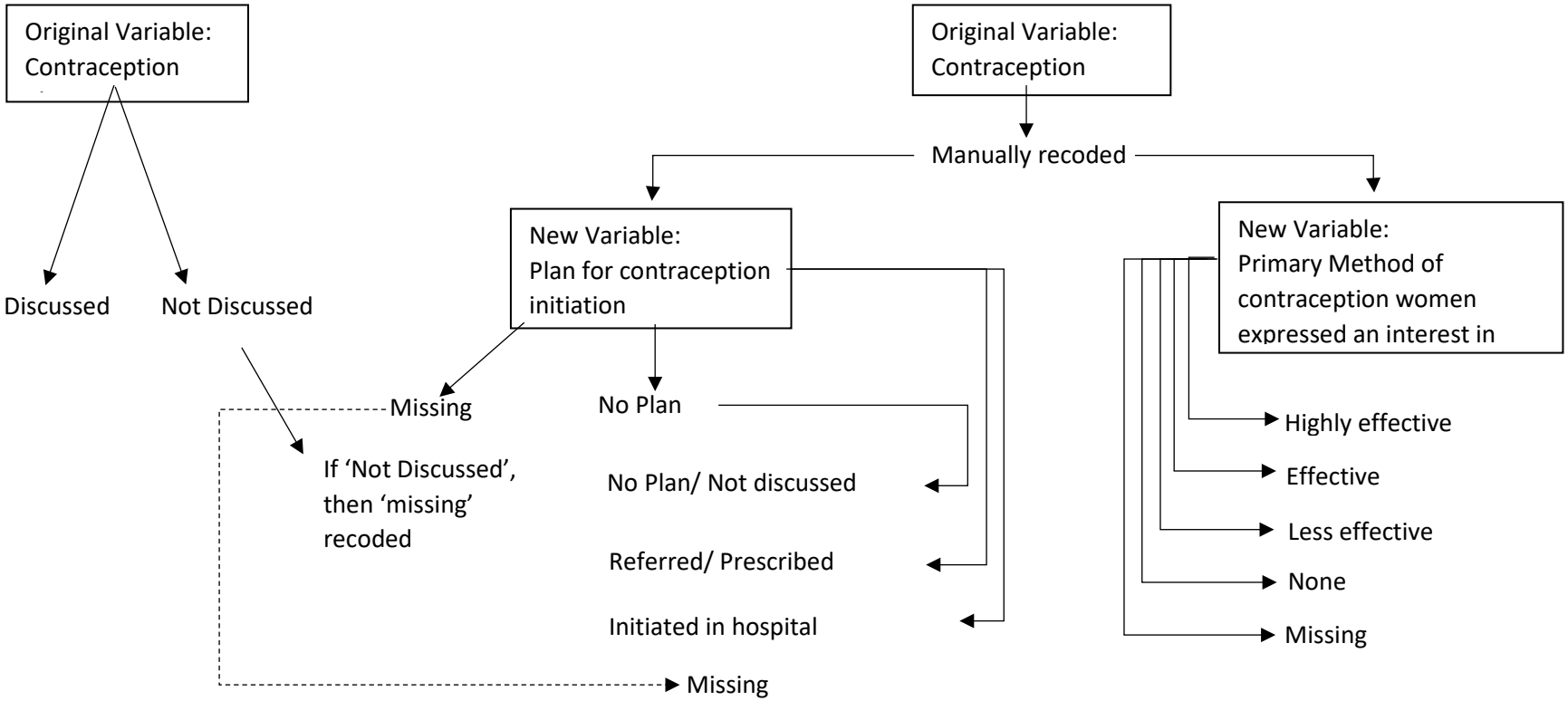
Data analysis and ethical approval

Data on plan for contraception initiation, and primary method of contraception in which women expressed an interest, were manually coded into Microsoft Excel.(16) Analyses were conducted using SPSS 29.0.1.0.(17) Maternal and neonatal characteristics were compared between women with SUD and without SUD using Pearson Chi Squared Test, or where numbers were less than 5 in a group, Fisher-Freeman-Halton Exact Test. Chi squared test for trend was used to examine associations between maternal length of stay and study outcomes. P-values less than 0.05 were considered significant. To compare outcomes between women with and without SUD, multivariate multinomial regression was performed, adjusting for main factor of interest, unintended pregnancy, and then other significant factors identified in univariate analysis: maternal age and parity. Odds ratios and 95% confidence intervals were calculated to assess results.

Ethics approval was granted by South Eastern Sydney Local Health District Human Research Ethics Committee (2019/ETH11539), and site-specific approval was gained from Sydney Local Health District.

Figure 3-1: Derivation and coding of contraception plan, initiation and method of contraception women expressed an interest in.

There were two variables describing postpartum contraception. 'Contraception plan' was a dichotomous variable assessing if contraception was discussed or not. 'Contraception detail' was a free text variable describing specific information about the postpartum contraception plan. Data for 'Contraception detail' had 9,061 unique responses recorded, these were manually coded into two new categorical variables by two researchers (authors 1 and 3) to: 1) plan for contraception initiation; and 2) primary method of contraception in which women expressed interest. One researcher coded all unique responses (author 3), whilst a second (author 1) coded a 5% random sample of responses to validate coding. Cohen's Kappa (κ) was calculated to assess agreement between the two researchers for the new coded contraception variables. Results showed very good agreement for plan for contraception initiation (κ= 0.98, 95% CI 0.97-0.99, p<0.001) and the primary method of contraception in which interest was expressed (κ= 0.96, 95% CI 0.94-0.97, p<0.001). However, when 'Contraception Detail' had missing data, but the original variable 'Contraception Plan' stated 'not discussed', this was recorded as 'No Plan/Not discussed' in the new variable 'Plan for contraception initiation'. 'No Plan/Not Discussed' incorporates cases that did not have contraception discussed, and cases that did have contraception discussed, but no plan was made.



3.3: Results

In the index period 60,163 babies of 59,195 mothers were identified. 74.7% (n= 44,239) birthed at hospital with the high-risk service. Less than one percent (0.7%,n=429) of women had evidence of a SUD. The proportion of women with SUD did not change over time (p= 0.69). Maternal socio-demographic, social and medical history, birth and neonatal outcomes, differed between the two groups (**Table 3-2** and **Table 3-3**). Women with SUD almost 2.5 times more likely to report an unintended pregnancy than women without SUD (60.4% vs 21.9%, p<0.001). In women with SUD, 64.7% of pregnancies were unintended in 2011, consistently rising to a peak of 84.6% in 2015, then falling to 55.2% in 2019. No changes in unintended pregnancy rates were seen over time in women without SUD.

Table 3-2: Maternal Demographics of women with and without substance use disorder (SUD)

Maternal characteristics	**Women without SUD (N= 58,766)**	**Women with SUD (N= 429)**	**P-value**
Age (years)			
24 or younger	4861 (8.3%)	73 (17.0%)	**<0.001**
25 to 34	35,997 (61.3%)	235 (54.8%)	
35 or older	17,908 (30.5%)	121 (28.2%)	
Australian Nationality	24,571 (41.8%)	354 (82.5%)	**<0.001**
Required an interpreter	4875 (8.3%)	4 (0.9%)	**<0.001**
Partnered	53,685 (91.6%)	174 (40.9%)	**<0.001**
Hospital of birth			**<0.001**
General unit, with SCN, births from 34 weeks	14,917 (25.4%)	39 (9.1%)	
High risk unit, with NICU	43,849 (74.6%)	390 (90.9%)	
Eight or more antenatal visits	49,602 (86.4%)	270 (63.8%)	**<0.001**
Gestational age at first antenatal appointment:			
<13 weeks	43570 (76.2%)	240 (59.6%)	**<0.001**
13-27 weeks	12670 (22.1%)	123 (30.5%)	
28+ weeks	970 (1.7%)	40 (9.9%)	
Primiparous	29902 (51.5%)	170 (39.9%)	**<0.001**
BMI group:			
19 or less	5155 (8.8%)	54 (12.6%)	**<0.001**
20 to 34	41,117 (70.0%)	277 (64.6%)	
35 or more	1867 (3.2%)	24 (5.6%)	
Missing	10627 (18.1%)	74 (17.2%)	
History of past or present mental illness			
Yes	7801 (13.3%)	257 (59.9%)	**<0.001**
No	34086 (58.0%)	96 (22.4%)	
Missing	16879 (28.7%)	76 (17.7%)	
Total Edinburgh Depression Score ≥13			
Yes	2281 (3.9%)	49 (11.4%)	**<0.001**
No	40774 (69.4%)	282 (65.7%)	
Missing	15711 (26.7%)	98 (22.8%)	

Question 10 Edinburgh Depression Score ≥1			
Yes	371 (0.6%)	4 (0.9%)	**<0.001***
No	39479 (67.2%)	227 (52.9%)	
Missing	18916 (32.2%)	198 (46.2%)	
Any Tobacco smoking during pregnancy	1967 (3.4%)	284 (66.5%)	**<0.001**
Singleton Pregnancy	57823 (98.4%)	423 (98.6%)	0.74
Estimated blood loss at birth ≥ 500 ml	13320 (22.7%)	100 (23.3%)	0.76
Mode of birth			
Emergency caesarean section	9978 (17.0%)	88 (20.5%)	**0.01**
Elective caesarean section	8445 (14.4%)	45 (10.5%)	
Instrumental vaginal birth	8761 (14.9%)	52 (12.1%)	
Spontaneous vaginal birth	31,543 (53.7%)	244 (56.9%)	
Postnatal length of stay > 5days	6229 (10.6%)	198 (46.5%)	**<0.001**
A previous child living away from mother			
Yes	893 (1.5%)	118 (27.5%)	**<0.001**
No	28645 (48.7%)	1153 (35.7%)	
Missing	29228 (49.7%)	158 (36.8%)	
Pregnancy intention (current pregnancy)			**<0.001**
Intended	34023 (57.9%)	120 (28.0%)	
Unintended	12,895 (21.9%)	259 (60.4%)	
Missing	11848 (20.2%)	50 (11.7%)	

Numbers do not add to totals due to a small amount of missing data. Where missing data accounts for ≥5% of totals, it is included in the table.

* Fisher-Freeman-Halton Exact Test

SCN = special care nursery

NICU = Neonatal intensive care

Table 3-3: Neonatal characteristics of women with and without substance use disorder (SUD)

Neonatal characteristics	**Babies of women without SUD (n= 59,727)**	**Babies of women with SUD (n= 436)**	**P-value**
Female sex	28,906 (48.4%)	236 (54.1%)	0.17
Low birth weight (<2500g)	4686 (7.9%)	77 (17.7%)	**<0.001**
Gestational age at birth			
<37 weeks	5228 (8.8%)	82 (18.9%)	**<0.001**
37+0 to 38+6	15,883 (26.7%)	142 (32.8%)	
≥39+0	38,279 (64.5%)	209 (48.3%)	
APGAR <7 at 5 minutes	1792 (3.0%)	27 (6.2%)	**<0.001**
Infant admitted to SCN or NICU	9547 (16.0%)	228 (52.3%)	**<0.001**
Liveborn/Stillborn			0.05
Liveborn	53821 (90.1%)	383 (87.8%)	
Stillborn	426 (0.7%)	7 (1.6%)	
Missing	5480 (9.2%)	46 (10.6%)	
Length of stay > 5 days	6797 (11.7%)	202 (54.9%)	**<0.001**

Numbers do not add to totals due to a small amount of missing data. Where missing data accounts for ≥5% of totals, it is included in the table.

* Fisher-Freeman-Halton Exact Test

SCN = special care nursery

NICU = Neonatal intensive care

By discharge, half (50.1% SUD,56.2% without SUD,p=0.03) did not have a plan for contraception initiation (**Table 3-4**). Referral or prescription for contraception occurred in 37.3% of women with SUD and 42.4% of women without SUD (p=0.56). Contraception was initiated in hospital in 12.5% of women with SUD and 1.4 % without SUD (crude odds ratio 10.32, 95% confidence interval (CI) 7.29 – 14.62). After adjusting for unintended pregnancy (adjusted odds ratio (aOR) 6.33,95% CI 4.30 – 9.31) and then all other important maternal characteristics, women with SUD had a more than 6-fold higher rate of contraception initiation compared to those without SUD (aOR 6.26,95% CI 4.24-9.56), (**Table 3-4**). In women with SUD, 52.0% expressed interest in a specific method of contraception, which was higher than the 30.7% in women without SUD (aOR 2.27,95% CI 1.72-3.00). Compared to women without SUD, women with SUD were more likely to express interest in highly effective methods, intra-uterine devices, implants, and male or female sterilisation, (aOR 3.73,95% CI 2.68-5.18) and effective methods, pills, injections and lactational amenorrhoea method, (aOR 2.30,95% CI 1.28-4.13). Interest in less effective methods (aOR 1.17,95% CI 0.76-1.80) was not different (**Table 3-4**). The proportion of missing data was similar for both groups for the plan for contraception initiation (21.9% with SUD, 26.5% without SUD) and the method of interest (46.6% with SUD and 52.9% without SUD). Maternal length of stay of greater than five days was associated increased rates of contraception initiation in hospital for both women with SUD (19.2% vs 7.1%, p=0.002) and women without SUD (2.2% vs 1.3%,p<0.001), compared to those with a shorter stay. Similarly, a neonatal length of stay of greater than five days was also associated with increased rates of contraception initiation in women with SUD (17.7% vs 3.8%,p<0.001) and women without SUD (2.3% vs 1.2%,p<0.001).

Table 3-4: Post partum plan for contraception initiation, and main method of in which women expressed an interest

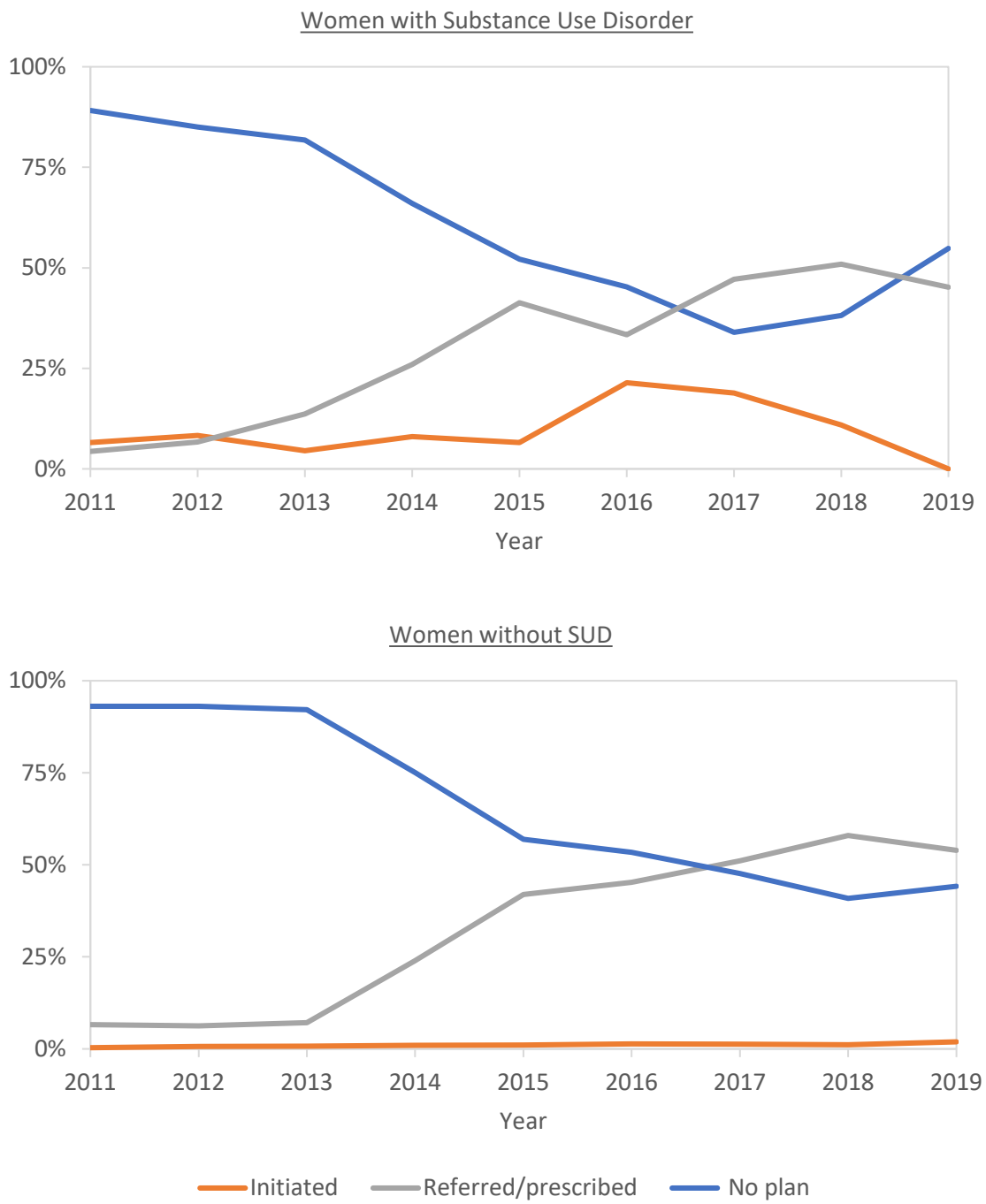
	Women without SUD n (%)	Women with SUD n (%)	Crude OR (95% CI)	aOR[a] (95% CI)	aOR[b] (95% CI)
Plan for contraception initiation					
	n=43,217	n=335			
No plan/ Not discussed	24,284 (56.2)	168 (50.1%)	Reference	Reference	Reference
Referred/ prescribed	18,345 (42.4)	125 (37.3%)	0.99 (0.78 – 1.24)	1.03 (0.98 – 1.08)	1.10 (0.86 – 1.41)
Initiated during admission	588 (1.4%)	42 (12.5%)	**10.33 (7.29 – 14.62)**	**6.33 (4.30 – 9.31)**	**6.26 (4.24-9.56)**
Missing	15,549	94			
The main method of postpartum contraception in which women expressed an interest					
	n=27,667	n=229			
None	19,178 (69.3%)	110 (48.0%)	Reference	Reference	Reference
Less Effective methods: *Condoms or natural methods*	4958 (17.9%)	26 (11.4%)	0.91 (0.60 – 1.40)	1.17 (0.76 – 1.80)	1.24 (0.80 – 1.91)
Effective methods: *Pills, injections, LAM*	1044 (3.8%)	14 (6.1%)	**2.34 (1.34 – 4.09)**	**2.32 (1.29 – 4.17)**	**2.30 (1.28-4.13)**
Highly effective methods: *IUDs, implants, male or female sterilisation*	2487 (9.0%)	79 (34.5%)	**5.54 (4.14 – 7.42)**	**3.35 (2.72 – 5.14)**	**3.73 (2.68-5.18)**
Missing	31099	200			

OR: Odds Ratio; CI: Confidence Interval; Adj: Adjusted

[a]Adjusted for unintended pregnancy

[b]Adjusted for unintended pregnancy, parity, maternal age group

Figure 3-2: Changes over time in the plan to initiate contraception, stratified by substance use disorder



The plan for contraception initiation was categorised into: i) Initiated in hospital: representing that a method of contraception was enacted, inserted, or supplied; ii) Referred/prescribed: involved referral to another provider on discharge, or a prescription was written for; or iii) No plan/Not Discussed.

There were changes in the plan for contraception initiation for both groups over time (**Figure 3-2**). For women with SUD, the proportion who initiated contraception in hospital ranged between 6.9% and 12.8% up to 2015, then sharply increased to 25% in 2016, and gradually fell to zero by 2019. The proportion of women with SUD discharged with a referral or prescription for contraception, consistently increased from 7.1% in 2013 onwards up to a peak 53.9% in 2018. There was a corresponding decrease in the proportion of women who did not have a plan to 34.6%. For women without SUD, the proportion who initiated contraception in hospital was very low in all years (0.6% to 2.2%). From 2013 onwards the proportion of women without SUD discharged from the birth admission with a referral or prescription for contraception increased from 12.3% to a peak of 64.6% in 2018. The proportion who had no contraceptive plan reduced to 34.1%.

3.4: Discussion

This study shows that between 2011 and 2019 over half of all women, with or without SUD, did not have a contraceptive plan in place at discharge from their birth admission. Initiation of postpartum contraception in hospital was low (12.5%) in women with SUD and varied over time. Nevertheless, this was almost six times higher than in women without SUD (1.4%), even after accounting for unintended pregnancy and maternal factors. For women without SUD there were minor fluctuations over time in contraception, the rate remained below 2.5% at all time points. In 2016, a sharp rise to 25% in contraception initiation in women with SUD was observed. The results also show women with SUD were more than three times more likely to express interest in highly effective methods, and more than twice as likely to express interest in effective methods, than women without SUD.

Two recent Australian studies have investigated and reported postpartum contraception use among women with SUD. A study of 210 women with SUD or other complex social needs from another NSW maternity service showed 12% initiated contraception in hospital, similar to the 12.5% in this study.(9) A study of 93 women with SUD from a Victorian maternity service showed about 30% initiated contraception in hospital and 93.5% of women had discussed postpartum contraception, both around twice as high as in this study.(10) These differences may reflect differences in local postpartum health care practices or populations.

The reasons for differences in contraception initiation in hospital, between women with and without SUD, require further evaluation. Anecdotally, the rise in contraception initiation in hospital in 2016 and the fall to zero in 2019, corresponded with the introduction and subsequent loss of a clinical champion. It is likely the changes this champion introduced were not incorporated into routine care. It is possible the women with SUD received more contraception counselling than women without SUD. Contraception counselling is delivered in the SUD specific antenatal clinic, but not in a

formalised way. This practice is acceptable to women and is associated with an increase in initiation.(18, 19) The changes over time in referral or prescription for contraception could represent changes in documentation rather than practice. A longer neonatal or maternal stay in hospital may facilitate access to postpartum contraception, and this requires further evaluation. Women with SUD were almost three times as likely to be interested in highly effective and effective methods, which could represent targeted counselling, or maternal choice, due to the known increased risk of unintended pregnancy in this population. It has previously been demonstrated that provider bias against women with SUD can result in counselling that promotes LARC ahead of other methods contraception, disregarding a woman's preference and patient centred care.(20) Overall, contraception initiation was low in all women. In Australia, fewer than 50% of women access prescribed hormonal contraception in the first 12 months postpartum.(21) Whilst this study does not include contraception initiation that occurred following discharge, women prefer postpartum contraception to be provided during the birth admission, and this study shows this is clearly not being implemented.(19)

3.5: Conclusion

In summary, initiation of contraception from the birth admission is low for all women, however it is six times higher in women with SUD than in those without SUD. 60% of women with SUD experience unintended pregnancy and the birth admission is an opportunity to offer and provide contraception. Women with SUD were more likely to express interest in the more effective methods and hence ensuring access to all methods, including the most effective methods, in the postpartum period is important. Future directions could involve formalising antenatal contraception counselling, developing immediate postpartum contraception programs for all women, and trialling contraception delivery following the birth admission for women with SUD through other services, such as AOD services and rehabilitation centres.

3.6: References

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Chapter 4: Integration of a facilitated access pathway for contraception into alcohol and other drug treatment services: a cohort study comparing metropolitan and regional settings

McNamara KA, Murnion B, Lintzeris N, Chase V, Black E, Malcolm A, Harvey Dodds L, Nassar N, Black KI. Integration of a facilitated access pathway for contraception into alcohol and other drug treatment services: a cohort study comparing metropolitan and regional settings. Drug Alcohol Rev. Accepted for publication on 16th September. DOI:10.1111/dar.13957

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Author contribution statements are available in **Appendix B: 8.5.**

4.1: Background

Amongst Australian women who attend alcohol and other drug (AOD) services, 75% report a previous unintended pregnancy (UIP), compared to 25% in the general population.(1, 2) In general, an UIP has important implications for perinatal health, including poorer mental health and higher rates of pregnancy complications.(3) In women with opioid use disorders, UIP is associated with possible reduced retention in AOD treatment during pregnancy.(4) Retention in AOD treatment is associated with less maternal overdose, less preterm birth and fewer infants with low birth weight.(5) In women who drink alcohol in the pre-conception period, UIP is also associated with increased binge drinking in the third trimester.(6) Binge drinking and drinking into third trimester, particularly over three drinks per day, are associated with increased rates of fetal alcohol spectrum disorder.(7)

There are a number of socio-demographic factors linked to lower contraceptive use and higher UIP rates; the strongest consistent associations are with low education and poverty.(8) Women who attend AOD services often experience these circumstances in addition to a range of complex issues, including violence and trauma.(9) Unsurprisingly then compared to the general population, women who have a substance use disorder (SUD) access contraception at lower rates, and report experiencing barriers to accessing contraception services.(10, 11) When women with SUD use contraception it is more likely to be a less effective method.(12)

Pathways that provide facilitated access to contraception have demonstrated increased uptake of effective and highly effective methods of contraception in the general population in the United States and Australia.(13, 14) In women who use AOD, international studies that involved contraceptive counselling, free contraception, and mechanisms to change behaviour resulted in

increased uptake of contraception compared to those that only provided written information.(15) At the commencement of this study, there were no Australian studies available that investigated contraception pathways within AOD services. We hypothesise that within an Australian setting, a program that provides access to a range of free contraception options, including on-site options at AOD services, and contraception education for study participants and AOD services staff, will improve initiation and continuation of contraception. The current study aimed to observe contraceptive initiation and use at 12 months after the introduction of facilitated pathways for contraception were offered at a metropolitan and regional AOD services.

4.2: Methods

Study Design

This was a pilot study, using a pragmatic clinical cohort design, to provide contraception to women who use AOD services

Setting and time frame

The study was conducted in public AOD services across two local health districts, one metropolitan and one regional, in New South Wales, Australia between June 2017 and November 2021. The metropolitan local health district services a population of almost 1 million residents and covers an area of 468 square kilometres. However, only two of the three metropolitan AOD service locations were included in this study, servicing the highest population density and approximately half the geographical area of the local health district.(16) The regional local health district services a population of 350,000 residents and covers an area of 1853 square kilometres.(17)

Study Population, including eligibility criteria

Participants were eligible for inclusion if they were women aged 16 to 49 years and were active clients at AOD services. Potential participants were excluded if they were unable or unwilling to provide informed consent, comply with study procedures, or had insufficient English language skills to complete the study questionnaires. Pregnant women were excluded up to three months postpartum.

Sample size

As this was a pilot study with convenience sampling, a sample size of 100 (50 for each AOD service) was selected due to feasibility.

Study Procedures

Participants were recruited by researchers from outpatient services in the metropolitan AOD service, and inpatient or outpatient services in the regional AOD service. In some circumstances, potential

participants were identified by AOD clinical staff, who conducted the initial discussion about the project. Therefore, it was not possible to record who declined to participate. Researchers who were also clinicians did not recruit participants for whom they provide clinical care, including those that provided contraception.

This study involved the development of facilitated pathways for contraception access through AOD services. Participants were educated with a video on contraception options, before being offered referral to contraception services. The contraception pathway included:

- Individualised, one-to-one contraception counselling appointments with medical addiction medicine (MAM) consultants, onsite at AOD services.
- Access to a range of contraception methods, with condoms, pills, injections and implants available on-site at AOD services.
- Facilitated and prioritised external appointments to collaborating sexual and reproductive health (SRH) services where contraception was not able to be provided at AOD services, such as for intrauterine device insertion.
- 12-month provision of a range of reversible contraception.
- Care navigation and, if required, transport to external appointments.
- Participants were also able to access contraception later within the 12 month follow up period, if they preferred.
- No participants incurred out of pocket costs.

The specific components of the study design, including differences between metropolitan and regional sites, are outlined in **Table 4-1**. Differences in collaborative pathways reflected the difference in local service availability at the time (noting that a substantial proportion of participants were recruited during the early years of the Covid-19 pandemic, particularly from the regional AOD service). Differences in the recruitment settings reflected differences in service provision between the AOD services. Recruitment strategies included advertisements and promotional material in public areas in AOD services, researcher presence in outpatient clinic waiting rooms, and referral from AOD services clinical staff. Trained research staff assessed eligibility for inclusion and discussed participation in the study. During the consent process, participants were informed that participation in one-to-one contraception counselling and initiation of contraception were optional parts of the project. If required, researchers were available to read consent paperwork and questionnaires to participants with limited literacy skills.

Table 4-1: Study procedures: Comparison between metropolitan and regional AOD services

Components of Study	**Metropolitan**	**Regional**
Before enrolment of participants		
Design of contraception pathways	-Consultation with AOD services, local SRH services and consumer representatives	-Consultation with AOD services, local SRH services -consumer representatives were not available
Education and training for AOD staff, including familiarisation with Australian contraception guidelines (18). Provided by researcher with accredited experience in gynaecology (KM)	-AOD nurses -MAM consultants	-AOD nurses -MAM consultant did not require this as held qualifications in Family Planning (19)
Hormonal implant education	-Provided by manufacturer (20)	-Not required as staff held existing qualifications (19)
Collaborations developed with local SRH services	-Public hospital gynaecology service within the same LHD	-Three private primary care facilities.
Cost of external appointments	-Funded by the LHD	-Funded by the project
Distance from AOD service to external appointment	-10-40 minutes' drive (both metropolitan and regional AOD service had locations)	
Enrolment		
Recruitment	-AOD outpatient service -Convenience sample	-AOD outpatient service -AOD inpatient service -Convenience sample
Consent	-Obtained by researcher	
Intervention – facilitated pathway for contraception		
Contraception educational video	-2017 – 2019 'Which Birth Control Method is Right for You?' from the Choice Contraception Project.(13) - 2019 onwards, Australian Contraceptive Choice Project (ACCORd).(14) -AUD$30 grocery voucher provided after watching the video -the video provided comprehensive, non-biased education on all methods of contraception including efficacy, how the method is used, risks and benefits.	-Australian Contraceptive Choice Project (ACCORd).(14) -AUD$30 grocery voucher provided after watching the video -the video provided comprehensive, non-biased education on all methods of contraception including efficacy, how the method is used, risks and benefits.
Offered referral to onsite contraception clinic	-Provided at AOD services by MAM consultant -contraception counselling was provided by the MAM consultants, who were all experienced AOD clinicians who regularly use share decision models as part of their AOD care and had received training in family planning. However,	

	contraception specific shared decision-making approaches were not an additional part of the training. -Included counselling, pills, emergency contraception pills, injections and implants -Referral to external SRH service, as required	
Referral for complex contraception needs or intrauterine devices	-Facilitated appointments within 2-4 weeks	
Care navigation and transport	Provided by non-clinical researchers and women's health clinician researchers	-Provided by AOD clinician researchers
Pre-requisites for referral to collaborative SRH service	-Prior to 2019, up to date cervical screening. This was perceived by researchers as a barrier to care. -From 2019 onwards, cervical screening could be performed at the SRH service appointment	Nil
Cost of contraception covered by project	-contraception devices for insertion -12 months' supply of oral or injectable contraception	
Follow up		
Follow up questionnaires	-Participants contacted by telephone, email, post, or face to face in AOD services - AUD$30 grocery voucher provided after completion of questionnaire -If participant unable to be contacted, follow up information extracted from LHD medical record	

AOD: Alcohol and other drug
SRH: Sexual and reproductive health
MAM: Medical Addiction Medicine
LHD: Local Health District

Baseline Measures

On completion of written informed consent, participants completed a baseline questionnaire **(Appendix A: Figure 7-5**) on obstetrics and gynaecology history, pregnancy intention, contraception use and other demographic factors, which were entered into and stored in REDCap.(21) A self-report of penetrative heterosexual intercourse in the previous 12 months was used to define the woman as being sexually active. Highly effective and effective contraception methods were combined and termed 'highly reliable'.

Baseline information on drug and alcohol use, general functioning, and further demographic factors were extracted from AOD services datasets. Age at enrolment, principal drug of concern, and whether they identified as a First Nations person were extracted from the New South Wales

Minimum Dataset for Drug and Alcohol Treatment Services, clinician-collected, patient-reported entries in the electronic medical record.(22) The remaining AOD service-collected data was extracted from the Australian Treatment Outcomes Profile (ATOP), a clinician-administered, patient-reported validated tool.(23) This included self-rated scales on psychological health, physical health, and quality of life, where scores of five or less have been validated to represent clinically significant problems.(24)

Study outcomes

All study outcomes were measured in women not planning to conceive within 12 months from baseline. Highly effective and effective contraception methods were combined and termed 'highly reliable'. The primary outcome was highly reliable contraception initiated through the pathway. Secondary outcomes were the method of contraception initiated, participant progress through each step of the pathway, and contraception use and method at 12 months.

Data analysis and ethical approval

Data were collated in a Microsoft Excel spreadsheet, then imported and analysed using SPSS 29.0.1.0.(25, 26) Baseline contraception data and outcome data were calculated in women not intending to conceive a pregnancy within 12 months. A post-hoc comparison of contraception initiation between the metropolitan and regional sites was conducted. The rationale for conducting the post hoc analysis was that large differences in findings were observed by researchers between the sites, and researchers wished to understand if the findings were applicable across settings.

Baseline and outcome data were compared between the metropolitan and regional AOD services. T-Tests were used to compare mean age scores. Exact McNemar's Test, using a binomial distribution, was used to compare changes from baseline to follow up in the method of contraception used. Pearson Chi-squared Test, or Fisher-Freeman-Halton Exact Test where numbers were less than 5 in some groups, were used to compare all other variables. The p value significance level was set at 0.05 when assessing changes between baseline and follow up. For the post hoc analysis examining differences between sites, a Bonferroni correction was applied to control for the risk of Type 1 error by dividing 0.05 by the number of baseline and outcome measures assessed (26 measures), giving an adjusted significance level of 0.002. The STROBE statement for reporting observational studies was used to report the results (**Appendix A: Figure 7-6**).(27)

Ethics approval was granted by South Eastern Sydney Local Health District Human Research Ethics Committee (approval number: 16/338) and site-specific approval attained from metropolitan and regional settings.

4.3: Results

Between 27th June 2017 and 10th November 2021, 100 participants were enrolled in the study, 50 from the metropolitan AOD service and 50 from the regional AOD service. At baseline, 85% had previously been pregnant, of those 96% reported a previous unintended pregnancy and 70% reported a previous abortion. 46% of all women reported they had children who did not live in their care. 91% of women were not planning a pregnancy within 12 months (**Table 4-2**). Of those, 79% were sexually active (**Table 4-2**) and 44% (36/81) were using any method of contraception (**Table 4-3**). The most common reasons women provided for not using contraception, despite not planning to conceive, were ambivalence to pregnancy or contraception (29%, n=13/45) and not being sexually active (64%, n=29/45) (**Table 4-4**). Of those who indicated not having sex was the reason for not using contraception, 59% (17/29) reported they were sexually active within the previous 12 months on the baseline questionnaire.

In the post-hoc analysis between women in the metropolitan and regional AOD service, for the most part there was no difference in demographics, social history, medical history, obstetrics and gynaecological history, or pregnancy intention. The main differences were that women at the metropolitan AOD service were older (mean difference 6.2 years,95% CI [3.6, 8.7],$t(98)=4.833$,$p<0.001$) and the proportion with opioids as the principal drug of concern was higher (88.0% vs 36.0 %,$\chi^2(1)=28.693$,$p<0.001$), compared to the women from the regional AOD service (**Table 4-2**). In women not intending to conceive, there was no difference between the two AOD services in the proportion using any method of contraception at baseline (43%,n=17/40 vs 46%,n=19/41, $\chi^2(1)=0.121$,$p=0.728$) (**Table 4-3).**

Table 4-2: Baseline demographics, medical history, obstetrics and gynaecology history, social history, and pregnancy intention, across the metropolitan and regional AOD services.

	Both services	Metropolitan service	Regional service	P value
All women	n=100	n=50	n=50	
Mean age at enrolment	34.8 (SD 7.06)	37.8 (SD 5.85)	31.7 (SD 6.9)	**<0.001****
Missing data	0	0	0	
English spoken at home	98 (99.0%)	49 (98.0%)	49 (100%)	1.000*
Missing	1	0	1	
Identifies as First Nations Person	26 (26.3%)	14 (28.0%)	12 (24.5%)	0.692
Missing data	1 (1.0%)	0 (0.0%)	1 (2.0%)	
Partnered	36 (36.0%)	21 (42.0%)	15 (30.0%)	0.211
Missing data	0	0	0	
Main Source of Income				
Government Benefits	88 (88.0%)	43 (86.0%)	45 (90.0%)	0.062*
Paid Employment	9 (9.0%)	7 (14.0%)	2 (4.0%)	
Other, non-employment income	3 (3.0%)	0 (0.0%)	3 (6.0%)	
Missing data	0	0	0	
Education Level				
Attended primary or secondary school	64 (66.0%)	33 (68.8%)	31 (63.3%)	0.569
Completed postschool qualifications	33 (34.0%)	15 (31.3%)	18 (36.7%)	
Missing data	3	2	1	
Current living situation				
Homeowner	2 (2.0%)	0 (0.0%)	2 (4.0%)	0.172*
Private rental	31 (31.0%)	14 (28.0%)	17 (34.0%)	
Public housing	46 (46.0%)	28 (56.0%)	18 (36.0%)	
Homeless	5 (5.0%)	1 (2.0%)	4 (8.0%)	
Other (incl. rent free)	16 (16.0%)	7 (14.0%)	9 (18.0%)	
Missing data	0	0	0	
Number of children not living in their care				
None	23 (23.0%)	10 (20.0%)	13 (26%)	0.367
1	13 (13.0%)	5 (10.0%)	8 (16.0%)	
2	18 (18.0%)	9 (18.0%)	9 (18.0%)	
3 or more	15 (15.0%)	6 (12.0%)	9 (18.0%)	
Missing data[#]	31 (31.0%)	20 (40.0%)	11 (22.0%)	
Even been pregnant	84 (84.8%)	39 (79.6%)	45 (90.0%)	0.149
Missing data	1	1	0	
Not intending to conceive within 12 months	89 (90.8%)	42 (85.7%)	47 (95.9%)	0.159*
Missing data	1	1	1	
If not intending to conceive within 12 months, sexually active at time of interview? (n=89)				
Yes	70 (78.7%)	30 (71.4%)	40 (85.1%)	0.069*
No	13 (14.6%)	10 (23.8%)	3 (6.4%)	

Missing data	6 (6.7%)	2 (4.8%)	4 (8.5%)	
Principal Drug of Concern				
Opioids	62 (62.0%)	44 (88.0%)	18 (36.0%)	**<0.001***
Alcohol	7 (7.0%)	4 (8.0%)	3 (6.0%)	
Cannabinoids and related drug	12 (12.0%)	0 (0.0%)	12 (24.0%)	
Amphetamines and other stimulants	16 (16.0%)	2 (4.0%)	14 (28.0%)	
Other	3 (3.0%)	0 (0.0%)	3 (6.0%)	
Missing data	0	0	0	
Daily use of tobacco	81 (84.4%)	42 (87.5%)	39 (81.3%)	0.399
Missing data	4	2	2	
OAT was main service accessed at AOD services	59 (59.0%)	39 (78.0%)	20 (40.0%)	**<0.001**
Missing data	0	0	0	
Self-rated psychological health score of 5 or less				
Yes	36 (36.0%)	20 (40.0%)	16 (32.0%)	0.587
No	49 (49.0%)	24 (48.0%)	25 (50.0%)	
Missing[##]	15 (15.0%)	6 (12.0%)	9 (18.0%)	
Self-rated physical health score of 5 or less				
Yes	37 (37.0%)	19 (38.0%)	18 (36.0%)	0.701
No	48 (48.0%)	25 (50.0%)	23 (46.0%)	
Missing	15 (15.0%)	6 (12.0%)	9 (18.0%)	
Self-rated quality of life score of 5 or less				
Yes	27 (27.0%)	14 (28.0%)	13 (26.0%)	0.953
No	56 (56.0%)	28 (56.0%)	28 (56.0%)	
Missing[##]	17 (17.0%)	8 (16.0%)	9 (18.0%)	
Women ever pregnant	n=84	n=39	n=45	
Age at first pregnancy				
Under 18	33 (40.7%)	11 (29.7%)	22 (50.0%)	0.012*
18-24	39 (48.1%)	18 (48.6%)	21 (47.7%)	
25 and over	9 (11.1%)	8 (21.6%)	1 (2.3%)	
Missing	3	2	1	
Parity				
0	9 (11.0%)	3 (8.1%)	6 (13.3%)	0.276
1	20 (24.4%)	12 (32.4%)	8 (17.8%)	
2 or more	53 (64.6%)	22 (59.5%)	31 (68.6%)	
Missing	2	2	0	
Ever had an unintended pregnancy	77 (96.3%)	34 (94.4%)	43 (97.7%)	0.585*
Missing	4	3	1	
No of previous abortions				

0	23 (28.0%)	14 (37.8%)	9 (20.0%)	0.005
1	33 (40.2%)	18 (48.6%)	15 (33.3%)	
2 or more	26 (31.7%)	5 (13.5%)	21 (46.7%)	
Missing	2	2	0	
No of previous miscarriages				
0	53 (64.6%)	27 (73.0%)	26 (57.8%)	0.333
1	16 (19.5%)	5 (13.5%)	11 (24.4%)	
2 or more	13 (15.9%)	5 (13.5%)	8 (17.8%)	
Missing	2	2	0	
History of previous stillbirth				
Yes	3 (3.7%)	1 (2.7%)	2 (4.4%)	1.000*
No	79 (96.3%)	36 (97.3%)	43 (95.6%)	
Missing	2	2	0	

Numbers do not add up to totals due to missing data. Where missing values account for >5% of totals, these are included in percentages.

#Missing data indicates the question was not answered by the participant. This could be because they did not have any children, or because they chose not to answer the question.

##Data was missing from existing AOD service datasets.

* Fisher Exact Test

** T-Test

OAT = Opioid agonist therapy

AOD = Alcohol and other drugs

Table 4-3: The most effective method of contraception used by women not intending to conceive at baseline, at metropolitan and regional sites.

	Both services (n=89)	Metropolitan service (n=42)	Regional service (n=47)
Most effective type of contraception use in past month			
Highly effective	11 (13.6%)	6 (15.0%)	5 (12.2%)
Effective	6 (7.4%)	1 (2.5%)	5 (12.2%)
Less Effective	19 (23.5%)	10 (25.0%)	9 (22.0%)
No method	45 (55.6%)	23 (57.5%)	22 (53.7%)
Missing	8	2	6

Table 4-4: Differences between AOD services in reasons for not using contraception at baseline, in women not planning to conceive and not using contraception.

	Both services (n=45)	Metropolitan service (n=23)	Regional service (n=22)	P value
Not sexually active	29 (64.4%)	19 (82.6%)	10 (45.5%)	**0.013***
Perceived infertility	6 (13.3%)	1 (4.3%)	5 (22.7%)	0.096*
Ambivalence to pregnancy or contraception	13 (28.9%)	6 (26.1%)	7 (31.8%)	0.672
Knowledge or access barriers	6 (13.3%)	0 (0.0%)	6 (27.3%)	**0.009***
Reproductive coercion	2 (4.4%)	1 (4.3%)	1 (4.5%)	1.000*
Faith/Beliefs	1 (2.2%)	1 (4.3%)	0 (0.0%)	1.000*
Side effects	6 (13.3%)	3 (13.0%)	3 (13.6%)	1.000*
Other	3 (6.7%)	1 (4.3%)	2 (9.2%)	0.608*

Participants could provide more than one response.
*Fisher Exact Test.

Just over one-quarter of women not intending to conceive (28%) initiated highly reliable contraception, the primary outcome, via the pathway (**Table 4-5**). In the post-hoc analysis between women from each AOD service, 51% of women from the regional AOD service, compared to 2% from the metropolitan AOD service, initiated highly reliable contraception (odds ratio 42.48, 95%

confidence interval:5.48-337.19). There also were differences in secondary outcomes. More women were using highly reliable methods at 12 months' follow up (21%,n=17/81 vs 44%,n=25/56, McNemar's Test,p=0.002), compared to baseline (**Table 4-6**). Additionally, three women who were using highly reliable contraception at both baseline and 12 months, changed from an effective method to a highly effective method within that time period. Compared to baseline, more women from the regional AOD service were using highly reliable contraception at 12 months' follow up (24%,n=10/41 vs 66%,n=23/35,McNemar's Test,p=0.004), whilst there was a no change for women from the metropolitan AOD service (18%,n=7/40 vs 9.5%,n=2/21,McNemar's Test,p=0.125). **Table 4-6** shows the most effective type of contraception women were using at baseline, immediately after the intervention, and at 12 months.

Table 4-5: Association between initiation of contraception and AOD service, in women not intending to conceive within 12 months of enrolment in the study.

	Both services (n=89)	Metropolitan service (n=42)	Regional service (n=47)	OR	95% CI
Initiation of highly reliable contraception via the pathway					
Yes	25 (28.1%)	1 (2.4%)	24 (51.1%)	**42.48**	**5.48-337.19**
No	64 (71.9%)	41 (97.6%)	23 (48.9%)		
Missing data	0	0	0		

Table 4-6: Contraception use, grouped by effectiveness, at baseline, after the intervention, and at follow up questionnaires, and, in women not planning to conceive within 12 months of enrolment in the study.

	Baseline (n=89)	After intervention (n=89)	12-month follow-up (n=89)
Highly effective	11 (13.6%)	18 (22.2%)	17 (30.4%)
Effective	6 (7.4%)	3 (3.7%)	8 (14.3%)
Less Effective[+++]	19 (23.5%)	17 (21.0%)	6 (10.7%)
None	45 (55.6%)	43 (53.1%)	25 (44.6%)
Missing[###]	8	8	33

Missing data is due to questions not being completed, or participants not available for follow-up. Baseline and follow up questionnaire recorded contraception used in the month prior to completion of the questionnaire. The first 18 participants (all metropolitan) were not asked a question on method of contraception used at 12 months' follow up.
+++ Initiation of condoms or natural methods was not able to be recorded at the time of the intervention.

An intrauterine device was the most common form of contraception requested through the pathway (28%,n=25/89). Overall, 15% (n=13/89) had an intrauterine device inserted, all from the regional AOD service. 12 women (6 metropolitan, 6 regional) who requested an intrauterine device did not have it inserted. The common reasons for this were not being able to obtain the pre-screening (cervical screening, sexually transmitted infection screening, or pregnancy test) that was required by

the collaborating SRH service prior to insertion, or not presenting for the appointment for insertion. These reasons were similar across the two sites. **Table 4-7** shows the different methods of contraception initiated at each site.

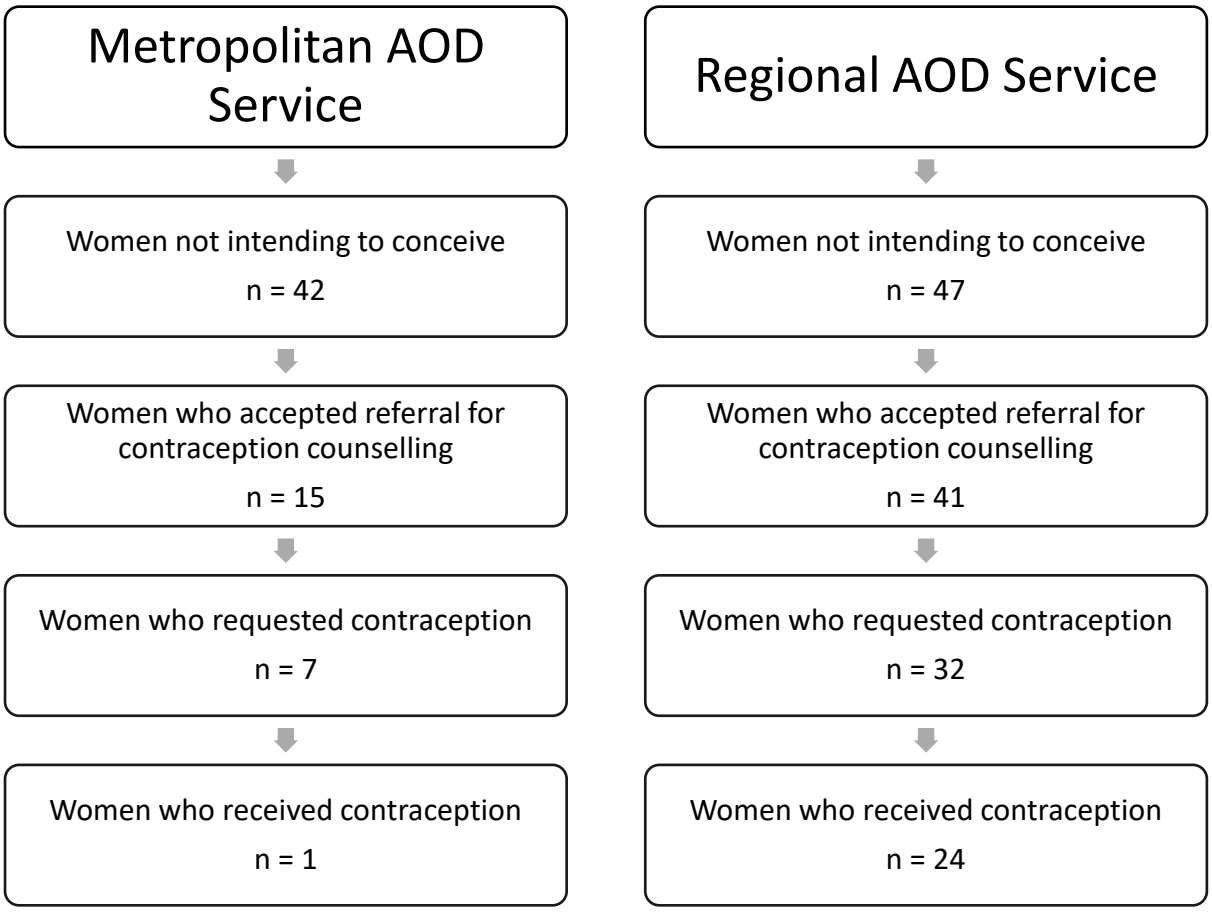
Table 4-7: Differences between AOD services in the method of contraception initiated from the contraception pathway, in women not planning to conceive.

	Both services (=89)	Metropolitan service (n=42)	Regional service (n=47)	P value
Method initiated				
Intrauterine devices	13 (14.6%)	0 (0.0%)	13 (27.7%)	**<0.001***
Implants	2 (2.2%)	0 (0.0%)	2 (4.3%)	0.496*
Injections	7 (7.9%)	0 (0.0%)	7 (14.9%)	**0.013***
COCP	3 (3.4%)	1 (2.4%)	2 (4.3%)	1.000*
POP	1 (1.1%)	0 (0.0%)	1 (2.1%)	1.000*
ECP	0 (0.0%)	0 (0.0%)	0 (0.0%)	-
None	64 (71.9%)	41 (97.6%)	23 (48.9%)	**<0.001***
Missing	0	0	0	

Participants could initiate more than one method (e.g. pills or injections could be used as bridging contraception whilst awaiting intrauterine device insertion).
* Fishers exact test
COCP: Combined oral contraception pill
POP: Progesterone only pill
EC: Emergency contraception pill

Fewer women accepted a counselling referral after the intervention at the metropolitan AOD service site compared to the regional AOD service (36%,n=15/42 vs 89%,n=41/46,χ2(1)=27.071,p<0.001); or requested contraception (18%,n=7/40 vs 74%,n=32/43,χ^2(1)=26.952,p< 0.001) (**Figure 4-1**). The most common reasons for declining referral did not differ between women from the two sites and were: not having sex (46%,n=12/26 vs 50%,n=2/4,Fisher's Exact Test,p=1.000); other priorities or desire to defer decision (22%,n=6/27 vs 20%,n=1/5,Fisher's Exact Test,p=1.000).

Figure 4-1: Depicts the number of women who progressed through each stage of the contraception pathway at the metropolitan and regional AOD services.



15% (n=13/89) of women experienced a pregnancy by 12 months and there was no difference between the metropolitan and regional AOD services (10%,n=4/42 vs 19%,n=9/47,Fisher's exact Test, p=0.240). At baseline, 11 of these women reported they were not sexually active, one was using a highly effective method at baseline, none were using effective methods, four were using less effective methods and eight were not using contraception. The most common reason provided by these women for not using any method contraception at baseline was ambivalence to pregnancy (four women). 10 of the women who conceived had accepted referral to the contraception pathway. Two initiated pills, and one initiated an intrauterine device, through the pathway. The woman who initiated an intrauterine device discontinued within a few months of insertion.

4.4: Discussion

This study shows that women who attend AOD services in NSW, both in the metropolitan and regional settings, have a high unmet need for contraception. Over 50% of women from the regional AOD service initiated contraception through the pathway, compared to 2% of women from the

metropolitan service. Compared to women from the metropolitan AOD service, more women from the regional AOD service accepted a referral for contraception, requested contraception, initiated highly reliable contraception, and were using highly reliable contraception at 12 months. Intrauterine devices were the most requested and initiated method of contraception.

In this study, at baseline, less than 50% of women who were not intending to conceive were using contraception, which is lower than the 63.8% reported in another Australian AOD service. That study was in a neighbouring district to the metropolitan service in this study.(1) Similarly, 72% of women who had ever been pregnant reported a previous abortion, which is higher than the previously reported 57.9%.(1) Over the 12 month follow up period, almost 15% of women who, at baseline were not intending to conceive, experienced a pregnancy. This is substantially higher than the global rate of 6.2%, and the rate of 5% for high income countries.(28) Some women were ambivalent to pregnancy, and women's pregnancy intention could have changed throughout the study period, however the pregnancy rate in women in this study is likely consistent with a high unmet need for contraception. However, one third of women who responded that they were not intending to conceive yet not using contraception, expressed ambivalence to pregnancy as the reason for non-use of contraception. This highlights the insufficiencies in the pregnancy intention framework, which is not nuanced enough to capture women's situations. It may be that ambivalence to pregnancy represented a view that the woman was not able to control when she conceives a pregnancy.(29) Women with SUD have previously described not feeling able to prioritise contraception and avoid sexual risk during periods of active drug use, an observation supported by healthcare workers.(30, 31) Given the increased risk of intimate partner violence victimisation in women with SUD, it should also be considered that these pregnancies could be result of sexual assault or coercion.(32)

The difference between contraception initiation between the metropolitan and regional AOD services in the post-hoc analysis was unexpected. There were differences in key demographics (mean age, principal drug of concern). Other key variables that did not show a difference between women at each site could be type 2 errors due to missing data (sexual activity in women not planning to conceive) or the Bonferroni correction (age at first pregnancy, number of previous abortions). It should be considered if the differences between sites was due to the different contraception needs of the study population. However, most demographic factors were comparable between the two AOD services. The physical health, psychological health, and quality of life measures were also comparable to the broader AOD population in NSW during 2020-2021.(33) Therefore, it should also be considered if the large difference in initiation of contraception represents differences in the delivery of the contraception pathway at each AOD service. Additionally, it is possible missing data from 12-month follow up questionnaire biased those results.

This study demonstrates that is feasible to incorporate contraception pathways into AOD services. However, larger scale assessment of the efficacy of pathways, assessment of applicability to external settings and consideration given to the target population should be conducted.(13) The project design provided practical solutions such as contraception education, covered the costs of contraception, and provided transport to external appointments, which have previously been reported as barriers to accessing reproductive healthcare in women with SUD.(30, 34) Following education, women were more likely to request intrauterine devices, which is consistent with prior qualitative research.(30) Contraception was provided by a trusted source (AOD services), participation was voluntary, and the focus on patient preference for contraceptive method defined a person-centred, trauma-informed approach, all of which are valued by women with SUD in relation to access to SRH services.(30, 35)

4.5: Conclusion

Facilitated contraceptive access pathways for women in AOD treatment can improve initiation of highly reliable methods of contraception. Nevertheless, one in seven women not wanting to conceive still became pregnant within a year. There were differences between contraception initiation and use at 12 months between the metropolitan and regional AOD services, which require further evaluation to understand the underlying factors. Understanding additional barriers to contraception access may be useful. Future pathways should include access to all contraceptive methods, including intrauterine devices; be developed according to local need and service configuration; and consider involving care navigators and clinical champions.

4.6: References

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Chapter 5: Lessons Learnt Throughout this PhD

This chapter describes the experience of navigating research through challenges throughout the PhD candidature. The sensitive nature of both substance use disorder (SUD) and pregnancy means there were specific considerations regarding the conduct of research in the populations studied in this thesis. This PhD also spanned the entire length of the Covid-19 pandemic, which brought multiple complexities to the conduct of studies.

5.1: Conducting Human Research in Populations with Specific Ethical Considerations

Pregnant women form one of the groups recognised by the National Health and Medical Research Council Pregnant as having specific ethical considerations for the conduct of human research. People with SUD may also fall into several of the other groups for which specific ethical consideration apply including: 'People with cognitive impairment, and intellectual disability, or a mental illness'; 'People who may be involved in illegal activities'; 'Children and Young People'; 'People in dependant relationships'; and 'Aboriginal and Torres Strait Islander Peoples'.(1) Whilst these latter groups were not the focus of the work in this thesis, consideration needed to be given to them in ensuring the research met the requirements for the ethical conduct of human research. The specific ethical considerations for conducting the research in this PhD fell broadly into two categories: 1) Studies that involved pregnant women –**Chapter 2** and **Chapter 3**; and 2) Studies that involved a health intervention – **Chapter 4**.

Chapters 2 and 3

Chapter 2 and **Chapter 3** present studies using existing maternity datasets, and whilst these did not involve the enrolment of participants in a study, they did involve the use of a waiver of consent to the use health data of people with specific ethical considerations. Additionally, these studies were initially designed to sit alongside a survey of pregnant women with SUD regarding pregnancy intention and contraception use. Whilst that study was abandoned (see section 5.2) due to low recruitment, the human research ethics application covered both the maternity dataset component and the survey. From a practical perspective, this meant the New South Wales (NSW) Human Research Ethics Committee's 'low and negligible risk' application for human research ethics was able to be used. Instead, the longer and detailed 'human research ethics application' was undertaken.

Researchers were required to state that standard aspects of human research ethics applications were adhered to, including the usual requirements to inform participants at time of consent that participation was voluntary and would not result in them being treated differently were adhered to. Additional to the standard aspects, there were several specific ethical aspects that needed to be specifically addressed:

1) Pregnant women –There were concerns by the ethics committee that discussing alcohol and other drug (AOD) use in pregnancy would lead to a requirement for researchers to place mandatory child protection reports. A response to the ethics committee was provided that explained in NSW there are no mandatory reporting requirements relating to fetuses, and that all women recruited would have already been identified by maternity providers as using AOD in pregnancy, and therefore mandatory reports, if required, would be submitted by the maternity providers and researchers would not be involved in any aspect of those reports.
2) People with a cognitive impairment, intellectual disability, or mental illness – information was provided to the ethics committee that recruiting researchers were experienced clinicians with the capability of assessing if an individual has adequate capacity to consent to participation.
3) Child and young people – young people from the age of 16 were able to be recruited for the study. It was explained to the ethics committee that in NSW young people aged 16 and 17 provide their own consent, so additional requirements around consent to participate in research were not necessary.
4) People in dependant relationships –Several clinician researchers in this study provided clinical care within the maternity units where participants were recruited from. It was important to ensure the nature of this clinician-patient relationship did not compel women to enrol in the study. To ensure this, recruiting researchers who were also clinicians were either not involved in recruitment, or recruited participants at arm's length. Arm's length recruitment meant a researcher who had provided clinical care could not recruit a participant into the study during the same episode of care.
5) Aboriginal or Torres Strait Islander Persons – although it is likely First Nations Women were recruited into the study, a woman was not identified as being a First Nations Person at recruitment or during the survey. Therefore, it is unlikely a First Nations Woman would have been treated differently than other women in the study.
6) People involved in illegal activities – whilst researchers recognised that use of drugs may involve use of illicit substances and therefore constitute an illegal activity, women were not asked about the specific nature of their drug use as part of the survey. Rather, survey questions were limited to pregnancy intention and contraception use. Therefore, it is unlikely that illegal activities would affect, or be affected by, any aspect of this study.

The human research ethics committee was satisfied with the information provided on the special ethical considerations for conducting research in pregnant women with a substance use disorder and granted ethical approval to conduct the study.

Chapter 4

Chapter 4 involved the recruitment of women with SUD from AOD treatment services and tested an intervention to provide contraception through a collaborative pathway developed between the AOD service and nearby sexual and reproductive health services. As part of this project an enhanced clinical intervention to screen for sexually transmitted infections was also established. Whilst many of the special ethical considerations described above (for Chapters 2 and 3) applied, additional ethical considerations applied as Chapter 4 tested a clinical intervention that involved the prescription and administration of pharmaceuticals and medical devices. The specific considerations that needed to be addressed for the human research ethics committee were:

1) Risk of harm or discomfort from the contraception provided as part of the intervention. It was acknowledged that all forms of contraception come with potential harms, however they are predominantly low frequency, and physical discomfort is usually minor. Additionally, it was explained that all forms of contraception provided through the project are available readily in Australia and the prescription and supply of these would be within Australian contraception guidelines available at the time.(2) It was explained that separate to the consent provided to participate in the study, all methods of contraception prescribed and/or provided, and the risks and benefits of these, would be discussed with the woman by the clinician providing the clinical contraception care, in line with standard practice within Australia. It was also explained that the contraception provided through the study would be at no cost to the participant, therefore there were no economic harms for participants.
2) The ethics committee had additional questions regarding how cultural and religious beliefs regarding contraception would be managed. It was explained that women would be under no obligation to initiate contraception and that such discussions would occur in line with standard Australian clinical care guidelines.
3) The ethics committee were concerned that the incidence of sexually transmitted infections, particularly human immunodeficiency virus, may be increased by the introduction of contraception in a population already at increased risk of such infections. Information, including a citation, was provided explaining that contraception use does not increase the risk of sexually transmitted infections. Evidence was provided to the ethics committee supporting this statement.(3)

Overall, the process to achieve ethical approval to conduct human research was lengthy for the projects in Chapters 2-4 of this thesis. However, I learnt much about how to navigate the process, which will be useful when undertaking future research in this field.

5.2: Recruiting Women with Substance Use Disorder from Antenatal Settings

Chapter 2 of this thesis presents a maternity dataset study that examined pregnancy intention and pregnancy and birth outcomes for women with SUD. The project in that study was originally designed as a mixed method study that included a survey of pregnant women with SUD as well as the dataset study. However, the survey component of the study was abandoned due to low recruitment. Initially, the project had planned to recruit 114 pregnant women with SUD from seven hospitals across five NSW local health districts. This equated to 15-20 participants to be recruited from each hospital, although the anticipated distribution was not expected to be equal across the sites. The 114 was based on a power calculation to test the agreement between unintended pregnancy using the London Measure of Unplanned Pregnancy(LMUP), and the single item question available within maternity datasets.(4) The power calculation was:

Assuming a prevalence of unintended pregnancy of 70% within women with SUD, when measuring the agreement between a validated pregnancy intention scale (LMUP) and a single item question using kappa, a sample size of 103 will provide approximately 90% power to detect a kappa of 0.8 (substantial agreement) and reject a null hypothesis of 0.5 (moderate agreement). Given the single item question is estimated to be 90% complete in maternity databases, 114 participants will need to be recruited.

The project was granted ethical approval in September 2019. The survey component was abandoned in December 2023, with only 22 participants having been recruited across all sites. The specific issues that impacted recruitment were:

1) <u>Governance approvals across multiple sites.</u>

   Due to processes in place in NSW, all studies that involve human research conducted in NSW public hospitals and health services must undergo dual approval through human research offices: one approval process for ethical approval, which can then be used across all NSW health sites, and a separate research governance approval process for every individual site to permit the conduct of the research at that site. For multisite research, the latter involves applications across different research offices, each with different requirements and slightly different processes. Additional to this, NSW Health Research Offices implemented a new online platform over 2019 and 2020, with the net result being lost documentation and lengthy delays in approvals. The last of the site governance

approvals was obtained in October 2020, 13 months after initial ethical approval for the project was gained.

2) <u>There were a small number of pregnant women with SUD available at each site to recruit.</u>

Whilst the maternity dataset study presented in Chapter 2 suggested there were adequate numbers of women with SUD across the study sites to achieve a sample size of 114 women (**Table 2-4**), identifying these women was difficult. Only one of the seven hospitals had a substance use in pregnancy specific antenatal clinic, with the other hospitals providing antenatal care for women with SUD through a range of general antenatal clinics. When the recruiting researcher attended the general antenatal clinics, it was usually not possible to ascertain which women had a SUD, and often no women recruited into the study during an entire clinic session. Additionally, the recruiting phase of this project occurred during the Covid-19 pandemic (**section 5.3**) and researchers experienced limitations to access to maternity services. To expand the available opportunities to recruit women into the study, amendments to the protocol (and corresponding ethical approvals) were made which included:

a. Engagement with substance use in pregnancy clinicians (who are part of AOD treatment services.)
b. Initial conversations about the project could be had by maternity or AOD health providers, with referral on to the researcher where a woman was interested in participating in the project.
c. The ability to enrol participants in the study, and to complete the study questionnaire, over the telephone.

Additionally, the researcher met with maternity providers from each site on several occasions, providing education sessions about substance use in pregnancy, promoting the project, and taking feedback on mechanisms to improve recruitment. Despite this, the researchers received very few referrals from clinicians, and the bulk of referral came from two clinicians from substance use in pregnancy services.

This led researchers to deduce that recruiting women with SUD from antenatal settings is challenging. It is possible that maternity providers were not comfortable referring the women they care for to research projects which discuss unintended pregnancy, given women with SUD have known very high rates of unintended pregnancy. It is also possible that due to the many competing demands maternity providers have, discussing a research project they were not involved in was not a priority.

3) One recruiting researcher covered all sites

This was a modestly funded study, and one researcher completed all the recruitment. It was not possible to get to each site regularly. This was in part due to the number of sites (five), the geographical distance between sites (250 km), and human movement restrictions put in place as part of the response to the Covid-19 pandemic.

Attempts were made to employ a nurse research assistant. Whilst multiple suitable candidates were identified at one site, for a variety of organisational reasons this was not supported by their primary employer.

The move to conducting the research over the telephone did work to reduce some of the barriers, and anecdotally, the recruiting researcher perceived women were more comfortable in completing the questionnaire via telephone than face-to-face. However, as described above, the lack of regular access to pregnant women with SUD placed barriers to identifying potential participants.

It is not possible to determine how much the Covid-19 pandemic impacted these issues and how much is attributable to other issues; however, it likely the pandemic played a role. Nonetheless, it may be useful to try different approaches to recruiting women with SUD for this type of research in the future. Options include:

- Using existing datasets (as demonstrated in Chapters 2 and 3).
- Online recruiting of pregnant women using social media, with the option to remain anonymous.
- Qualitative research, with requires smaller sample sizes.
- Restricting recruitment from antenatal clinics to services that care for high numbers of pregnant women with SUD.

5.3: Research During the Covid-19 Pandemic

The research in this thesis spanned the course of the Covid-19 pandemic. At the beginning of the pandemic, the contraception pathway tested in Chapter 4 was recruiting participants from AOD treatment services. At the same time, the survey described above (**section 5.2**) had ethical approval and governance approval from one site but had not commenced recruitment. Two issues arose immediately at the beginning of the Covid-19 pandemic: 1) research staff lost all access to AOD and maternity services and could not recruit participants; and 2) clinician researchers were required to increase clinical work as part of the pandemic response. This was particularly the case for me, as the

author of this thesis, who is a clinician in obstetrics and gynaecology and worked in a maternity unit that faced immediate staff shortages.

The following approaches were taken to ensure the ongoing progress of this PhD despite the challenges presented by the Covid-19 pandemic:

1) I organised an early meeting with the post-graduate co-ordinator from The University of Sydney's Faculty of Medicine and Health and formulated a plan to suspend the PhD candidature for one research period. The suspension was to allow time to redevelop and plan projects that could be undertaken throughout the pandemic, acknowledging at that point in time it was not possible to understand how long the situation would persist. After one research period of suspension, I re-enrolled but in changed from full-time to part-time.
2) The development of the scoping review (**section 1.1**). This was a research project that could be undertaken from home, which circumnavigated the issue of not having access to clinical areas for participant recruitment. A narrative literature review had already been conducted for this thesis; however, it was felt that the scoping review approach would more broadly canvas the literature and ensure all available research studies were identified. Data collection was able to be done from home and therefore not impacted by the human movements restrictions that occurred during the pandemic. Whilst data collection for the scoping review was ongoing, protocol modifications and the associated amendments to ethical approval could be undertaken. This plan also gave me the opportunity to learn about how to conduct systematic and scoping review, and that education could also be conducted from home, which was important during the lockdown phases of the pandemic.
3) Protocol modifications and amendments to ethics and governance approvals for existing projects. Modifications were made to the projects in Chapter 2 and 4, noting that the modifications for Chapter 2 related to the now abandoned survey component of the study (**section 5.2**). The protocol modifications involved: extension of recruitment time frames; remote recruitment of participants including phone consents and questionnaire completion over the telephone; ethical approval for clinical staff to discuss the project with potential participants; and the sharing of information about potential participants via email with researchers. A full list of the protocol changes is available in **Appendix A: Figure 7-7 and Figure 7-8.**

Despite these changes, recruitment for the survey component of **Chapter 2** was limited. However, for **Chapter 4**, recruitment was ongoing. Most participants for Chapter 4 were still recruited face-to-face, at times when access to clinics was available. However, the flexibility in the recruitment

process increased participation. It may be this flexibility would be useful for similar projects, unrelated to the issues surrounding the pandemic.

The lessons learnt from conducting research through the Covid-19 pandemic were:

- Flexibility to react to a changing situation is important. Projects can be modified, candidatures can be changed, new projects can be developed.
- Proactive and open discussions with research supervisors and course co-ordinators can facilitate a more seamless and acceptable solution.
- Changes to research projects do not always mean a negative outcome. Although recruitment for the survey was never able to meet the target sample size, researchers learnt that participants were comfortable sharing information over the telephone, perhaps more so than face-to-face.

5.4: Conclusions

The lessons learnt from conducting research through the pandemic may be generalisable to problems and delays encountered in research studies due to unforeseen events. These lessons could be incorporated into the design and implementation of future research projects. Systematic reviews and scoping reviews are valuable additions to a PhD thesis. These allow for data collection whilst other projects are being designed and ethical approval sought. Flexible recruiting strategies for hard-to-reach populations, such as pregnant women with substance use disorders, are valuable. Working with university staff and supervisors is valuable when difficulties in the conduct of research arise.

5.5: References

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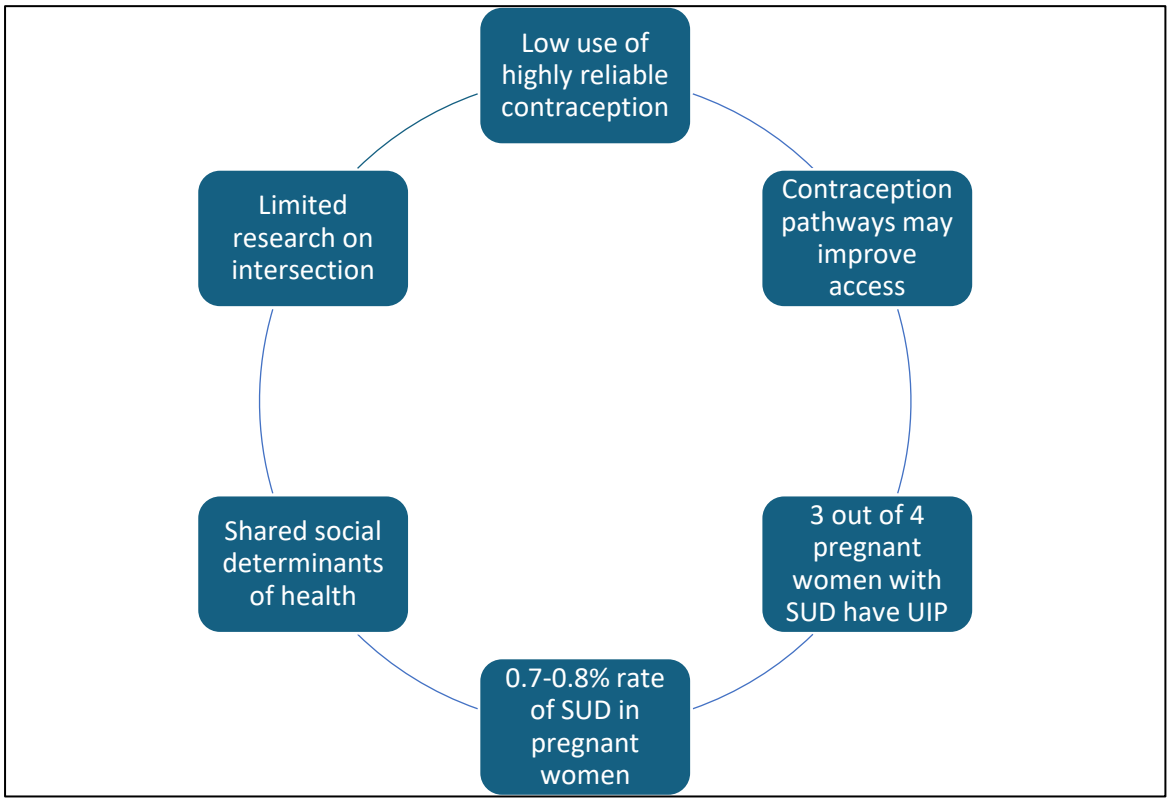
Chapter 6: Discussion

6.1: Summary of findings

This thesis had two broad aims: 1) to investigate the rate of substance use disorder (SUD) and unintended pregnancy (UIP), and how the intersection of these issues is associated with outcomes following a pregnancy; and 2) investigate contraception use (as a mechanism to prevent unintended pregnancy) and programs to increase access to contraception, in women with SUD.

Figure 6-1: The Intersection between Unintended Pregnancy, Contraception, and Substance Use Disorder



UIP: Unintended Pregnancy, SUD: Substance Use Disorder: Highly reliable contraception: Highly effective and effective methods (male and female sterilisation, intrauterine devices, hormonal implants, hormonal injections, pills and rings)

To achieve these aims, four discrete studies were conducted: a scoping review and three primary research studies, which are presented in Chapters 1-4 of the thesis. These studies showed that there are limited existing data investigating the intersection between SUD and UIP. It was then demonstrated that most pregnancy and birth outcomes were not associated UIP in women with SUD. This is despite both UIP and SUD having known associations with pregnancy and birth outcomes in the general population. This suggests common social determinants of health play more of a role than UIP itself. Less than one percent of pregnant women were identified through

antenatal services as having a SUD, which was likely an underreporting of the true rate. Approximately two-thirds of pregnant women with SUD had an UIP, which was three-fold higher than in women without SUD. Despite the high rates of UIP in women with SUD, there was low initiation of contraception whilst in hospital at the birth admission. In non-pregnant women with SUD, less than half of those not wanting to conceive a pregnancy were using contraception, and when contraception was used it was typically a less effective method. Facilitated access pathways to contraception through alcohol and other drug (AOD) treatment services were demonstrated to improve the initiation and use at 12 months of highly effective and effective methods of contraception, although there was diversity of results amongst study sites and the 12-month pregnancy rate was still high. **Figure 6-1** shows the intersection of these key findings.

6.2: Key Findings for Each Thesis Chapter, Comparison to Existing Literature and Implications

The key findings of each for each study of this thesis are presented, along with a comparison of the existing literature.

6.2.1: Interconnections between unintended pregnancy, alcohol and other drug use, and outcomes from pregnancy

Research is lacking that examines the intersection between unintended pregnancy and alcohol and other drug use, on outcomes following pregnancy.

In women who use alcohol and other drugs, no research is available that examines the associations between unintended pregnancy and pregnancy and birth outcomes.

The scoping review in **section 1.1** examined the existing literature to investigate the relationship between UIP and AOD use, and how they interact to affect pregnancy, birth, infant, childhood, social and economic outcomes in high income countries. It focused on the broader topic of AOD use, rather than SUD, to ensure all available research on the topic was captured in the search.

There were only three studies identified, and these used different tools to assess pregnancy intention and examined different patterns of AOD use, with some studies examining all women who use AOD, and others focusing specifically on women with SUD. Importantly, no study assessed or reported on pregnancy or birth outcomes, and no study examined long-term child health outcomes.

There were no studies examining maternal health outcomes relating to mental health or other aspects of physical health. No studies examined economic outcomes. One study examined retention in opioid treatment programs during pregnancy. This showed women with an UIP left treatment five weeks earlier than women with an intended pregnancy, although the effect disappeared following adjustment for confounders.(1) Another study examined placement into out-of-home care. It showed women with UIP, compared to those with an intended pregnancy, had a 2-fold higher rate of their children entering out-of-home care by the age of two years, although adjustment for confounders was not performed.(2) Only one study demonstrated an association that persisted after adjustment for confounders. That study examined persistent binge drinking into third trimester in women who drank alcohol in the three months prior to pregnancy. Compared to women with an intended or mistimed pregnancy, those with an unwanted pregnancy were had an almost 1.5-fold increase in binge drinking the third trimester.(3)

Given the lack of available research, this scoping review was not able to clarify the relationship between UIP and AOD use. The implications of the size of effect either being substantially reduced, or disappearing altogether, with the adjustment for confounders suggests that SUD and UIP are likely intrinsically linked by shared causative pathways, involving social determinants of health such as poverty, and access to healthcare and education. The factors that contribute to UIP in women with SUD include a perception of low risk of pregnancy, sexual coercion, poor reproductive health knowledge, cost and access to services, and mental illness.(4) People who use illicit drugs are more likely to live in poverty,(5) and women living in poverty are more than twice as likely to experience an UIP.(6) It has previously been demonstrated that almost all the effect of illicit drug use on low birth weight can be attributed to psychological, physical and behavioural factors, including unwanted pregnancy, finances, nutritional status, and exposure to violence.(7) Within sexual and reproductive spheres there has been a recent shift away from a focus on prevention of unintended pregnancy towards a more holistic view of improving systemic barriers to obtaining reproductive autonomy. The reason for this includes a tempering of the interpretation of adverse outcomes caused by unintended pregnancy and more of a focus on social determinants of health. The findings of the research from this study nicely support this concept.(8) Further work to evaluate social and structural determinants of health, and their role in access to sexual and reproductive health care for women with substance use disorder would be beneficial.

The scoping review in Chapter 1 (**section 1.1**) demonstrated there are limited data assessing the short- and long-term impact on health, social and economic outcomes following an unintended pregnancy in women with SUD. There were no studies identified that have looked at pregnancy and birth outcomes, and this justified the research undertaken in **Chapter 2**.

6.2.2: Unintended Pregnancy, and Pregnancy and Birth Outcomes, in Women with Substance Use Disorder: A Retrospective Cohort Study

The only pregnancy and birth outcomes associated with unintended pregnancy in women with substance use disorder are:

- An increased length of stay (maternal and neonatal)
- Reduced use of intrapartum anaesthesia

The rate of substance use disorder in pregnant women was 0.8%.

Three-quarters of women with SUD had an unintended pregnancy.

This study used existing maternity datasets to evaluate the prevalence of SUD in pregnant women. In the cohort identified as having a SUD, associations between UIP and maternal and neonatal outcomes were investigated. As identified in the scoping review in Chapter 1 (**section 1.1)** it is the first known study worldwide to evaluate these associations.

The rate of SUD in pregnant women was 0.8%. Three-quarters of the women with SUD had an UIP. Women with SUD who experienced an UIP differed from those with an intended pregnancy in a range of social determinants of health, including higher rates of tobacco smoking in pregnancy, exposure to domestic violence, regional or rural location and lower rates of having a partner. For women with SUD, those who had an UIP had around twice the odds of a maternal and neonatal inpatient stay of more than five days, compared to those with intended pregnancies. Conversely, those with an UIP had reduced odds of having received a general, spinal or epidural anaesthesia during labour or birth. There was no association between UIP and most maternal and neonatal outcomes.

The rate of SUD in this study (0.8%) was comparable to existing Australian data. However existing research was either conducted more than 15 years ago or limited to specific drugs.(9-11) The rate of SUD in pregnancy reported in this study was lower than the background rate (2.1%) reported in Australian women, although that data were not limited to those of reproductive age.(12) The rate of 0.8% is also substantially lower than the 12 month prevalence rates of substance use disorder in the general Australian population of 3.1%.(13) This suggests underreporting of SUD in pregnancy in this study, and more generally in studies that use existing Australian datasets. The rate of SUD found in this study is also lower than the rates of 2.7% to 6.0% reported in pregnant women in the USA,

although the study that reports a rate of 2.7% does not include alcohol use disorders.(14, 15) A dataset study from the USA, with methodology comparable to ours although using Medicaid not hospital data, reported a rate of SUD of 7.1%.(16) It must be acknowledged that North America is experiencing an opioid epidemic, which is largely not present in Australia, which may account for the differences in the rate of SUD in pregnancy.(17, 18) The rate of 0.8% is also higher than reported in The Czech Republic and Sweden, 0.03% and 0.24% respectively. However, both those rates are very low compared to the global rate of SUD in the general population (2.2% for alcohol and 0.7% for illicit drugs), which suggest substantial underreporting in those studies.(19, 20) The implication of the likely underreporting of SUD in maternity datasets is that Australian maternity services under-recognise SUD in pregnancy and are therefore unable to provide specific pregnancy care for this cohort of women.

The rate of UIP in pregnant women with SUD in this study (73.9%) was consistent with other Australian research, which reports around three-quarters of pregnancies in women with SUD are unintended.(21, 22) The study in this thesis demonstrated the rate of UIP was three times higher than the 27.1% in women without SUD. The demonstrated rate in women without SUD was consistent with previous research in the general population that reports about one-third of pregnancies in Australia are unintended.(23, 24) Whilst there are many available international studies that examine pregnancy intention in women who use AOD, few specifically do so in a population that has a SUD. The largest available study is from a cross-sectional analysis using baseline data obtained as part of randomised control trial on the management of opioid use disorder in pregnancy.(25) It was multi-national study of 946 women with an opioid use disorder in rural and urban USA and urban Austria. Eighty six percent of pregnant women in the study had an unintended pregnancy. Women from that study were pregnant at the time of the questionnaire, meaning recall bias may have been less pronounced than in studies which assessed pregnancy intention sometime distant from pregnancy. Additionally, the 26% of women that reported ambivalence to pregnancy were included in the unintended group, leaving 60% that were mistimed or unwanted.(26) Another study from the USA of women with an opioid use disorder(OUD) have reported an unintended pregnancy rate of 75%, although there was over 10% missing data.(27) Similar to our study, pregnancy intention was assessed outside of pregnancy using retrospective recall of prior pregnancies, and reported dichotomously as unintended/intended. Indeed, in our single district study in **Chapter 3** there was also substantial amount of missing data, and the UIP rate in that study was closer to 60%, suggesting missing data may result in an under-estimation of the UIP rate. A third USA study reported that 60% of women with OUD had previously experienced an unintended pregnancy, although it did not report the overall proportion of unintended

pregnancies.(28) When interpreted in the context of different measures of pregnancy intention, different timing of assessment (pregnant/non pregnant), and missing data, the unintended pregnancy rate of 73.9% in our study is broadly comparable to the available international data. This is an important finding as the background rates of UIP in Australia and USA are comparable and therefore it is reasonable to expect similarities in the rate of UIP in women with SUD.(29) It is therefore also reasonable to suggest around three-quarters of pregnancies in women with SUD are unintended, acknowledging most of the international data is specific for women with OUD, rather than SUD more broadly.

In this study, the longer maternal and neonatal length of stays associated with UIP may be to provide increased psychosocial support for women, or requests by child protection services to facilitate child protection orders during the birth admission. Whilst length of stay is not typically reported as a birth outcome in studies on unintended pregnancy, it seems unlikely that it would exert a direct effect.(30-32) However, it is known women with more complex psychosocial environments and unmet AOD treatment needs are at increased risk of an UIP due to a lack of focus on contraception, misperceptions about low risk of pregnancy, and sexual risk taking.(33-35) We propose that women with SUD and UIP are likely to have more complex psychosocial situations, and perhaps more AOD treatment needs, and therefore require longer lengths of stays to address these issues, compared to women with SUD and intended pregnancies. Additionally, those with unmet AOD treatment needs would be more likely to have babies with neonatal abstinence syndrome, and whilst this was not recorded in the dataset used for this study, it would also result in longer lengths of stay. The longer post-partum admission could be utilised by maternity services to ensure women have the opportunity to access contraception, should they desire, and therefore prevent a cycle of repeat UIP.

In this study, the reduced use of intrapartum anaesthesia in women with UIP could be due to stigma and a lack of health care provider knowledge regarding their intrapartum anaesthesia needs, which have been well described more broadly in populations of women with SUD.(36, 37) In a qualitative study from Massachusetts, USA, stigma and lack of provider knowledge were identified as barriers to accessing anaesthesia by women with SUD.(36) In Pennsylvania, USA, pregnant women with OUD have described systemic barriers to accessing intrapartum anaesthesia and described feeling stigmatised when asking for pain relief.(38) In the Pennsylvania study, health care providers do report recognising that women with OUD are more likely to have poorly controlled pain, however the providers have a lack of confidence and knowledge around optimal management of peripartum analgesia for these women.(38) Importantly, the providers interviewed in that study all reported they regularly care for women with OUD, therefore stigma, and provider knowledge and confidence

barriers may be more pronounced in providers with less experience caring for women with OUD. However, despite these concerns about access to care, it has previously been demonstrated in the Australian setting that women who use illicit drugs access more analgesia for labour and delivery than women who do not use illicit drugs.(39) Whilst there is no specific research available for women with both SUD and UIP, stigma, discrimination and a lack of provider knowledge could explain the finding in our study that women with an UIP were less likely to receive a general, spinal, or epidural anaesthetic. In women with SUD, those with an UIP are likely to have more complex psychosocial needs or unmet AOD treatment needs, and therefore it is possible they may have experienced additional stigma and discrimination beyond those with an intended pregnancy.(33-35) Whilst this discrimination may not be deliberate, the health system should work to ensure health care providers have the training and capacity to provide equitable access to care for all women.

The finding that all other pregnancy and birth outcomes were not associated with UIP in women with SUD is also important. Acknowledging most of the literature examines AOD use in pregnancy, rather than specific for those with SUD, it is well documented that adverse maternal and infant outcomes are more common in women who use AOD in pregnancy compared to women who do not. Whilst specific outcomes do depend on the substance used, broadly they include maternal anaemia, placental abruption, antepartum haemorrhage, fetal growth restriction, low birth weight, stillbirth, preterm birth, admission to the nursery.(9, 10, 39-41) Given these background associations, it was reasonable to anticipate UIP would further worsen pregnancy and birth outcomes in women with SUD. The lack of association suggests that it is not UIP, and perhaps not SUD, that is responsible for associations with pregnancy and birth outcomes. Rather that shared population characteristics, such as social determinants of health and adverse life experiences, are the responsible for the underlying factors. There is research available that supports these conclusions. A meta-analysis of adverse neonatal outcomes following maternal marijuana found that whilst there were unadjusted associations between marijuana use, and low birth weight and preterm birth, after adjustment for sociodemographic factors including concomitant tobacco use, there was no association.(42) It has also been demonstrated that most of the low birth weight seen in women who use illicit drugs can be attributed to social determinants of health.(7) Additionally, it has been known for over 25 years that adverse childhood experiences, such as exposure to abuse, living in a household where parents are affected by SUD, mental illness, violence, or involved in criminal activities, can affect adult health outcomes, including the development of SUD.(43) More recently, it has been demonstrated that both unintended pregnancy and pregnancy and birth outcomes are associated with adverse childhood experiences, highlighting the interconnectivity of these issues.(44, 45)

In **Chapter 2**, the rate of substance use disorder in pregnant women is described, using a large existing maternity dataset across five NSW LHD. The reported rate (0.8%) likely represents an underreporting as it is which is lower than the rate for Australian women. The rate of unintended pregnancy in women with SUD is also described and is consistent with prior research. It was shown that most pregnancy and birth outcomes were not further exacerbated by unintended pregnancy in women with SUD and suggested that where outcomes were associated (maternal and neonatal length of stay, and intrapartum anaesthesia use) these may be explained by psychosocial factors. Given the high rate of unintended pregnancy, access to post-partum contraception is important to prevent another unintended pregnancy. The research in **Chapter 3** examined access to post-partum contraception through maternity services.

6.2.3: Planning Postpartum Contraception for Women with Substance Use Disorders: Utilisation of the Birth Admission

Pregnant women with SUD had 2.5 the odds of reporting an UIP, compared to women without SUD.

Initiation of contraception in hospital during the birth admission was low in all women.

However, compared to women without SUD, women with SUD:

- Had 6 times the odds of initiating contraception in hospital.
- Had 3 times the odds of expressing an interest in highly effective contraception methods.

This study showed that between 2011 and 2019 over half of all women, with or without SUD, did not have a contraceptive plan in place at discharge from hospital following the birth admission. Initiation of postpartum contraception in hospital was low (12.5%) in women with SUD and varied over time. Nevertheless, women with SUD had more than six times the odds of initiating contraception in hospital compared to women without SUD. The results also show women with SUD had more than three times the odds of expressing interest in highly effective and effective methods, than women without SUD.

The rate of contraception initiation in hospital was similar to another study conducted in a NSW maternity service.(46) However, it was less than half that of a study from a Victorian maternity service.(47) These differences may reflect differences in local postpartum health care practices or

differences in the populations. National data was not available in Australia on the rate of SUD in pregnant women as the National Drug Strategy Household Survey reported the rate of AOD use in pregnancy rather than the rate of SUD in pregnancy.(48) However, similar to the results in Chapter 2, the calculated rate of SUD in pregnancy was 0.7% in this study, which was comparable to other Australian studies using existing datasets.(9-11)

Post-partum contraception initiation for women with SUD has also been studied internationally, and largely report findings different to our study, although most studies were conducted in the USA and were generally specific for women with OUD. In a retrospective cohort study of 7805 women with OUD from Pennsylvania, USA, 7.4% initiated highly-effective contraception, predominantly female sterilisation, and 18.1% initiated effective contraception by three months post-partum, and therefore contraception initiation is clearly much higher than the 12.5% in our study.(49) Unlike our study, there was no comparison provided to women without SUD, so it is possible the background rate of contraception initiation was also higher than in our setting. However, the discrepancy in findings is also likely due to differences in the follow up period between the studies (three months post-partum vs discharge from hospital). Over one-third (37.3%) of women with SUD in our study left the hospital with a prescription for contraception, or a referral to see another provider about contraception, and it is not known how many of those initiated contraception by three months post-partum. A large retrospective dataset study using Medicaid data from South Carolina, USA, used comparable methodology to our study. In that study, slightly more women with OUD initiated effective or highly effective contraception on discharge from hospital (OUD:19.1% v no-SUD: 16.2%, $p < 0.001$) ,compared to women without SUD.(16) Whilst the direction of results is consistent with our study, the background rate of post-partum initiation in women without SUD is much higher than the 1.4% in our study. Like the Pennsylvania study, the South Carolina study was conducted in women enrolled in Medicaid, which is only for low-socioeconomic populations, whilst our study was conducted in women from all socio-economic demographics. There are structural differences between health systems in Australia and USA which may be important. Australia has a universal health care system and the population of women. Whilst there are still access barriers, funding for most contraception options is available for everyone in the community through Medicare and the Pharmaceutical Benefits Scheme and it is therefore possible that public hospitals, which are funded separately by state governments, do not prioritise the provision of contraception during the hospital admission.(50) However, Medicaid funding in the USA is only available for low socio-economic populations, and the coverage varies between states. In some circumstances, contraception funding is tied to the post-partum period, resulting in wide variations of initiation of post-partum contraception.(51)

The preferred methods of contraception, and the documentation of post-partum contraception plans have also been studied internationally. Another study from Pennsylvania showed that following antenatal counselling for post-partum contraception, 35% of women with OUD preferred long-acting reversible contraception (LARC), which are highly effective methods. Despite the preference for highly effective methods, over 50% of women in that study did not have a plan for contraception documented in the medical records at the birth admission.(52) Similar results were demonstrated in a study from Vermont, USA, which showed 42% of women with OUD were interested in LARC as post-partum contraception, however only 9% had received it by the time of their next pregnancy.(53) The preference for highly effective methods, yet low rates of implementation of this preference, and the low rate of a documented plan for contraception, were consistent with the findings in our study.

The current study was not able to elicit the reasons for the differences between contraception initiation in hospital, between women with and without SUD, however the effect persisted after adjustment for maternal factors, including UIP. Anecdotally, it was felt the presence of a clinical champion may have been important and this requires further evaluation. It is known that clinical champions within maternity services facilitate of implementation of immediate post-partum contraception programs.(54) The benefit of clinical champions in the delivery of AOD care has also been described.(55) Despite the differences in initiation in hospital between women with and without SUD, contraception initiation during hospital was low in all women. It is known women prefer post-partum contraception to be provided during the birth admission and that preference was clearly not being implemented in the maternity services in this study.(56) This may be related to resources, staffing, cost or women's priorities whilst in hospital. Women with SUD were almost three times as likely to be interested in highly effective and effective methods. Although the reasons for this are not well understood, it could represent targeted counselling, or maternal choice, due to the known increased risk of unintended pregnancy in this population.

In **Chapter 3**, it was demonstrated that within a single NSW LHD women were not regularly initiating contraception in hospital during the birth admission. However, it was also demonstrated that initiation was 6-fold higher in women with SUD compared to those without SUD, and that those with SUD were more likely to express interest in highly effective and effective methods. As these methods were not being initiated regularly from the birth admission, investigating other settings to provide access to contraception for women with SUD is important. A study that investigates this is demonstrated in **Chapter 4**.

6.2.4: Integration of a facilitated access pathway for contraception into alcohol and other drug treatment services: a cohort study comparing metropolitan and regional settings

Unmet need for contraception is high in women with SUD.

Contraception pathways within AOD treatment services can improve initiation of highly reliable methods of contraception for women.

Facilitators for access to contraception likely include care navigators and clinical champions. The needs of the local population are likely also important.

Intrauterine devices are popular with women with SUD.

This study showed that women who attend AOD services in NSW, both in the metropolitan and regional settings, have high unmet needs for contraception. The contraceptive pathway improved access to contraception for women attending AOD services at the regional but not the metropolitan site. Compared to women from the metropolitan AOD service, more women from the regional AOD service accepted a referral for contraception counselling, requested contraception, initiated highly reliable contraception, and were using highly reliable contraception at 12 months. Intrauterine devices were the most requested and initiated method of contraception.

In this study, at baseline, 44% of women who were not intending to conceive were using any method of contraception, which was lower than previously reported in the Australian setting.(21) However, this rate is virtually the same at the 45% reported in a meta-analysis of 24 international publications, although the rate did vary widely from 9% to 77%.(57) Following contraception education from a reliable source women preferred intrauterine devices, which is consistent with prior research in women with opioid use disorder.(58) Over the 12 month follow up period, almost 15% of women who, at baseline were not intending to conceive, experienced a pregnancy. This was substantially higher than the 5% background rate for high incomes countries.(59) Whilst the circumstances surrounding these pregnancies were not examined, women with SUD have previously described not feeling able to prioritise contraception and avoid sexual risk taking during periods of active drug use, an observation also supported by healthcare workers.(58, 60) Sexual assault or coercion is high in women with SUD and could be another explanation for the pregnancies.(61)

Whilst not formally evaluated as part of this project, there are several internal and external study factors that could explain the differences in findings between the metropolitan and regional AOD services. The collaboration with primary care facilities in the regional pathway may have been more acceptable to women than the collaboration with a public hospital gynaecology service in the metropolitan pathway. Real and perceived stigma and emotional cost of attending sexual and reproductive health services(SRH) is a recognised barrier for women with SUD.(62) Women may have experienced babies being placed into out of home care from the birth admission at the public hospital in the metropolitan pathway, and may experience institutional re-traumatisation engaging with these services again.(63) Metropolitan pathway SRH provider requirements for cervical screening, sexually transmitted infection screening, and pregnancy tests prior to the day of insertion of an intrauterine device appeared to create barriers, which have previously been described in the general population.(64) However, this issue was resolved part way through the study, with no subsequent increase in contraception initiation. Provision of service in a regional setting, where access barriers in the community (e.g. availability of other contraception pathways) may be greater than in a metropolitan area, may have meant women from the regional AOD service were more ready to take up a service when offered.(65) The MAM consultant at the regional AOD service demonstrated characteristics of a clinical champion for contraception, including previously completing a formal qualification in family planning. Clinical champions are a recognised strategy to facilitate access to contraception through maternity services and clinical champions have also been recognised in improving access to AOD care.(54, 55, 66) Peer navigation has been demonstrated to improve access to contraception care for women in opioid treatment programs.(63) Whilst care navigation in this study was provided by researchers, not peers, it is likely the AOD nurse-researchers who provided the navigation in the regional pathway better understood the women's needs in respect to care navigation, compared to the non-clinician researchers and the women's health clinician-researcher at the metropolitan service. It is likely unevaluated factors also played a role.

The findings from the metropolitan AOD service were similar to a 2020 study from a district neighbouring the metropolitan service in this study. That study tested a contraception pathway in an AOD service in a tertiary hospital. In that study, two out of 48 women initiated contraception over a six-month period.(67) Contraception services were provided though the gynaecology service, which was located within the same hospital campus. That study facilitated referral for subdermal implants and intrauterine devices, although other methods were not available. There were no care navigators, and it did not provide contraception education for clinic staff and study participants. The similarity in results between the metropolitan AOD service in the two studies could be due to the

study population having similar contraception needs, or because the contraception pathways were similar, yet distinct from that in the regional AOD service. However, there are several examples internationally where programs aimed at facilitating access to contraception for women with SUD have seen an increase in contraception initiation. One study from Vermont, USA randomised 31 women with OUD not wishing to conceive to a usual care or an experimental contraception pathway, and found significantly higher contraception initiation in the experimental groups (100% vs 29%, p <0.01), which is similar to the results in our study, particularly for the regional AOD service, albeit with higher rates of initiation.(68) Usual care involved the receipt of an information booklet about contraception and a list of nearby external providers, whilst the experimental pathway involved contraception counselling with a trained nurse with the World Health Organization's Contraceptive Decision-Making Tool,(69) no cost access to a range of contraception methods. Similar to our project most methods (pills, patches, rings, and injections) were available immediately on the day, whilst intrauterine devices and hormonal implants were facilitated at a nearby university-affiliated clinic within a few weeks. In contrast to our study, women from the experimental group regularly attended followed visits to discuss side effects and ensure prescription of short acting methods. To encourage attendance at the follow up visits, women received a grocery voucher for attending but were not required to continue with contraception at the visit to receive the voucher. Whilst slightly different, another study from Vermont retrospectively investigated if the co-location of obstetrics and gynaecology services, and AOD services, increased post-partum contraception initiation in women with OUD and found co-location did not improved contraception initiation. This suggests that provision of a service alone is not adequate to promote contraception initiation, and there are likely other barriers to access. This concept is supported by the findings in our study, where large differences in contraception initiation were seen between the regional and metropolitan service, and other factors, such as the presence of clinical champions and care navigators were thought to be important.

The research in **Chapter 4** of this thesis demonstrated a high unmet need for contraception in women with SUD, which was able to be reduced through developing a contraception pathway within AOD treatment services. Access to effective and highly effective contraception improved with the pathway, and women demonstrated a preference for intrauterine devices. There were large differences between the regional and metropolitan AOD services, which could relate to components of the pathway or to population characteristics, and this require further evaluation.

6.3: Strengths and Limitations of Component Studies

The component studies of this thesis, when linked together, investigated the interconnections between unintended pregnancy and substance use disorder (SUD), determining that two issues have

shared root causes in social determinants of health. Each study had its own set of strengths and limitations.

The main strength of the scoping review in Chapter 1 (**section 1.1**) was that it identified a research gap that had not been previously identified. The methodology involved a comprehensive, systematic search of scientific literature across multiple databases and facilitated a broad search of all possible short-term and long-term outcomes, including pregnancy, birth, infant and childhood health outcomes, as well as social and economic outcomes. The broad criteria of all AOD use and UIP, and the search across databases of multiple disciplines, meant there is unlikely to be a substantive body of literature on this topic that was not identified. The search was restricted to the 21st century to ensure only contemporaneous concepts relating to AOD use and pregnancy intention were included. However, there were also limitations. Overall, only three studies were included in the review after the full-text stage. Those included were heterogenous in sample size, methodology, assessment of pregnancy intention, and AOD use definitions and patterns, making it difficult to draw general conclusions. No study assessed the role of underlying factors, such as poverty, education, or access to healthcare, in the development of SUD and UIP. Additionally, the first included study was likely underpowered to detect an association between UIP and remaining in AOD treatment during pregnancy.(1) The second included study did not adjust for social determinants of health and therefore was not able to demonstrate a causative pathway between UIP and children entering into out-of-home care.(2) The third study assessed alcohol consumption during pregnancy using retrospective recall in the post-partum period, which may have biased the results.(3) Finally, this scoping review overall was limited to quantitative data, which met the its purpose to examine outcomes from pregnancy. However, review of the qualitative literature would provide an interesting perspective on this issue.

The main strength of the retrospective cohort study on pregnancy and birth outcomes in **Chapter 2** was that it was the first known first known study to examine associations between pregnancy and birth outcomes and unintended pregnancy in women with SUD. That it utilised a large dataset, over multiple NSW LHDs, is another strength. However, it is a limitation that all the included LHDs were in or near the Sydney Metropolitan region, and all in the east, which means the population is unlikely to be representative of all women in Australia, or even all women in NSW. Other limitations were that the dataset did not record neonatal abstinence syndrome, which would have impacted length of stay. Information on complex psychosocial factors, for example, readiness for parenting, stable employment, housing, education and measures of psychosocial functioning commonly used in NSW AOD datasets, were not available.(70) It is possible these factors also influenced maternal and neonatal length of stay. Another limitation was the study definition of SUD, which used engagement

with or referral to AOD treatment services as a marker of SUD. This likely contributed to the under-reporting of SUD, as women with milder SUD, and those who did not disclose their SUD, were not counted. Unfortunately, the maternity datasets used do not capture SUD independently.

The main strength of the retrospective cohort study on post-partum contraception in **Chapter 3** was that it analysed a larger sample size than any other Australian study in this field. It also allowed comparisons to women without SUD, which no Australian study had previously done. Limitations included that the dataset was restricted to a single NSW LHD, which may not be representative of women elsewhere, and that there was likely under-reporting of women with SUD, which may have introduced a selection bias to the post-partum contraception results. The study used midwifery collected documentation from within the dataset to determine postpartum contraception, which may be inaccurate. It is possible women who were recorded as not having a contraception plan, did have a plan but that it was not accurately recorded in the dataset. Additionally, there was a substantial amount of missing data, which could also have biased the results.

The study in **Chapter 4** was a pilot study which investigated a facilitated access pathway for contraception within AOD treatment services and was the first Australian study of this type to demonstrate an increase in contraception initiation. Strengths of the study were that it developed a collaborative pathway with SRH services, provided contraception counselling from trusted sources (AOD clinical staff), promoted women's autonomy by providing access to a range of contraception methods and ensuring women knew they were not obliged to initiate contraception. It provided practical solutions including the funding of contraception, provision of transport, and care navigation. The study limitations were that specific evaluation of the reasons for differences between AOD services was not incorporated in the study design, and the small number of women who took up contraception from the metropolitan site meant adjustment for confounders was not possible. Additionally, this pilot study attracted modest funding, and time taken to recruit 100 participants was limited by researcher availability, and researcher access to AOD clinics during the Covid-19 pandemic. Sources of bias include the convenience sampling and loss to follow up at 12 months. Detailed information about changes in pregnancy intention and sexual activity over time, and hence changes in contraception needs, were not recorded. The principal drug of concern was extracted from a self-reported AOD dataset, which was not validated and may not be fully accurate. Follow up data regarding pregnancy was likely underreported due to loss to follow up at the 12-month questionnaire. Extracted data from the medical record was unable to identify pregnancies that were cared for or occurred outside the LHD, and thus may be under-reported. Furthermore, the acceptability of the contraception pathway to participants was not evaluated. This may be

important when interpreting the differences in results between the metropolitan and regional AOD services.

6.4: Directions for Future Research and Clinical Practice

The component studies of this thesis achieved their aims of evaluating if UIP amplifies the health, social and economic outcomes following a pregnancy in women with SUD, the rate of SUD in pregnant women and in those women, the rate of UIP. The studies also achieved the aim of understanding access to post-partum contraception and providing access to contraception through AOD treatment services. However, there is more to be understood about the interconnections between substance use disorder, unintended pregnancy and contraception.

SUD and UIP are important public health issues, both with significant implications for women and children. They have shared root causes in social determinants of health, but despite these interconnections, little is known how they interact to affect health, social and economic outcomes following pregnancy. Whilst the study in chapter 2 demonstrated no impact on most pregnancy and birth outcomes, there is much still not understood about the intersection of these issues. Future research could involve analysis of existing datasets, including from prospectively collected cohort studies such as Avon Longitudinal Study of Parents and Children or Growing up in New Zealand.(71, 72) Other sources of existing data are maternity datasets, which often record pregnancy intention, drug and alcohol use, socio-demographic factors and labour and birth outcomes. Data linkage using paediatric datasets would also enable more comprehensive and longitudinal follow-up of both maternal and infant outcomes. Importantly, future research should examine and compare differences between women with low level AOD use and SUD. Future research should also consider how the complexity of women's lives, in relation to social determinants of health, impact outcomes. It would also be useful to further understand how health provider attitudes and responses affect women with UIP and SUD, particularly in relation to intrapartum anaesthesia access. Review of qualitative studies could provide a more contextual and subjective response around the intersection between UIP and AOD use.

UIP is measured dichotomously in the studies throughout this thesis, however, for most women the concept is more nuanced. There is a substantial difference between a mistimed yet wanted pregnancy and an unwanted pregnancy, and a dichotomous measure cannot elicit the difference. It is also not possible to tell if the pregnancy intention recorded during the midwifery antenatal appointment is reflective of pregnancy intention at time of conception. Future research could incorporate a validated tool of UIP, such as the 'London Measure of Unplanned Pregnancy' which is

more stable over time. This can be used during pregnancy or the postnatal period and can also capture differences between a mistimed and unwanted pregnancy.(73) Use of this tool within a population of women with SUD may help to better understand their health needs. Additionally, when used in a health setting such as maternity services or AOD treatment services, may help direct resources for contraception to the women who would benefit the most.

SUD is characterised by ongoing use of a substance/substances despite experiencing substance related problems, and can be mild, moderate or severe depending on the extent of symptoms.(74) However, throughout this thesis, it became apparent that such a succinct understanding does not always exist within maternity settings. Much of the obstetric literature conflates AOD use and SUD. The underreporting of SUD in maternity datasets likely represents an under recognition of SUD by maternity health care staff and/or a lack of disclosure by the woman. Future research should develop more robust screening systems to identify both AOD use and SUD in pregnant women and reduce the real or perceived stigma with disclosing a SUD in pregnancy.(37) The benefit of accurately identifying women with AOD use in pregnancy is that there are implications for fetal in-utero exposure, particularly for alcohol, and advice for cessation can be provided. The implications for accurately identifying pregnant women with SUD is that it is the first step in enabling the delivery of SUD specific pregnancy care, including treatment for SUD and the provision of psychosocial supports.

Health policy and research should ensure the provision of extra psychosocial support and care pathways for pregnant women with SUD. Policies that act more broadly, to reduce socio-economic disadvantage, domestic violence, and reduce societal inequities are likely to be more useful. Attention should be focused on those who experience domestic violence, live in regional or rural areas, have a past history of mental illness, and who use drugs other than alcohol or cannabis, as these factors were associated with UIP and are known to negatively impact pregnancy and birth outcomes.(75)

It may not be possible to further optimise initiation of post-partum contraception from the birth admission for women with SUD without identifying and addressing the underlying reasons for low rates of initiation within the entire maternity service. Low implementation of post-partum contraception in all women may be related to resources, staffing, cost or women's priorities during admission. Qualitative interviews with health care workers may help to understand this. I am the co-ordinating investigator on a study interviewing AOD and maternity staff about barriers to access for contraception in women with SUD. The project protocol is provided in **Appendix A: Figure 7-9**, the project has ethical approval, and qualitative interviews have commenced. The use of clinical champions could be employed to create organisational change in service delivery through maternity

services, although changes should be incorporated into routine care to ensure long term sustainability. Key successful attributes of clinical champions that result in implementation of postpartum contraception during the birth admission have been described. These include influence, ownership of implementation, physical presence within the maternity service, grit, persuasiveness, and a participative leadership style.(54) It is known women prefer antenatal delivery of counselling regarding post-partum contraception, and this could be implemented for all women as part of changes in service delivery.(76) AOD service providers could look for other opportunities to provide access postpartum contraception, such as through substance use in pregnancy programs and mother-baby AOD rehabilitation centres.(77) Formal evaluation of service innovations would be helpful so that these can be implemented on a wider scale.

Whilst it was demonstrated that facilitated access pathways to contraception through AOD services can improve contraception initiation of the most effective methods of contraception, there a many remaining questions, particularly regarding the stark differences between the metropolitan and regional sites. Future pathways would benefit from focusing on the women with the greatest unmet need for contraception. The use of pregnancy intention screening tools within AOD services to identify those with the greatest need should be undertaken.(78) I am the co-author on a study that developed a screening tool for UIP and tested this in a AOD treatment service. That manuscript is currently under peer review (**Appendix C: Figure 9-2**). There are several future research priorities for the provision of contraception services through AOD services. Co-location of AOD and SRH services could be trialled as they have successfully been in the United Kingdom, and is similar to other collaborative models used, such as provision of hepatitis C services.(79-81) Funded ongoing training of AOD services providers in SRH should be explored. Ongoing coaching following clinical training has previously been shown to improve collaborative care.(81) The role of the potential facilitators for contraception pathways were not formally assessed in this study, however these should be investigated. A realist analyses could be included during implementation of future pathways.(82) Robust health economic evaluations should be undertaken.

6.5: Conclusion

This thesis demonstrates there is a large paucity of research about the intersection between UIP and SUD and, despite a well-documented unmet contraception need within the population, there are a lack of large scale, effective programs to improve contraception initiation and use in women with SUD who wish to avoid pregnancy.

UIP and SUD are two very important public health issues, that both disproportionately affect women from priority populations, and it is likely the root cause of both issues lies in social determinants of

health and adverse childhood experiences. Despite this, UIP doesn't further amplify the already known association of most pregnancy and birth outcomes, apart from length of stay, which may be to provide psychosocial support or specific care for neonatal abstinence syndrome. This is important information, as stigma and discrimination experienced by women with SUD and UIP, as likely evidenced by the demonstrated reduced access to intrapartum anaesthesia, and a reduction in stigma and discrimination may improve health outcomes for women with SUD.

Contraception is a health equity issue, and all women have the right to access contraception and have control over their reproductive health. Social determinants of health, such as poverty and education, limit access to contraception. However, it is likely some factors specific to SUD, such as sexual risk-taking during periods of intoxication, and the misperception of infertility related to opioid use, also play a role. Pregnancy care and the birth admission represent an opportunity to provide contraception counselling and access to contraception and it has been shown to be acceptable and preferred by women to deliver this care antenatally and in the immediate post-partum period. However, women, including those with SUD, are frequently not accessing post-partum contraception during hospital, which may be related to the culture of service delivery within the wider maternity service. Irrespective of the reasons, it is a lost opportunity to provide contraception to women with SUD, a group known to have access barriers to contraception and high rates of unintended pregnancy. The low rates of contraception initiation in hospital in all women, including those with SUD, does suggest that opportunities outside the birth admission should be developed to ensure access to post-partum contraception for women with SUD.

The development of contraception pathways within AOD treatment services, or other facilities such as mother-baby rehabilitation centres, may be a useful intervention to increase contraception use and therefore improve health equity in women with SUD. However, the provision of contraception within AOD services alone is unlikely to be effective, unless coupled with other innovations to enhance the pathways. Pathways should be designed to ensure barriers, such as knowledge, cost and transport, are overcome. Ensuring pathways are designed to meet the needs of those who are at the greatest risk of an unintended pregnancy is important, and care navigators and the presence of clinical champions may improve the efficacy of such interventions. Ongoing evaluation of future contraception pathways for women with SUD would be beneficial.

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Chapter 7: Appendix A: Supplemental Information

This chapter contains supplemental information for Chapters 1-4.

7.1: Chapter 1: Supplementary Information

Table 7-1: Database Search Strategies for Scoping Review

Database	Search Strategy
Medline via Ovid	1. unplanned pregnancy/ 2. unwanted pregnancy/ 3. unintended pregnan*.tw. 4. unplanned pregnan*.tw. 5. unwanted pregnan*.tw. 6. mistimed pregnan*.tw. 7. ((unintended or unwanted or unplanned) adj3 pregnan*).tw. 8. 1 or 2 or 3 or 4 or 5 or 6 or 7 9. exp Substance-Related Disorders/ 10. Addiction Medicine/ 11. exp Alcohol Drinking/ 12. exp Illicit Drugs/ 13. Designer Drugs/ 14. exp Drug Misuse/ 15. alcohol*.tw. 16. amphetamine*.tw. 17. methamphetamine*.tw. 18. cocaine*.tw. 19. ((dependence or overdose or misuse) adj3 drug*).tw. 20. inhalant*.tw. 21. marijuana*.tw. 22. narcotic*.tw. 23. Phencyclidine*.tw.

	24. ((dependence or overdose or misuse) adj3 substance*).tw. 25. addict*.tw. 26. opioid*.tw. 27. opiate*.tw. 28. heroin*.tw. 29. 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 30. 8 and 29
Embase	1. exp unplanned pregnancy/ 2. exp unwanted pregnancy/ 3. unintended pregnan*.mp. 4. unplanned pregnan*.mp. 5. unwanted pregnan*.mp. 6. mistimed pregnan*.mp. 7. ((unintended or unwanted or unplanned) adj3 pregnan*).mp. 8. 1 or 2 or 3 or 4 or 5 or 6 or 7 9. exp substance abuse/ 10. exp drug dependence/ 11. exp addiction medicine/ 12. exp drinking behavior/ 13. exp illicit drug/ 14. exp designer drug/ 15. exp drug misuse/ 16. alcohol*.mp. 17. amphetamine*.mp. 18. cocaine*.mp. 19. ((dependence or overdose or misuse) adj3 drug*).mp.

	20. inhalant*.mp. 21. marijuana*.mp. 22. narcotic*.mp. 23. Phencyclidine*.mp. 24. ((dependence or overdose or misuse) adj3 substance*).mp. 25. addict*.mp. 26. opioid*.mp. 27. opiate*.mp. 28. heroin*.mp. 29. 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 30. 8 and 29
Scopus	(TITLE-ABS-KEY (pregnan* W/3 (uninten* OR unplan* OR unwant* OR intention)) AND TITLE-ABS-KEY ("substance use disorder" OR "addiction w/3 medicin*" OR (substance W/3 (use OR misuse OR dependenc* OR overdose)) OR "drug use" OR "illicit w/3 drug*" OR alcohol OR amphetamine* OR methamphet* OR cocaine OR opioid* OR opiate* OR marijuana OR cannib* OR narcotic* OR phencyclidine* OR addict* OR heroin OR inhalant*))
Cinahl	S1. (MH "Pregnancy, Unplanned") S2. (MH "Pregnancy, Unwanted") S3. unintended pregnan* S4. unplanned pregnan* S5. unwanted pregnan*.tw S6. unwanted pregnan* S7. mistimed pregnan*

	S8. (unintended or unwanted or unplanned) N3 pregnan*) S9. S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 S10. (MH "Substance Use Disorders+") S11. (MH "Substance Dependence+") S12. (MH "Street Drugs+") OR (MH "Designer Drugs") S13. alcohol* S14. amphetamine* S15. methamphetamine* S16. cocaine* S17. (dependence or overdose or misuse) N3 drug* S18. inhalant* S19. marijuana* S20. narcotic* S21. Phencyclidine* S22. (dependence or overdose or misuse) N3 substance* S23. addict* S24. opioid* S25. opiate* S26. heroin* S27. S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 S28. S9 AND S27
Google Scholar	(“unplanned pregnancy” OR “unintended pregnancy” OR “unwanted pregnancy” OR “mistimed pregnancy”) AND ("substance use" OR "drug use" OR "alcohol*" OR "amphetamine*" OR "methamphetamine*" OR "inhalant" OR "marijuana" OR "narcotic" OR

	"phencyclidine" OR "addict*" OR "opioid*" OR "opiate*" OR "heroin*")
Cochrane Database	1. unplanned pregnancy/ 2. unwanted pregnancy/ 3. unintended pregnan* 4. unplanned pregnan* 5. unwanted pregnan* 6. mistimed pregnan* 7. (unintended or unwanted or unplanned) NEAR/3 pregnan* 8. #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 9. exp Substance-Related Disorders/ 10. Addiction Medicine/ 11. exp Alcohol Drinking/ 12. exp Illicit Drugs/ 13. Designer Drugs/ 14. exp Drug Misuse/ 15. alcohol* 16. amphetamine* 17. methamphetamine* 18. cocaine* 19. (dependence or overdose or misuse) NEAR/3 drug* 20. inhalant* 21. marijuana* 22. narcotic* 23. Phencyclidine* 24. (dependence or overdose or misuse) NEAR/3 substance*

	25. addict* 26. opioid* 27. opiate* 28. heroin* 29. #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23 or #24 or #25 or #26 or #27 or #28 30. #8 and #29
TRIP	(“unplanned pregnancy” OR “unintended pregnancy” OR “unwanted pregnancy” OR “mistimed pregnancy”) AND ("substance use" OR "drug use" OR "alcohol*" OR "amphetamine*" OR "methamphetamine*" OR "inhalant" OR "marijuana" OR "narcotic" OR "phencyclidine" OR "addict*" OR "opioid*" OR "opiate*" OR "heroin*") Selected “Primary Research” and “Systematic Review”

Table 7-2: High Income Countries as listed by The World Bank, June 2020

Andorra	Greenland	Poland
Antigua and Barbuda	Guam	Portugal
Aruba	Hong Kong SAR, China	Puerto Rico
Australia	Hungary	Qatar
Austria	Iceland	Romania
Bahamas, The	Ireland	San Marino
Bahrain	Isle of Man	Saudi Arabia
Barbados	Israel	Seychelles
Belgium	Italy	Singapore
Bermuda	Japan	Sint Maarten (Dutch part)
British Virgin Islands	Korea, Rep.	Slovak Republic
Brunei Darussalam	Kuwait	Slovenia
Canada	Latvia	Spain
Cayman Islands	Liechtenstein	St. Kitts and Nevis
Channel Islands	Lithuania	St. Martin (French part)
Chile	Luxembourg	Sweden
Croatia	Macao SAR, China	Switzerland
Curacao	Malta	Taiwan, China
Cyprus	Mauritius	Trinidad and Tobago
Czech Republic	Monaco	Turks and Caicos Islands
Denmark	Nauru	United Arab Emirates
Estonia	Netherlands	United Kingdom
Faroe Islands	New Caledonia	United States
Finland	New Zealand	Uruguay
France	Northern Mariana Islands	Virgin Islands (U.S.)
French Polynesia	Norway	
Germany	Oman	
Gibraltar	Palau	
Greece	Panama	

Figure 7-1: Data Extraction Template (Covidence)

Summary of outcomes and association with unintended pregnancy

Preview

General information

Study ID:
Citation:
Type of Publication:

- Peer reviewed publication
- Guidelines
- Public health organisation reports
- Unpublished academic research
- Other (Specify……)

Methodology

Study design:

- Prospective cohort study
- Retrospective cohort study
- Analytical Cross sectional study
- Case control study
- Health Economic evaluation
- Systematic review
- Meta-analysis
- Scoping review
- Cochrane Collaboration systematic review
- Other (Specify……)

Methods

Study setting:

- Antenatal
- Retrospective (assessment of pregnancy)
- Paediatric datasets
- National Survey
- Drug and Alcohol Clinics
- Other

Country/Countries in which the study is conducted:

- North America
- Europe
- Asia
- Australia/New Zealand
- Other (Specify……)

Time period of recruitment:

Adapted from: https://app.covidence.org/reviews/137774/extraction/build/24720?extraction_form_type=data_extraction

Method of recording of pregnancy intention

Timing of recording of pregnancy intention:

- Prospective (before pregnancy)
- During pregnancy
- Retrospective (after pregnancy)
- Other

Tools used to assess unintended pregnancy:

- London Measure of Unplanned Pregnancy
- Dichotomous question
- Other

Participants

Total number of participants:

Population Characteristics:

- Age range
- Socio-economic group(s)
- Ethnicities
- Gravidity
- Parity
- Other

Principal drug(s) of choice:

Pattern of drug use:

Severity of drug use:

Results

Outcome(1):

Outcome(2):

Outcome(3):

Type of outcomes assessed (1)

- Maternal
- Fetal
- Neonatal
- Childhood

Type of outcomes assessed (2)

- Health
- Social
- Economic

Adapted from: https://app.covidence.org/reviews/137774/extraction/build/24720?extraction_form_type=data_extraction

Frequency of Outcome in Study Population (Outcome 1)

	Frequency	**95% Confidence Intervas**	**Measure of frequency used (e.g. incidence, prevalence)**
All women in the study			
Women with unintended pregnancy			
Comparator group			

Frequency of Outcome in Study Population (Outcome 2)

	Frequency	**95% Confidence Intervas**	**Measure of frequency used (e.g. incidence, prevalence)**
All women in the study			
Women with unintended pregnancy			
Comparator group			

Frequency of Outcome in Study Population (Outcome 3)

	Frequency	**95% Confidence Intervas**	**Measure of frequency used (e.g. incidence, prevalence)**
All women in the study			
Women with unintended pregnancy			
Comparator group			

Effect of unintended pregnancy on outcomes

	Size of effect 95% Confidence intervals & P-values Measure of effect (e.g. RR, OR)	Size of effect 95% Confidence intervals & P-values Measure of effect (e.g. RR, OR)	Size of effect 95% Confidence intervals & P-values Measure of effect (e.g. RR, OR)
Outcome 1			
Outcome 2			
Outcome 3			

Adapted from: https://app.covidence.org/reviews/137774/extraction/build/24720?extraction_form_type=data_extraction

Summary of outcomes and association with unintended pregnancy

	Association between unintended pregnancy and measured outcome (positive, negative, none)
Health outcome	
Social outcome	
Economic outcome	
Maternal outcome	
Fetal outcome	
Neonatal outcome	
Childhood outcome	

Adapted from: https://app.covidence.org/reviews/137774/extraction/build/24720?extraction_form_type=data_extraction

Figure 7-2: PRISMA Reporting Checklist

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	Page 1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	Page 2, 3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	Page 5,6
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	Page 6
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	Page 6
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	Page 6,7
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	Page 6
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Page 6 & Appendix 1
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	Page 7,8 & Appendix 2
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	Pages 8
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	Appendix 3
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	Page 8
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	N/A

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SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	Pages 8 & Figure 1
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Pages 9, 10, Table 1 & 2
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	Page 9
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Pages 9, 10, Table 3.
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	N/A
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	Pages 10, 11
Limitations	20	Discuss the limitations of the scoping review process.	Page 11, 12
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	Page 13
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	Page 14

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.
* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.
† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).
‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.
§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. Ann Intern Med. 2018;169:467–473. doi: 10.7326/M18-0850.

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Note: The page numbers on the PRISMA checklist refer to the page numbers of the article submitted for publication, not within this wider thesis.

7.2: Chapter 2: Supplemental Information

Figure 7-3: STROBE Statement for Chapter 2

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	a) 1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	b)3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up (*b*) For matched studies, give matching criteria and number of exposed and unexposed	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding (*b*) Describe any methods used to examine subgroups and interactions (*c*) Explain how missing data were addressed (*d*) If applicable, explain how loss to follow-up was addressed (*e*) Describe any sensitivity analyses	8/9
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	9 Tables 1-3
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1, page 9/10
		(b) Indicate number of participants with missing data for each variable of interest	b)Yes
		(c) Summarise follow-up time (eg, average and total amount)	c)n/a

1

Outcome data	15*	Report numbers of outcome events or summary measures over time	Tables 2 & 3. Page 10
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (*b*) Report category boundaries when continuous variables were categorized (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Page 10
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	10/11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

Note: The page numbers on the STROBE statement refer to the page numbers of the article submitted for publication, not within this wider thesis.

7.3: Chapter 3: Supplemental Information

Figure 7-4: STROBE Statement for Chapter 3

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	a) 1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	b)2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3&4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up (*b*) For matched studies, give matching criteria and number of exposed and unexposed	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4&5 Supplement 2
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding (*b*) Describe any methods used to examine subgroups and interactions (*c*) Explain how missing data were addressed (*d*) If applicable, explain how loss to follow-up was addressed (*e*) Describe any sensitivity analyses	4&5
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	5 Table 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1 & 2, page 5
		(b) Indicate number of participants with missing data for each variable of interest	b)Yes
		(c) Summarise follow-up time (eg, average and total amount)	c)n/a

1

Outcome data	15*	Report numbers of outcome events or summary measures over time	Tables 3 & 3. Page 5 & 6
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (*b*) Report category boundaries when continuous variables were categorized (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Page 5&6, table 3
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	6
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	7
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	7
Generalisability	21	Discuss the generalisability (external validity) of the study results	7
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Provided to journal

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

Note: The page numbers on the STROBE statement refer to the page numbers of the article submitted for publication, not within this wider thesis.

7.4: Chapter 4: Supplemental Information

Figure 7-5: Baseline Questionnaire, with explanations of data recategorisation for chapter 4

Supplement 1. Baseline Questionnaire, including combined response as reported.

Pre Video Questionnaire

1. What language do you speak at home?
    - English
    - Other (Specify.....)

2. What is your current marital status?
    - Single and never married
    - Engaged
    - Married
    - De-facto
    - Widowed
    - Divorced
    - Separated

*Engaged, Married, De-facto were combined into 'partnered'

3. What is your current living arrangement?
    - Home owner without a mortgage
    - Home owner with a mortgage
    - Rent through a private landlord
    - Rent through State/public housing
    - Rent free
    - Other arrangement (Specify.....)
    - No fixed address

**Home owner with and without mortgage were combined into 'Home owner', rent free was combined with other into 'other', no fixed address was considered to be 'homeless'*

4. What is your postcode of residence? .....

5. What is your main source of income?
    - Government benefits
    - Full-time employed
    - Part-time/casual employed
    - Maternity leave
    - Other (Specify.....)

*Full-time, part-time and maternity leave were combined into 'paid employment'.

6. What is your average weekly household disposable income (after tax) including wages, government benefits or other sources of income?

1 of 7

Please specify amount in whole dollars.....

7. What is your highest level of educational attainment?
    - Left school before finishing year 10
    - Complete year 10 (School Certificate)
    - Completed year 12 (Higher School Certificate)
    - Completed trade/TAFE certificate
    - Complete university degree
    - Other (Specify.....)

**Completed trade/TAF and completed university were combined into 'completed post school qualifications.*

8. When was your last period?
    - Less than 2 weeks ago
    - About a month ago
    - 3-6 months
    - 6-12 months
    - >12 months ago
    - Can't remember

9. Have you had penetrative sex with a man?
    - In the last month
    - In the past year
    - Over one year ago
    - Never
    - Prefer not to answer

10. What age were you when you first had sexual intercourse with a man?
    Specify .....

11. Concerning the following types of contraception (tick all that apply)?*

Method of Contraception	Have you heard of it?	Have you ever used?	Have you used in past 1 month?
Condoms (male)			
Combined Oral Contraceptive pills			
Progesterone only pill (minipill)			
IUD/IUS			
Depo-Provera (injection)			
Implant (implanon)			
Withdrawal (pulls out)			
Sterilisation for Men (Vasectomy)			
Sterilisation for Women (tubal ligation or hysterectomy)			
Safe period/rhythm method			
Diaphragm/cap			
Female Condom			
Spermicidal foam or jelly			
Douching			
Other (please specify) _____			
None			

**Use in the past month was considered as use a baseline*

12. If you are not currently using contraception please say why?*
**Please identify a <u>maximum</u> of three most important reasons and order them from 1 – 3 (where 1 is the most important and 3 is the least important)*

a. Not having intercourse with a man ___
b. Currently pregnant ___
c. Currently breastfeeding ___
d. Would like to become pregnant ___
e. Don't care/don't worry/forget/never got pregnant before ___
f. I am infertile ___
g. My partner is infertile ___
h. I am past the menopause ___
i. Don't care or worry about contraception ___
j. Don't know what to do/don't know about methods of contraception ___
k. Religious objection ___
l. Leave it to chance/fate/God, when to have babies ___
m. Believe it unnatural or unhealthy ___
n. I experienced side effects/contraindications ___
o. Partner doesn't allow ___
p. No access to a clinic or confidential service ___
q. I didn't have money for contraception ___
r. Other (Specify.....) ___

All responses indicated as 1-3 were considered as 'Yes', i.e. rankings were not included in the analysis.

**Responses to this question were recategorised into eight categories:*

- *Not sexually active: 'Not having intercourse with a man'*
- *Perceived infertility: 'Currently breastfeeding', 'I am infertile', 'My partner is infertile', 'I am past the menopause'.*
- *Ambivalence to pregnancy or contraception: 'Don't care/don't worry/forget/never got pregnant before', 'Don't care or worry about contraception', 'Leave it to chance/fate/God, when to have babies'.*
- *Knowledge or access barriers: 'Don't know what to do/don't know about methods of contraception', 'No access to a clinic or confidential service', 'I didn't have money for contraception'.*
- *Reproductive coercion: 'Partner doesn't allow'*
- *Faith or belief objections: 'Religious objection', 'Believe it unnatural or unhealthy'*
- *Side effects: 'I experienced side effects/contraindication'*
- *Other.*

Note:

Where possible, 'Other' responses to other were recategorised to once of the above groups using the free text response. Where not possible, the response was recorded as 'other'. 'Currently pregnant' was not recategorised as no women were pregnant at

baseline. 'Would like to become pregnant' was not recategorised, as women who planning to conceive were not included in the results.

13. Have you ever been pregnant?
    - Yes
    - No
    - Prefer not to answer

14. Have you ever had an unplanned pregnancy?
    - Yes, but not in the past 12 months
    - Yes, within the last 12 months
    - No
    - Prefer not to answer

15. How old were you when you first became pregnant?
    - Under 18
    - 18-24
    - 25-34
    - Over 35

16. Was your first pregnancy planned?
    - Yes
    - No
    - Prefer not to answer

17. How many times have you had each of the following?
Please mark a tick in the appropriate boxes

	None	One	Two	Three	Four	Five or More
a) Live Birth after 36 weeks						
b) Live Birth before 36weeks						
c) Stillbirth						
d) Miscarriage						
e) Termination of Pregnancy						
f) Ectopic (tubal) Pregnancy						

18. **If you have children, how many of them are currently:**

	None	One	Two	Three	Four	Five or More
a) In your care?						
b) In the care of another person?						

19. Have Family and Community Services (FACS) been involved with any of your children?
- Yes
- No

20. Are you intending on becoming pregnant in the future?
- Yes, in the next 12 months.
- Yes, but not in the next 12 months
- No, I have never wanted children
- No, my family in now complete
- N/A. I am currently pregnant

21. We can refer you to a staff member to answer any of your questions on contraception. If you would like our staff member may also provide a contraception plan and/or prescription for you. Are you interested to talking to a staff member about further contraception options available through our services?
    - Yes……Your questionnaire is complete. Your case worker will refer you on to one of our contraception doctors or nurses
    - No

22. If you are not interested in contraception options available our service, why?
    - Already go to another facility for contraception
    - Do not want a Drug and Alcohol doctor/nurse talking to me about women's health
    - Do not want Drug and Alcohol case workers talking to me about contraception
    - Already pregnant
    - Planning a pregnancy in the next 12 month
    - Have not had heterosexual activity in past 12 months and not wanting/planning heterosexual activity in the next 12 months
    - Don't have time/not bothered
    - Other (Specify……)

**Responses to this question were recategorised into seven groups:*

- *Goes elsewhere for contraception: 'Already go to another facility for contraception'.*
- *Do not want to discuss women's health/contraception with AoD staff: 'Do not want a Drug and Alcohol doctor/nurse talking to me about women's health', 'Do not want Drug and Alcohol case workers talking to me about contraception'*
- *Not having intercourse 'Have not had heterosexual activity in past 12 months and not wanting/planning heterosexual activity in the next 12 months'*
- *Perceived infertility: exclusively from 'other' responses.*
- *Wants to discuss with partner: exclusively from 'other' responses.*
- *Other priorities/don't have time/not bother: 'Don't have time/not bothered'*
- *Think about it/defer till later: exclusively from 'other' responses.*

Note:

'Other' responses were recategorised into one of the above categories. 'Currently pregnant' was not recategorised as no women were pregnant at baseline. 'Would like to become pregnant' was not recategorised, as women who planning to conceive were not included in the results.

Figure 7-6: STROBE Statement for Chapter 4

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	a) 1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	b)3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4/5
Methods			
Study design	4	Present key elements of study design early in the paper	5 & Table 1
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up (*b*) For matched studies, give matching criteria and number of exposed and unexposed	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Bias	9	Describe any efforts to address potential sources of bias	9-11
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding (*b*) Describe any methods used to examine subgroups and interactions (*c*) Explain how missing data were addressed (*d*) If applicable, explain how loss to follow-up was addressed (*e*) Describe any sensitivity analyses	7
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	Table 4. It was not possible to record who declined to participate (page 5).
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 2, page 7,8

1

		(b) Indicate number of participants with missing data for each variable of interest	b)Yes
		(c) Summarise follow-up time (eg, average and total amount)	c)Yes
Outcome data	15*	Report numbers of outcome events or summary measures over time	Table 3, Table 4, Page 8
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (*b*) Report category boundaries when continuous variables were categorized (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Page 8 – no adjustment
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	10
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

7.5: Chapter 5: Supplemental Information

Figure 7-7: Protocol Modifications for Survey on Pregnancy Intention and Contraception in Women with Substance Use Disorder due to Covid-19 Pandemic Restrictions (Chapter 2)

Modification for the COVID-19 Pandemic

1. Potential participants will be initially informed about the study by their maternity or drug health provider
2. Where the maternity or drug health provider is also an investigator on the research project, they will complete the participant consent form with the participant and give the participant the participant information sheet to take home
3. Potential participants' name and contact details will be emailed (via NSW health email addresses) to the recruiting researcher
4. The recruiting researcher will phone the participant; obtain and record verbal consent to participate; and complete the survey over the telephone
5. Where the recruiting researcher is permitted and able to attend the site, face to face interviews to complete the survey may still be conducted
6. Survey entry forms will be completed over the telephone by the recruiting researcher
7. Follow up surveys will also be conducted via telephone, and no change in the protocol is required for this to occur as phone calls were always planned for follow up.
8. Recruitment will be extended to December 2022 in light of perceived difficulties with recruitment, research availability (researchers are also clinicians involved in pandemic response)

The recruitment time frame was later extended further to December 2023. The survey part of Chapter 2, which these changes relate to, was later abandoned.

Figure 7-8: Protocol Modifications for the Contraception Pathway due to Covid-19 Pandemic Restrictions (Chapter 4)

Safety Modifications for the COVID-19 Pandemic

1. Potential participants may be initially informed about the study by their drug and alcohol health provider.
2. Where necessary, recruitment may be conducted, and consent for participation obtained, by a recruiting researcher via the telephone. When a recruiting researcher is permitted and able to attend the site, recruitment and consent may still be conducted face to face as per the original protocol.
3. When phone consents are to be obtained, potential participants will be given the participant information sheet and consent form by their health provider prior to the phone call.
4. A recruiting researcher may be any researcher at that site who does not currently provide clinical care for the potential participant. (Note: some of these researchers may provide clinical care at the site for other patients or participants).
5. The recruiting researcher will phone the participant, obtain and record verbal consent (see attached verbal consent script).
6. Verbal consents will be stored on a password protected folder on the researchers hard-drive and at the first possible convenience transferred to a secure, password protected folder on CCLHD or SESLHD servers.
7. Phone consents may occur on separate days (but prior to) implementation of the baseline survey and watching the video.
8. Implementation of the baseline questionnaires, watching the video, and recording of participant contact details will still be completed face to face with researcher, but this researcher may also provide clinical care to the participant. [This step is added to ensure that there is an arm's length approach for recruitment and consent, but that a researcher is present for the completion of the questionnaire and to show the video.
9. A participant that completes a consent, but that does not complete the baseline questionnaire and watch the video, will be removed from the study.
10. As per the current protocol, the participant will only receive the $30 voucher after completing the baseline questionnaire and watching the video.
11. The contraception appointments will remain face to face.
12. Follow up surveys will also be conducted via telephone, and no change in the protocol is required for this to occur as phone calls were always planned for follow up.

7.6: Chapter 6: Supplemental Information

Figure 7-9: Protocol for Study Involving Qualitative Interviews of Health Care Workers on Identifying Unintended Pregnancy and Provision of Post Partum Contraception to Women with Substance Use Disorder

Pregnancy Intention, Contraception and Obstetric Outcomes in Women Who Use Alcohol and Other Drugs in Pregnancy Part 3: A qualitative study of health care workers

Study Protocol

REGIS Study Number: 2022/PID02904

Definitions

SUPPS – substance use in pregnancy and parenting services

SRH – Sexual and reproductive health

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Background

Exposure to alcohol and other drugs in pregnancy can occur when use occurs prior to recognition of pregnancy or continued use following recognition of a pregnancy.(1) Broadly, strategies to reduce exposure to alcohol and other drugs in pregnancy include a reduction in unintended pregnancies and/or a reduction of alcohol and other drug use. (2)

Unintended Pregnancy and Contraception

Whilst pregnancies exposed to alcohol and other drugs may be intended or unintended, available data suggests up to with 75% of all pregnancies are unintended in women who use alcohol and other drug. This compares to 44% in the general population.(3) There is variation according to the drug used. Women who have heavy, daily alcohol use have unintended pregnancy rates as low as 29%, whilst women who use opioids have rates as high as 86%.(1, 4, 5)

There is an array of documented factors that impact unintended pregnancy rates in women who use alcohol and other drugs, including knowledge, a perception of low chance of pregnancy, contraception non-use whilst intoxicated, cost of contraception and availability of services.(6-12)

Studies conducted within NSW (unpublished data from projects 2019/ETH11539 and 2019/ETH05043) confirm high rates of unintended pregnancy and low rates of contraception use in women who use alcohol and other drugs. Study 2019/ETH05043 demonstrates an unmet need for contraception, as most women are not planning a pregnancy but are sexually activity with a man and not using effective contraception. This study also demonstrates that whilst access to contraception can be improved by providing free, rapid access pathways to contraception, there is a complex array of factors involved and provision of service alone is ineffective in reducing the unmet need.

Identification of Alcohol and Other Drug Use

Health care interventions to reduce alcohol and other drug use in pregnancy could be implemented preconception or during pregnancy. Implementation during the post-partum period could reduce alcohol and other drug use whilst parenting and breast feeding and may reduce the risk of a subsequent pregnancy exposed to alcohol and other drugs.

Accurate identification of alcohol and other drug use is important to target interventions at individuals most at risk. An Australian cohort study suggests 60% of women drink alcohol during pregnancy and 42% continue to drink once they have recognized they are pregnant.(1, 13) This contrasts with data reported to the Australian Department of Health from maternity datasets, which indicate less than 5% of women drink alcohol in the first 20 weeks of pregnancy.(14) Findings of less than 5% are also demonstrated in unpublished

data from study 2019/ETH11539, however the use of drugs other than alcohol was closer to that demonstrated in the aforementioned cohort study. This suggests that whilst maternity services are not able to identify most alcohol exposed pregnancies, identification of exposure to drugs other than alcohol is more reliable.

Justification for research

Health care staff that care for women who use alcohol and other drugs in pregnancy are likely to hold key insights into provision of care in the preconception, pregnant and post-partum periods. Identification of barriers and enablers to identifying and preventing pregnancies exposed to alcohol and other use is an important step in designing health systems that work to reduce alcohol and other drug exposure during pregnancy.

Aims

To examine, from the perspective of the health care worker, barriers and enablers to identifying and preventing pregnancies exposed to alcohol and other drugs. Specifically, this will:

i) Examine practices in identifying alcohol and other drug use in the preconception, pregnancy, or post-partum periods
ii) Examine practices in assessing pregnancy intention in women who use alcohol and other drugs
iii) Examine enablers and barriers to access for contraception care for women who use alcohol and other drugs

Hypothesis

Health care staff who care for reproductive aged women who use alcohol and other drugs are likely to hold key insights into the barriers and enablers associated with prevention of pregnancies exposed to alcohol and other drug use. This will include encompass care for alcohol and drug use, identification of pregnancy intention and access to contraception.

Research Plan

This project will be conducted within South Eastern Sydney Local Health District and Central Coast Local Health District. Health care workers from the local area who employed through the private sector (e.g. general practitioners) will also be included.

The involved sites are:

-Royal Hospital for Women

-St George Hospital

-SESLHD Drug and Alcohol Services

-Gosford Hospital

-Wyong Hospital

The following sites will not recruit participants but may form locations for the conduct of interviews or focus groups

-The University of Sydney

-Central Coast Research Institute

Materials and Methods

Study Setting/Location

Qualitative interviews and/or focus groups with up to 4 participants will be conducted face to face in the following locations:
-meeting rooms within the involved local health districts
-meeting rooms within the University of Sydney sites
-meeting rooms at Central Coast Research Institute (a collaboration between Central Coast Local Health District and the University of Newcastle)

Qualitative interviews and/or focus groups will also be conducted using teleconference or videoconference.

Qualitative interviews and/or focus groups can be conducted during work time or during the participant's own time.

Participants:

Inclusion criteria

Participants must be health care professionals who regularly ('often' or 'always' on a Likert scale) provide care for health care for reproductive aged women in the preconception, pregnancy or post-partum periods, including women who use alcohol and other drugs. The care the participant provides may relate to sexual or reproductive/gynaecological health, maternity care or drug and alcohol services. Eligible health care workers include (**but are not limited to**):

- Registered Midwives
- Registered Nurses
- Lactation Consultants
- Obstetrician & Gynaecologists (or registrars or career medical officers)
- Drug and Alcohol Physicians (or registrars or career medical officers)
- Sexual Health Physicians (or registrars or career medical officers)
- Social workers
- Counsellor
- Pharmacist
- Drug and Alcohol case workers
- General Practitioners
- Drug and Alcohol consumer health care workers
- All clinical staff from Mothersafe (NSW's Drugs in Pregnancy Service, based at the Royal Hospital for Women, SESLHD)
- Other healthcare workers will be considered for inclusion if the meet

Exclusion criteria

Participants will be excluded if they do not regularly provide clinical care for women who birth within one of the participating local health districts.

Recruitment

Participants will be recruited by a convenience sample by researchers at their employing healthcare facility, or they can self-refer via word of mouth or research advertisements (AdvertCUPS_Qual). Research advertisements will be placed in staff areas of involved health care facilities, distributed to community health care organizations via Primary Health Networks, and circulated on social media. Participants will be able to self-enrol using QR codes, or a coded REDcap internet link, provided on the research advertisements. Researchers will approach health care workers in person, or via email list provided employers, at their place of work. Snowballing referral technique will be employed to broaden participation.

Eligibility will be assessed prior to gaining consent using the form 'EligibilityCUPS_Qual . After consent to participate in the study has been gained 'EligibilityCUPS_Qual' will be retained and used as part of the demographic data for the participant. Data from 'EligibilityCUPS_Qual' will not be saved for potential participants who are not eligible to participate. Some potential participants may be eligible, but recruitment within their area has not yet commenced (e.g. governance approval within their LHD has not yet been gained, or active recruitment in those areas not underway). If these participants consent to being contacted in the future, they will be asked to provide an email address to facilitate that contact. Potential participants who provide consent to be contacted later will be notified that their responses to 'EligibilityCUPS_Qual' will be stored.

Participant Consent and Contact Details

Participant information sheets and consent forms ('PISCFCUPS_Qual') will be provided to all participants prior to enrolment. These will be provided to potential participants in hard copy, email or directly in RedCAP (using a QR code).

After consent is gained, participant's will be asked to return participant contact details ('StudyEntryFormCUPS_Qual) either via paper, email or electronically via REDCap. Written consent and study entry forms will be returned to the researcher prior to the interviews/focus groups being conducted. These forms may be returned to the researchers in hard copy, uploaded into a secure and individualized upload-only link using University of Sydney's Cloudstor subscription, or uploaded into RedCAP. Consent may also be obtained and stored using REDCap eConsent.

Data Collection

Demographic Data

Each participant will be provided a ' DemographicsCUPS_Qual' with the PISCF and will be completed prior to the interviews/focus groups. Where possible, standardized demographic questions from Australian Bureau of Statistics, have been used.(15, 16)

This form may be returned to the researchers in hard copy, uploaded into a secure and individualized upload-only link using University of Sydney's Cloudstor subscription, or electronically using REDCap.

Proposed interview guide for Qualitative Interviews

Participants will be asked of their experiences in providing health care to reproductive aged women who use alcohol and other drugs. Specifically, participants will be asked of their experiences relevant to the domains outlined in the aim of the study (identification of

alcohol and other drug use; identification of pregnancy intention; access to contraception). Questions will be asked that correspond to the areas identified in published and non-published literature. A sample of questions is provided in 'Appendix 1' at the end of this protocol.

The questioning will not follow a strict guide, rather be informed by the participant's responses. The interviewers will ensure participants stay focused on the domains of interest (as outlined in the aims on page 12) and redirect them back to these as required. This process is demonstrated in Figure 1 and is a recognized methodology for qualitative research known as grounded theory.(17) The interviewers may use prompts to stimulate discussion, if participation slows. Interviewers will use qualitative interview techniques, such as probing, clarifying, orienting to the specific and actively listening.

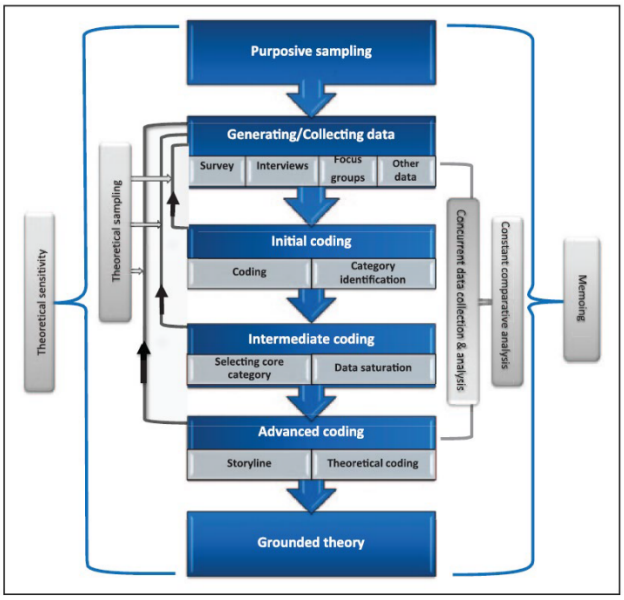

Figure 1. Research design framework: summary of the interplay between the essential grounded theory methods and processes [extracted from: (17)]

Expected duration

This part of the project is expected to take approximately 6-12 months from ethics approval.

Sample Size

There is no set sample size. Instead, grounded theory will be used to identify themes until data saturation is reached. Saturation may be reached after 12-15 participants, depending on the heterogeneity of the participants.

Analysis

For the interviews, all participants will be assigned a unique study identification number. The interviews will be audio recorded and transcribed verbatim by researchers, or a commercial third-party transcribing service. The major issues and themes raised and discussed during the interviews will be elicited and coded by the researchers.

Data analysis from the interviews will aim to assess what themes are emerging and identifying areas that may be relevant to influencing health care access with policy change. A qualitative descriptive approach will be used review the initial data that is collected. Researchers will assess the common themes that are emerging and use grounded theory to help classify these themes, allowing researchers to understand the themes in the context of the research question. NVivo software will be used for coding and analysis of the data from the interviews.

All documentation from the interviews will be confidential. Opinions and comment will be made re-identifiable (using a unique study number) and data stored and analysed manually by the research team. Third-party transcribing services will only receive the recorded interviews/focus groups and will not have access to participant contact information or demographic instruments.

Data Collection Storage and record retention.

All data will be stored in The University of Sydney's RedCAP subscription or Business OneDrive account in accordance with the University's and NHMRC guidelines on storing data securely. Any hard copy forms will be scanned into Business OneDrive and the hard copy destroyed using a shredder or organizational confidential waste management bins. Any files securely transferred to the researcher via Cloudstor will be transferred to a folder in Business OneDrive and deleted from Cloudstor. Data stored on Business OneDrive account will be backed up to the University of Sydney's Research Data Store.

Eligibility, consent, study entry and demographic forms a list of participants and unique identifying codes (which contain identifying information) will be password protected and stored separately from demographic data and audio recordings and transcriptions of the interviews/focus groups. Within REDCap: Eligibility, consent, study entry forms and demographic forms will be stored as separate instruments. Any fields containing identifiable information will be marked with the REDCap 'identifier' function.

Budget

Funding for the study, including the costs of interview transcription and data extraction/analysis, is supplied by a grant from the Royal Australian and New Zealand College of Obstetricians and Gynaecologists, which will be administered by The University of Sydney.

Research support will be provided through the University of Sydney as part of Dr McNamara's PhD candidature. Dr McNamara is supported through a scholarship awarded by the university. No other resources will be required.

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Appendix 1:

Sample question guide:

How do you ask women about their use of alcohol and other drugs?

Do you ask more than once in the pregnancy?

Do you discuss fertility planning with our patients?

What options do you discuss?

How do you introduce the idea of contraception use in a consultation?

Do you favour any forms of contraception in discussion?

What information do you provide about contraception?

Chapter 8: Appendix B: Statements of Contribution and Related Publications

8.1: Chapter 1: Statement of author contribution

Within Chapter 1, section 1.1 was published as a manuscript in BMJ Sexual and Reproductive Health as follows:

McNamara KA, Murnion B, Fotheringham P, Terplan M, Lintzeris N, Oei JL, Bond D, Nassar N, Black K. Interconnections between unintended pregnancy, alcohol and other drug use, and pregnancy, birth, infant, childhood and socioeconomic outcomes: a scoping review. BMJ Sex & Reproduct Health. 2024 Pages bmjsrh-2023-202140. DOI: 10.1136/bmjsrh-2023-202140

The co-authors made the following contributions to this manuscript:

Dr McNamara conceptualised and designed the study, contributed to and co-ordinated data collection, analysed the data and wrote all drafts of the manuscripts.

A/Prof Murnion contributed to data collection and reviewed and assisted with revision of the manuscript.

Dr Fotheringham contributed to data collection and reviewed and assisted with revision of the manuscript.

Dr Terplan assisted with interpretation of the results and reviewed and assisted with revision of the manuscript.

Prof Lintzeris contributed to conceptualisation and study design and reviewed and assisted with revision of the manuscript.

Prof Oei contributed to conceptualisation and reviewed and assisted with revision of the manuscript.

Dr Bond contributed to data collection and reviewed and assisted with revision of the manuscript.

Prof Nassar contributed to conceptualisation and study design and reviewed and assisted with revision of the manuscript.

Prof Black contributed to conceptualisation and study design, contributed to data collection, supervised data analysis and interpretation, and reviewed and assisted with revision of the manuscript.

8.2: Chapter 1: Published Manuscript

Figure 8-1: Manuscript: McNamara KA, Murnion B, Fotheringham P, Terplan M, Lintzeris N, Oei JL, Bond D, Nassar N, Black K. Interconnections between unintended pregnancy, alcohol and other drug use, and pregnancy, birth, infant, childhood and socioeconomic outcomes: a scoping review. BMJ Sex Reprod Health 2024 Pages bmjsrh-2023-202140. DOI: 10.1136/bmjsrh-2023-202140

Systematic review

Interconnections between unintended pregnancy, alcohol and other drug use, and pregnancy, birth, infant, childhood and socioeconomic outcomes: a scoping review

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ABSTRACT

Background Unintended pregnancy (UIP) and substance use disorder share underlying root causes with similar impacts for women and their offspring in pregnancy, birth and beyond. Furthermore, intoxication with alcohol and other drugs (AOD) increases the risk of UIP.

Objectives To assess the available evidence on associations between UIP and health, social and economic outcomes, in women who use AOD.

Search strategy The review utilised the Joanna Briggs Institute Methodology for Scoping Reviews and PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) reporting guidelines. The search was conducted across multiple databases, including Scopus and Medline, and limited to studies published between January 2000 to June 2023.

Selection criteria Studies reporting on interactions between AOD use and UIP, and pregnancy, birth, infant, childhood, social or economic outcomes. All patterns and types of AOD use, except isolated use of tobacco, were included. Studies were available in English and conducted in high-income countries.

Data collection and analysis Selected articles were reviewed, and data collected by two independent reviewers using a standardised data extraction sheet. Findings were summarised and reported descriptively.

Main results A total of 2536 titles and abstracts were screened, 97 full texts were reviewed, and three studies were selected for inclusion in the scoping review. There was heterogeneity in types and patterns of AOD use, differences in study design and tools to assess pregnancy intention, and each focused on disparate outcomes. No study assessed or reported on birth outcomes.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Women with substance use disorder experience high rates of unintended pregnancy (UIP).
⇒ Substance use disorder and UIP are both associated with similar adverse health and social outcomes following pregnancy.
⇒ It is unclear if UIP exacerbates outcomes for women who use alcohol and other drugs, or if adverse outcomes simply represent shared social determinants of health, such as poverty.

WHAT THIS STUDY ADDS

⇒ There is a substantial gap in the literature examining the intersection between UIP and alcohol and other drug use, particularly regarding the effect on short- and long-term outcomes following the pregnancy. No research is available that examines birth outcomes.
⇒ Social determinants of health may be more influential on outcomes from pregnancy than UIP and alcohol and other drug use.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Maternity and reproductive health services are likely to benefit from a better understanding of the underlying causes of pregnancy and birth outcomes in women who use alcohol and other drugs. This is an important public health issue, for which further research should be a priority for perinatal researchers.

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Conclusion There is a paucity of data examining the intersection between AOD use and UIP and further research is needed.

INTRODUCTION

Unintended pregnancy (UIP) and alcohol and other drug (AOD) use are interconnected issues that potentially impact the lives of pregnant women and their offspring. AOD intoxication is associated with risky sexual behaviour that may lead to UIP.[1–3] AOD use is associated with higher rates of UIP compared with the general population.[4 5] Worldwide, 44% of all pregnancies are unintended.[6] In women with opioid use disorder, 78–86% of pregnancies are unintended,[7 8] in women who use cannabis 64.7% are unintended,[9] and in women with binge or heavy alcohol use 67–74% of pregnancies are unintended.[10 11] Typically, AOD use reduces following recognition of pregnancy[12]; however, UIP is associated with delayed recognition of pregnancy.[13] Therefore, UIP may result in fetal exposure to AOD during the first trimester.[14 15]

Disentangling the impact of AOD on adverse pregnancy, birth, infant and childhood outcomes from socioeconomic deprivation and social determinants of disease is complex.[16] Nevertheless, there are outcomes that are substance-use specific, such as the association between alcohol and fetal alcohol spectrum disorders.[10] Preterm birth and low birth weight are associated with opioid use disorder, although access to integrated obstetric and AOD care, and maintenance on an opioid treatment programme (with methadone or buprenorphine) substantially reduces the risk.[17–19] Amphetamine use is associated with pre-eclampsia and low birth weight.[20 21]

UIP is associated with similar types of adverse pregnancy, birth, infant and childhood outcomes to AOD use. These include preterm birth, low birth weight and small-for-gestational-age neonates, although the strongest reported associations have been with unadjusted data and unwanted pregnancy.[22 23] A range of psychosocial issues are linked to UIP including a higher risk of interpersonal physical, sexual and emotional abuse, as well as psychological morbidity.[24–26]

AOD use encompasses low-level use as well as use within the context of a substance use disorder (SUD).[27 28] To identify and understand all available evidence, this review takes a broad approach examining all AOD use in pregnancy. The objective of this scoping review is to investigate the relationship between UIP and AOD use, and how they interact to affect pregnancy, birth, infant, childhood, social and economic outcomes in high-income countries. The purpose of this scoping review is to identify research gaps, and to inform policy development and practice in maternity and reproductive health settings.

METHODS

Protocol, search strategy and eligibility criteria

Development of this scoping review used the Joanna Briggs Institute (JBI) Methodology for Scoping Reviews.[29] An *a priori* protocol was registered on Open Science Framework.[30] The reporting of the review adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) extension for scoping reviews.[31]

The main search included Medline (via Ovid), Embase, Scopus, CINAHL, Google Scholar, Cochrane Database of Systematic Reviews and TRIP electronic databases. The key search terms were: unplanned pregnancy; unwanted pregnancy; substance-related disorders; addiction medicine; alcohol drinking; illicit drugs; designer drugs; drug misuse. The search strategy for all included databases has been included in online supplemental appendix 1. An internet search was also included to identify any relevant international guidelines, including from the WHO, US Centre for Disease Control and Prevention (CDC), the European Centre for Disease Prevention, and national guidelines from Europe, Australia and North America.

Studies were eligible for inclusion if they were:

- Published from January 2000 to June 2023
- Conducted in high-income countries (as defined by World Bank online supplemental appendix 2)[32]
- Written in, or translated into, English. (The initial protocol excluded studies not written in the English language; however, the search strategy did not apply this limit and Google Translate was used to review journal articles written in languages other than English.[33])
- Primary research studies, including quantitative and descriptive epidemiological studies, prospective and retrospective cohort studies, case–control studies and analytical cross-sectional studies, or health economic analyses
- Conducted in pregnant women who use alcohol, illicit or illegal drugs and non-medical use of prescription drugs, including, but not limited to, pregnant women who are engaged in alcohol and other drug treatment, including any pattern of AOD use
- Reported on interactions between AOD use and UIP.

Studies were excluded if:

- There was no comparison to intended pregnancy
- They were case series, reviews, audits or qualitative research
- Tobacco was the only drug used.

Search

The search was conducted in February 2021, in accordance with the developed search strategy. Due to the interval between the search and publication, an updated search was conducted in Medline (via Ovid) in June 2023.

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Screen

All identified studies were uploaded into Endnote.[34] A pilot title and abstract screen was conducted of 25 citations by two authors (KM and KB) to define the process for screening. All identified citations were uploaded into Covidence Systematic Review Software and duplicates were removed.[35] The titles and abstracts were screened according to the eligibility criteria by two reviewers (KM, KB, BM and/or PF). For the updated search in June 2023, title and abstract screening was performed by one author (KM). Selected full texts were assessed for eligibility by two reviewers (KM, KB, PF or DB). Conflicts at both the title and abstract stage and full-text review were resolved by discussion between the screening reviewers, or a third reviewer.

Following the selection of studies for inclusion, reference lists of included sources were screened; authors from two included sources were contacted, and an international expert in AOD use and UIP was contacted to identify additional evidence sources. Additional sources were then screened by two reviewers (KM, KB, PF or DB).

Data extraction

The data extraction template was adapted from the JBI Template Source of Evidence Detail, Characteristics and Results extraction instrument and modified for input into Covidence Systematic Review Software.[29 35] The template included information on the type of evidence sources; countries of research; time period, participant characteristics; classification of outcomes (maternal/fetal/neonatal/childhood, health/social/economic); the measure of frequency of UIP in the source population; and the measure of effect on UIP on the outcomes of interest. The data domains for extraction were defined in the protocol *a priori;* however, two additional domains were added prior to the extraction (type of publication; frequency of outcome(s) in the study population). Online supplemental appendix 3 shows the data extraction template. A quality assessment tool was developed using the JBI Critical Appraisal Checklist for Cohort Studies and imported into Covidence Systematic Review Software.[35 36] Data extraction and quality assessment for included sources was performed by two reviewers (KM, KB) with conflicts resolved by discussion. A pilot data extraction was unnecessary as only three articles were identified for inclusion in the study.

Data collation and summary

Extracted data were summarised into tables, and given the limited number of studies identified and the heterogeneity of the findings, results were summarised and reported descriptively. A systematic synthesis of results was not possible due to the heterogeneity of measured outcomes. The PRISMA reporting checklist for scoping reviews is provided in online supplemental appendix 4.[31]

RESULTS

The search identified 4045 citations. Following the removal of duplicates, the titles and abstracts of 2536 evidence sources were screened, 97 full texts were identified for full-text review and three studies selected for inclusion in the scoping review. Figure 1 shows the PRISMA 2020 flow diagram for study selection.[37] The three included studies varied in terms of methodology, population characteristics, measured outcomes, and results (table 1). The first study was a secondary analysis of prospectively collected cohort data from a randomised controlled trial of opioid treatment therapies in pregnancy[38 39]; the second a retrospective cohort study using antenatal and paediatric datasets of women with known AOD use in pregnancy[40]; and the third a subanalysis of Pregnancy Risk Assessment Monitoring System (PRAMS) survey data limited to women with alcohol use in pregnancy.[41] The studies were conducted in the late 1990s and early 2000s with the first two involving data collection during pregnancy and the third requiring retrospective recall.[38 40 41] Studies were conducted across North America and Europe and included 175 to 95 728 participants.

The first study was small, but otherwise of high quality.[38] The second study had no discussion of the reliability of pregnancy intention measurement (obtained from retrospective datasets) and did not present demographic factors according to the exposure groups (intended/unintended pregnancy) or adjust for confounders.[40] The third study was a population-based study that required retrospective recall of alcohol use during pregnancy, which is likely to underestimate alcohol use.[41–43]

Assessment of pregnancy intention during pregnancy varied across the three studies. The first used a non-validated screening questionnaire and then reclassified responses as an intended or unintended pregnancy[38]; the second used dichotomous responses (intended or unintended pregnancy) as recorded in a maternity dataset[40]; and the third study retrospectively assessed pregnancy intention in the postpartum period using a four-point question, then reclassified responses as intended, mistimed (unintended but would have liked the pregnancy to occur later than it did) or unwanted (unintended and did not want the pregnancy to occur at all). The differences between unwanted and intended/mistimed pregnancies were reported.[41]

Table 2 presents the population characteristics of the included studies, with the first study limited to women with opioid use disorder,[38] the second to women with known SUD and a mix of types of AOD,[40] and the third included women who used alcohol in the 3 months prior to pregnancy.[41] Unemployment rates of up of 81–96% were reported in the first study[38] and 72.9% in the second.[40]

There were limited and selected outcomes reported by pregnancy intention, which differed for each study

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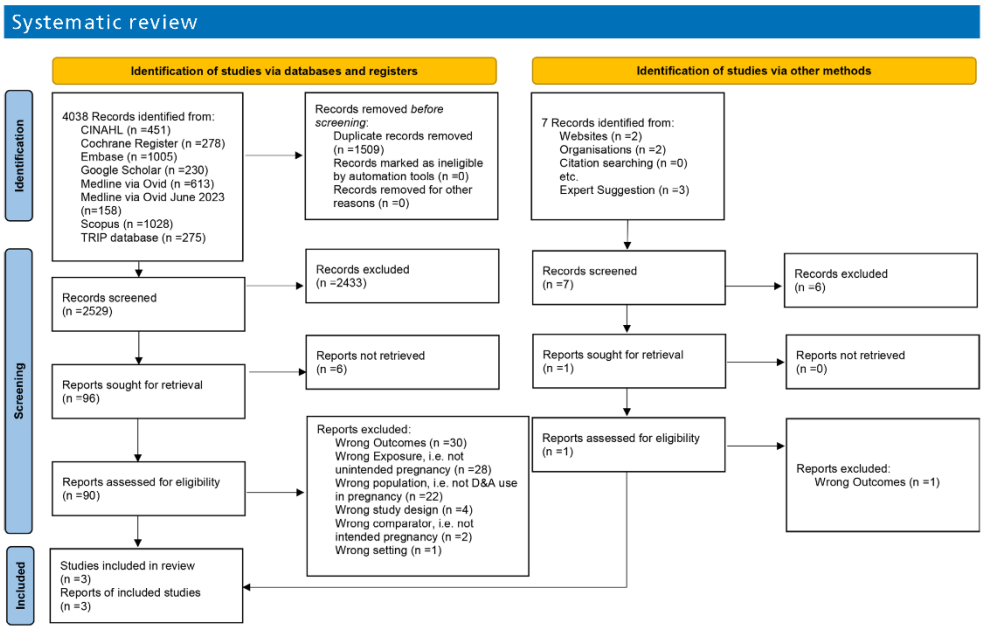

Figure 1 PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 flow diagram for studies investigating pregnancy intention among women using drugs and alcohol and their health, social and economic outcomes.

(table 3). The first study examined retention in AOD treatment during pregnancy[38]; the second focused on placement of the child into out-of-home care[40]; and the third study focused on continued and binge drinking during the last 3 months of pregnancy.[41] No included studies examined pregnancy and birth outcomes, childhood health outcomes, or postpartum or long-term maternal health, and no economic evaluations were included.

For women who were engaged in an opioid treatment programme, women with an UIP had an average 5-week shorter duration in antenatal AOD treatment compared with those with an intended pregnancy (16.3 vs 21.3 weeks, p=0.01). However, analysis showed that after adjusting for confounders there was no association between pregnancy intention and likelihood of remaining in an opioid treatment programme until the birth of a live baby (72% for UIP, 82% for intended pregnancy, p=0.28).[38]

For women who received antenatal care in specialised AOD services, those with an UIP had an almost two-fold higher rate of a child being placed into out-of-home care by the age of 2 years (42.5%) compared with an intended pregnancy (24.1%) (crude odds ratio (OR) 1.76, 95% CI 1.25 to 2.48, p=0.01).[40]

For women who drank alcohol in the 3 months prior to pregnancy, compared with women with an intended or mistimed pregnancy, women with an unwanted pregnancy showed no difference in the likelihood of continued drinking into the final 3 months of pregnancy (adjusted OR (aOR) 1.15, 95% CI 0.99 to 1.33). However, they did show an increase in binge drinking, defined as any episode of drinking five or more standard alcohol drinks at a time, in the final 3 months of pregnancy (aOR 1.40, 95% CI 1.07 to 1.83).[41]

Critical analysis

Main findings

AOD and UIP are both important public health issues and this scoping review shows there are very limited data available examining the intersection between the two issues. There were only three studies identified and these included women using different types and patterns of AOD use, used different tools to assess pregnancy intention, and focused on disparate outcomes. Importantly, no study assessed or reported on birth outcomes. Although there were unadjusted associations between UIP and remaining in AOD treatment during pregnancy,[38] UIP and children entering out-of-home care,[40] and adjusted associations between UIP and persistent binge drinking into the third trimester of pregnancy, data overall were limited.[41] Where studies adjusted for confounders, the size of effect either substantially reduced or disappeared altogether, indicating that social determinants of health may be more influential than UIP and AOD use on outcomes.

Strength and limitations

This main strength of this scoping review is that it identified a research gap that had not been previously identified. The methodology involved a comprehensive, systematic search of scientific literature across

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Table 1 Methodology of included studies

	Study		
	1*	2	3
General information	**Martin *et al*[38]**	**Sarkola *et al*[40]**	**Terplan *et al*[41]**
Type of publication	Peer-reviewed publication	Peer-reviewed publication	Peer-reviewed publication
Research question(s)	To compare treatment continuation and duration (in opioid treatment programmes) before delivery of a live infant in women with UIP vs IP	To identify risk factors for children being placed into out-of-home care	To examine the relationship between pregnancy intention and continued drinking, or binge drinking, in last 3 months of pregnancy
Population	Pregnant women in opioid treatment programme	Pregnant women in specialised AOD antenatal care services (mix of types of AOD)	Postpartum women who drank alcohol in the 3 months prior to pregnancy
Methodology			
Study design	Prospective cohort study	Retrospective cohort study	Retrospective cohort study
Study setting	Recruited in antenatal period from AOD treatment clinics	Antenatal datasets and paediatric datasets	Recruited in postpartum period from PRAMS telephone survey
Geographical region	North America (USA and Canada) and Europe (Austria)	Europe (Finland)	North America (33 USA states)
Time period of recruitment	4 May 2005 to 31 October 2008	1992 to 2001	2004 to 2008
Timing of recording of pregnancy intention	During pregnancy	During pregnancy	Retrospective (after pregnancy)
Reporting of AOD use/SUD	Addiction severity index as a measure of impairment. Overall AOD intake not reported	AOD use recorded in maternal records pre-conception, during pregnancy and postpartum. Alcohol use recorded as daily, weekly, less than daily. Opioid use recorded as 'regular' (daily or weekly) Urine toxicology results recorded	Self-reported using retrospective recall during the 3 months prior to pregnancy and final 3 months of pregnancy for: ► Average number of standard alcohol drinks per week drinking ► Any binge drinking episodes (five or more standard drinks at a time)
Tools used to assess UIP	Non-validated screening questionnaire Categorised: intended/unintended Unintended subgroups: mistimed, ambivalent or unwanted	Dichotomous: intended/unintended	Four-point questions. Reclassified into intended/mistimed or unwanted
Total number of participants	175	626	95 728

*Demographic data obtained from primary study (this study is a secondary analysis).[39]
AOD, alcohol or other drugs; IP, intended pregnancy; PRAMS, Pregnancy Risk Assessment Monitoring System; SUD, substance use disorder; UIP, unintended pregnancy.

multiple databases and facilitated a broad search of all possible short-term and long-term outcomes, including pregnancy, birth, infant and childhood health outcomes, as well as social and economic outcomes. The broad criteria of all AOD use and UIP, and the search across databases of multiple disciplines, means there is unlikely to be a substantive body of literature on this topic that has not been identified. The search was restricted to the 21st century to ensure only contemporaneous concepts relating to AOD use and pregnancy intention were included.

The limitations of this scoping review are the overall paucity of studies, heterogeneity in sample size, methodology, assessment of pregnancy intention, and variation in AOD use definitions and patterns, making it difficult to draw general conclusions. Another limitation is that no study assessed the role of underlying factors, such as poverty, education or access to healthcare, in the development of SUD and UIP. Additionally, the first study was likely underpowered to detect an association between UIP and remaining in AOD treatment during pregnancy.[38] The second study did not adjust for social determinants of health and therefore was not able to demonstrate a causative pathway between UIP and children entering into out-of-home care.[40] The third study assessed alcohol consumption during pregnancy using retrospective recall in the postpartum period, which may have biased the results.[41] Finally, the purpose of this study was to examine outcomes from pregnancy, which are typically assessed using quantitative data. While the exclusion of qualitative studies represents a limitation and review of the qualitative literature would be interesting, it was beyond the scope of our review.

Interpretation

This scoping review was not able to clarify the relationship between UIP and AOD use. There was a lack of consistency of the populations examined, with some studies examining all women who use AOD, and

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Table 2 Population characteristics of included studies

	Study		
	1*	2	3
Population characteristic	Martin *et al*[38]	Sarkola *et al*[40]	Terplan *et al*[41]
Age (years)	18–41	Mean: 27 (SD±6) 12% teenage.	≤19: 6.2% 20–39: 91.1% ≥40: 2.7%
Education level	Mean number of years in education: ~11	Completed secondary education or vocational training: 25.2%	Less than high school: 10.6% High school only: 26.1% Greater than high school: 63.2%
Employment	Employed: 4–19%	Unemployed at time of birth: 72.7%	NR
Out-of-home care: mothers as children	NR	9.4%	NR
Out-of-home care: previous child	NR	7.3%	NR
Other socioeconomic characteristics	Criminally unencumbered: 71–88%	Homeless or living in institution: 21.6%	Annual income (USD) <10 000: 14.1% 10 000–14 999: 7.5% 15 000–24 000: 12.0% 25 000–50 000: 20.1% ≥$50 000: 46.3%
Ethnicities	White 83% Black 14% Other 2%	NR	White 74.9%, Black 11.9%, Hispanic 7.9%, Other 5.3%
Gravidity	NR	NR	NR
Parity	NR	NR	NR
Gestational age at recruitment	16–20 weeks	NR	Postpartum
Tobacco smoking	~95%	78.4%	NR
Principal drug(s) of choice	Opioids: 100% Multidrug use common - including heroin, cocaine, alcohol, benzodiazepines.	▶ Alcohol: 25% before pregnancy, 11% during pregnancy, ▶ Opioids: 12% before pregnancy, 6% during pregnancy, ▶ 15%: anxiolytics/hypnotics	Alcohol
Pattern of drug use	NR	NR	Mixed - reports on binge and non-binge drinking
Severity of drug use	Mean addiction severity index 0.29–0.34	14% have a history of regular contact with AOD healthcare	All alcohol use reported, subset of heavy use

*Demographic data obtained from primary study (this study is a secondary analysis).[39]
NR, not reported; SD, standard deviation; USD, US dollars.

others focusing specifically on women with SUD. The effects of social determinants of health are likely very different between those with low-level AOD use and SUD, and the impact of differences were not assessed in this study. The factors that contribute to UIP in women with SUD include a perception of low risk of pregnancy, sexual coercion, poor reproductive health knowledge, cost and access to services, and mental illness.[44] People who use illicit drugs are more likely to live in poverty,[45] and women living in poverty are more than twice as likely to experience an UIP.[46] Previously, a comprehensive model found almost all the effect of illicit drug use on low birth weight can be attributed to psychological, physical and behavioural factors. These factors include unwanted pregnancy, finances, nutritional status, and exposure to violence.[16] SUD and UIP are likely intrinsically linked by shared causative pathways, involving social determinants of health such as poverty, and access to healthcare and education, which have not been examined in any study.

This scoping review identified no studies that reported on associations between UIP and long-term health problems in the offspring of women who use AOD during pregnancy. However, there were two other studies, excluded from the scoping review after full-text review, that examined the effects of alcohol following an UIP. The Avon Longitudinal Study of Parents and Children (ALSPAC) cohort study reported that children born following an UIP pregnancy were more likely to have fetal alcohol spectrum disorder (FASD) compared with children born following an intended pregnancy. However, it was excluded as the analysis was not limited to children of women who consumed alcohol during pregnancy.[47] The Growing Up in New Zealand cohort study reported changes in infant and childhood behavioural scores for those

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Table 3 Results of included studies

	Study		
	1*	2	3
Results	**Martin *et al*[38]**	**Sarkola *et al*[40]**	**Terplan *et al*[41]**
Outcome types	Health: maternal	Social	Health: maternal
Outcomes[1]	Mean duration in prenatal AOD treatment duration (crude): UIP: 16.3 weeks vs IP: 21.3 weeks (p=0.01)*	Cumulative placement into out-of-home care at less than 2 years of age UIP: 42.5% vs IP: 24.1% (no p-value provided)† Crude OR 1.76 (1.25–2.48, p=0.01)	Continued drinking during pregnancy (during the last 3 months of pregnancy) aOR‡ 1.15 (0.99–1.33)
Outcomes[2]	Treatment continuation before delivery of a live infant UIP: 72% vs IP: 82% (p=0.28) Cox proportional hazard ratio (adjusted) 0.73, p=0.21	Cumulative placement into out-of-home care for more than half their life UIP: 23% vs IP: 11.2% (no p-value provided)‡ Crude OR 2.06 (1.19–3.45, p=0.021)	Binge drinking during pregnancy (during the last 3 months of pregnancy) aOR‡ 1.40 (1.07–1.83)
Summary			
Association between outcome and UIP	In pregnant women in opioid treatment programmes, UIPs are associated with: ▶ A 5-week reduction in the duration spent in opioid treatment programmes† ▶ No difference in the likelihood of staying in opioid treatment programmes until birth	In pregnant women with AOD use, UIPs are associated with: ▶ 1.76 the odds of the child being placed into out-of-home care by the age of 2 years† ▶ Twice the odds of the child being placed into out-of-home care for more than half their life†	In women who drank alcohol in the 3 months prior to pregnancy, unwanted pregnancy, compared with intended and mistimed pregnancies, is associated with: ▶ 1.4 the odds of binge drinking, in the final 3 months of pregnancy ▶ No difference in continued drinking in the final 3 months of pregnancy

*Demographic data obtained from primary study (this study is a secondary analysis).[39]
†Adjustment for confounders not provided.
‡Unwanted vs intended/mistimed pregnancies
AOD, alcohol or drugs; aOR, adjusted odds ratio; IP, intended pregnancy; OR, odds ratio; UIP, unintended pregnancy.

whose mothers drank alcohol in pregnancy and had a UIP. Although this study did stratify the effects according to the quantity and pattern of alcohol use, the comparison group was to mothers who did not drink alcohol, not mothers with an intended pregnancy, and therefore it was not suitable for inclusion in the scoping review.[48] These and other cohort studies indicate that existing datasets may contain information that could be analysed to assess interconnections between AOD use and UIP on pregnancy, birth, infant and childhood outcomes.

Additional Educational Resources

Schempf AH, Strobino DM. Illicit drug use and adverse birth outcomes: is it drugs or context? J Urban Health 2008;85(6):858–73.
Nelson HD, Darney BG, Ahrens K, *et al*. Associations of unintended pregnancy with maternal and infant health outcomes. JAMA 2022;328(17):1714.
Chang G. Maternal substance use: consequences, identification, and interventions. Alcohol Res 2020;40(2):06.
Louw K-A. Substance use in pregnancy: the medical challenge. Obstet Med 2018;11(2):54–66.
Shafique S, Umer A, Innes E, *et al*. Preconception substance use and risk of unintended pregnancy: Pregnancy Risk Assessment Monitoring System 2016-17. J Addict Med 2022;6(3):278–85.

CONCLUSIONS

Future research could involve analysis of existing datasets, including from prospectively collected cohort studies such as ALSPAC or Growing up in New Zealand.[47 48] Other sources of existing data are maternity datasets, which often record pregnancy intention, AOD use, sociodemographic factors, and labour and birth outcomes. Data linkage using paediatric datasets would also enable more comprehensive and longitudinal follow-up of both maternal and infant outcomes. Importantly, future research should examine and compare differences between women with low-level AOD use and SUD. Future research should also consider how the complexity of women's lives, in relation to social determinants of health, impact outcomes. Review of qualitative studies could provide a more contextual and subjective response around the intersection between pregnancy intention and AOD use. Future research could also incorporate a validated tool of UIP, such as the London Measure of Unplanned Pregnancy that is more stable over time. This can be used during pregnancy or the postnatal period, and can capture differences between an unintended, but wanted pregnancy and an unwanted pregnancy.[49]

To our knowledge this is the only review to report on the associations between UIP and health, social or economic outcomes in women who use AOD. It highlights a substantial gap in the literature. Less is known about the causal pathways, including potential confounders such as poverty, education and

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access to healthcare including contraception. There is also little known about the long-term impacts on women and their children. Maternity and reproductive health services are likely to benefit from a better understanding of the underlying causes of pregnancy and birth outcomes in women who use AOD. This is an important public health issue, for which further research should be a priority for perinatal researchers.

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Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

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8.3: Chapter 2: Statement of author contribution

Chapter 2 has been submitted to Acta Obstetrica and Gynecologica Scandinavica and is currently under peer review:

McNamara KA, Black K, Murnion B, Shand A, Henry A, Ludlow J, Hankins K, Chinoy R, Nassar N. Unintended Pregnancy, and Pregnancy and Birth Outcomes, in Women with Substance Use Disorder: A Retrospective Cohort Study. Acta Obstet Gynecol Scand. Under Review.

Dr McNamara conceptualised and designed the study, obtained the funding, co-ordinated data acquisition, cleaned and analysed the data, and wrote all drafts of the manuscript.

Prof Black contributed to the study design, supervised the funding application, contributed the co-ordination of data acquisition, interpretation of results, and reviewed and assisted with revision of the manuscript.

A/Prof Murnion contributed to the interpretation of results and reviewed and assisted with revision of the manuscript.

Dr Shand contributed to conceptualisation and study design, interpretation of results, and reviewed and assisted with revision of the manuscript.

Prof Henry contributed to conceptualisation and study design, interpretation of results, and reviewed and assisted with revision of the manuscript.

Dr Ludlow contributed to study design, interpretation of results, and reviewed and assisted with revision of the manuscript.

Dr Hankins contributed interpretation of results and reviewed and assisted with revision of the manuscript.

Dr Chinoy contributed interpretation of results and reviewed and assisted with revision of the manuscript.

Prof Nassar contributed to conceptualisation and study design, contributed the co-ordination of data acquisition, supervised the data cleaning and analysis, contributed to the interpretation of results, and supervised the preparation of the manuscript.

8.4: Chapter 3: Statement of author contribution

Chapter 3 includes a manuscript that has been accepted for publication by Australian and New Zealand Journal of Obstetrics and Gynaecology and is currently in press as:

McNamara KA, Black KI, Bond O, Murnion B, Gordon A, Ludlow J, Nassar N. Planning Postpartum Contraception for Women with Substance Use Disorders: Utilisation of the Birth Admission. Aust N Z J Obstet Gynaecol. DOI:10.1111/ajo.13887

Dr McNamara conceptualised and designed the study, obtained the funding, co-ordinated data acquisition, cleaned and analysed the data, and wrote all drafts of the manuscript.

Prof Black contributed to the study design, supervised the funding application, contributed the co-ordination of data acquisition, interpretation of results, and reviewed and assisted with revision of the manuscript.

Mr Bond contributed substantially to the data cleaning and reviewed and assisted with revision of the manuscript.

A/Prof Murnion contributed to the interpretation of results and reviewed and assisted with revision of the manuscript.

Prof Gordon contributed to the interpretation of results and reviewed and assisted with revision of the manuscript.

Dr Ludlow contributed to interpretation of results and reviewed and assisted with revision of the manuscript.

Prof Nassar contributed to conceptualisation and study design, contributed the co-ordination of data acquisition, supervised the data cleaning and analysis, contributed to the interpretation of results, and supervised the preparation of the manuscript.

8.5: Chapter 4: Statement of author contribution

Chapter 4 includes a manuscript that has been accepted for publication by Drug and Alcohol Review and is currently in press as:

McNamara KA, Murnion B, Lintzeris N, Chase V, Black E, Malcolm A, Harvey Dodds L, Nassar N, Black KI. Integration of a facilitated access pathway for contraception into alcohol and other drug treatment services: a cohort study comparing metropolitan and regional settings. Drug Alcohol Rev.

Dr McNamara conceptualised and designed the study, contributed to the execution of the study, contributed to and co-ordinated the data collection, cleaned and analysed the data, and wrote all drafts of the manuscript.

A/Prof Murnion contributed to obtaining the funding, contributed to the execution of the study and interpretation of results, and reviewed and assisted with revision of the manuscript.

Prof Lintzeris contributed to the conceptualisation and design of the study, contributed to obtaining the funding, contributed to the interpretation of results, and reviewed and assisted with revision of the manuscript.

Dr Chase contributed to obtaining the funding, contributed to the execution of the study, and reviewed and assisted with revision of the manuscript.

Ms Black contributed to the execution of the study, contributed to the data collection, contributed to interpretation of results, and reviewed and assisted with revision of the manuscript.

Ms Malcolm contributed to the conceptualisation and design of the study, contributed to the execution of the study, and reviewed and assisted with revision of the manuscript.

Dr Harvey Dodds contributed to the conceptualisation of the study, contributed to the execution of the study, and reviewed and assisted with revision of the manuscript.

Prof Nassar contributed to the data analysis and interpretation of results and supervised the preparation of the manuscript.

Prof Black contributed to the conceptualisation and design of the study, supervised the data analysis and interpretation of results, and reviewed and assisted with revision of the manuscript.

Chapter 9: Appendix C: Presentations, achievements, and other publications during candidature

9.1: Conference Presentations

International Presentations

Perinatal Society of Australia and New Zealand Congress 2024, Christchurch, New Zealand
Utilisation of the Birth Admission to Plan Post-partum Contraception Use for Women with Substance Use Disorders
Oral and Poster Presentation
Kelly McNamara, Kirsten Black, Oliver Bond, Bridin Murnion, Adrienne Gordon, Joanne Ludlow, Natasha Nassar

Perinatal Society of Australia and New Zealand Congress 2024, Christchurch, New Zealand
Rapid Access Pathway for Contraception in Metropolitan and Regional Drug and Alcohol Services
Poster Presentation
Kelly McNamara, Vicki Chase, Victoria Hayes, Kate Masters, Rachel Deacon, Grace Carniato, Annie Malcolm, Lucy Harvey Dodds, Bridin Murnion, Nicholas Lintzeris, Natasha Nassar, Kirsten Black

Australasian Professional Society on Alcohol and Other Drugs Annual Scientific Conference 2018, Auckland, New Zealand
Addressing Unmet Contraception Needs in Women Who Access Drug and Alcohol Services: A Pilot Study Integrating a Reversible Contraception Clinic into a Drug and Alcohol Service
Poster Presentation
Kelly McNamara, Rachel Deacon, Annie Malcolm, Nicholas Lintzeris, Kirsten Black.
(presented by R Deacon on behalf of K McNamara)

National Presentations

Substance Use in Pregnancy and Parenting Conference 2024, Royal Hospital for Women, Randwick, Australia
Bringing Family Planning and AOD Services Together on the Central Coast
Oral Presentation
Kelly McNamara, **Kate Masters** (co-presenters), and Vicki Chase

Australasian Professional Society on Alcohol and Other Drugs Annual Scientific Conference 2023, Adelaide, Australia
Rapid Access Pathway for Contraception in Metropolitan and Regional Drug and Alcohol Services
Oral Presentation
Kelly McNamara, Vicki Chase, Victoria Hayes, Emma Black, Kate Masters, Rachel Deacon, Grace Carniato, Annie Malcolm, Bridin Murnion, Nicholas Lintzeris, Kirsten Black.

Substance Use in Pregnancy and Parenting Service Expert Roundtable Meeting, NSW Ministry of Health, 2022, Sydney, Australia
Contraception Pathways for Women who Attend D&A Services
Oral Presentation (online)
Kelly McNamara

Menzies Centre for Health Policy and Economics Perinatal and Paediatric Epidemiology Research Group 2022, Sydney, Australia
A Tale of Two LHDs – Contraception Pathways for Women who Attend D&A Services

Oral Presentation
Kelly McNamara

Central Coast Local Health District Research Office Meeting 2022, Gosford, Australia
Bringing Family Planning and AOD Services Together on the Central Coast
Oral Presentation
Kelly McNamara, Kate Masters, Grace Carniato, and Vicki Chase

Sydney Maternal, Adolescent, Child, and Reproductive Health (MARCH) Research Group, Sydney Australia 2020
Contraception for Women who Use Alcohol and Other Drugs: Lessons learnt in the city and the regions
Oral Presentation (online)
Kelly McNamara

Kirkton Road Centre Education Session 2021, Sydney, Australia
Unplanned Pregnancy and Contraception Women Who Use Alcohol and Other Drugs
Oral Presentation
Kelly McNamara

Royal Hospital for Women Grand Rounds 2021, Randwick, Australia
Drug and Alcohol Use in Pregnancy: A role for prevention?
Oral Presentation (online)
Kelly McNamara

University of Sydney School of Rural Health Research Meeting 2021, Orange, Australia
Unplanned Pregnancy and Contraception in Women Who Use Alcohol and Other Drugs
Oral Presentation
Kelly McNamara

Sydney Maternal, Adolescent, Child, and Reproductive Health (MARCH) Research Group, Sydney Australia 2020
Navigating the year that was 2020
Oral Presentation
Kelly McNamara

NHMRC Centre of Research Excellence in Sexual and Reproductive Health for Women (SPHERE) annual meeting 2020, Victoria, Australia
Preventing Substance Use in Pregnancy: The Contraception Project
Oral Presentation (online)
Kelly McNamara

Perinatal Society of Australia and New Zealand Congress 2019, Gold Coast, Australia
Addressing Unmet Contraception Needs in Women Who Access Drug and Alcohol Services
Poster Presentation
Kelly McNamara, Rachel Deacon, Annie Malcolm, Nicholas Lintzeris, Kirsten Black

The University of Sydney Lifespan Research Day 2019, Sydney, Australia
Addressing Unmet Contraception Needs in Women Who Access Drug and Alcohol Services
Poster Presentation
Kelly McNamara

Society of Obstetric Medicine in Australia and New Zealand 2018, Cairns, Australia
Addressing Unmet Contraception Needs in Women Who Access Drug and Alcohol Services: A Pilot Study Integrating a Reversible Contraception Clinic into a Drug and Alcohol Service
Oral Presentation
Kelly McNamara, Rachel Deacon, Annie Malcolm, Nicholas Lintzeris, Kirsten Black

9.2: Achievements

RANZCOG NSW Regional Committee Trainee Research Grant 2019

University of Sydney: Albert S McKern Research Scholarship 2019

9.3: Co-authored publications during candidature

Figure 9-1: Manuscript: Perez FA, Blythe S, Wouldes T, McNamara K, Black KI and Oei JL. Prenatal methamphetamine—impact on the mother and child—a review. Addiction:117(1):25-260

ADDICTION

SSA SOCIETY FOR THE STUDY OF ADDICTION

CLINICAL ISSUES: SUBSTANCE USE DISORDERS AND THE BODY

doi:10.1111/add.15509

Prenatal methamphetamine—impact on the mother and child—a review

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ABSTRACT

Methamphetamine (MA) is the second most commonly used illicit drug in the world, after cannabis. There are limited data on the outcomes of pregnant MA users but there is rapidly emerging evidence to suggest that they are more vulnerable, marginalized and impoverished compared with other drug-using mothers. MA use during pregnancy is associated with worse pregnancy outcomes and significantly higher rates of co-existing health and psychosocial problems. Newborn infants exposed to MA are at increased risk of perinatal complications, present differently at birth to infants exposed to other drugs of dependency such as opioids and have poorer neurological adaptation and feeding difficulties. Sparse literature from neuroimaging and cohort studies suggests that the neurocognitive deficits in MA exposed children persist, even into adulthood. Current clinical practice guidelines for the care of substance exposed pregnant women are opioid-centric with little attention paid to the consequences of prenatal MA exposure.

Keywords Long-term outcomes, methamphetamine, methamphetamine pregnancy mother newborn child outcomes, neurodevelopment, newborn, pregnancy.

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INTRODUCTION

The United Nations Office of Drug Control estimates that ~27 million people in the world use methamphetamine (MA), making it the most commonly used illicit drug in the world after cannabis [1]. It is also the only illegal drug that can be made entirely from legally obtained ingredients, making it one of the most easily manufactured, marketable and transportable illicit drugs. MA is one of the most potent neurostimulants, with highly lipophilic properties that allow it to rapidly cross cell barriers, including through the placenta and into the foetus and the developing central nervous system (CNS) [2]. The majority of MA users in the world are men, but women, especially those of child-bearing age, represent an increasing proportion of MA users. Pregnant MA users are a particularly vulnerable population that has worse health, psychosocial, pregnancy and child outcomes than even other drug using mothers [3] that are compounded by a lack of effective pharmacological treatment.

MA represents a unique problem, quite different from exposure to other stimulants including amphetamines, from which it is derived. MA exposure of the mother/infant dyad presents a unique and perplexing global public health problem that has a lifespan impact (Fig. 1). In this narrative review, we discuss the impact of MA on pregnancy and the child, including current epidemiology and best evidence-based management of pregnancy, health, social and psychological consequences. We propose strategies to address gaps in research and clinical practice. This analysis was not pre-registered and results should be considered exploratory.

WHAT IS METHAMPHETAMINE?

MA is a derivative of amphetamine, a neurotoxic stimulant. The addition of a methyl (CH_3) group to amphetamine produces MA and reduction with phosphorus and iodine results in the highly lipophilic and addictive

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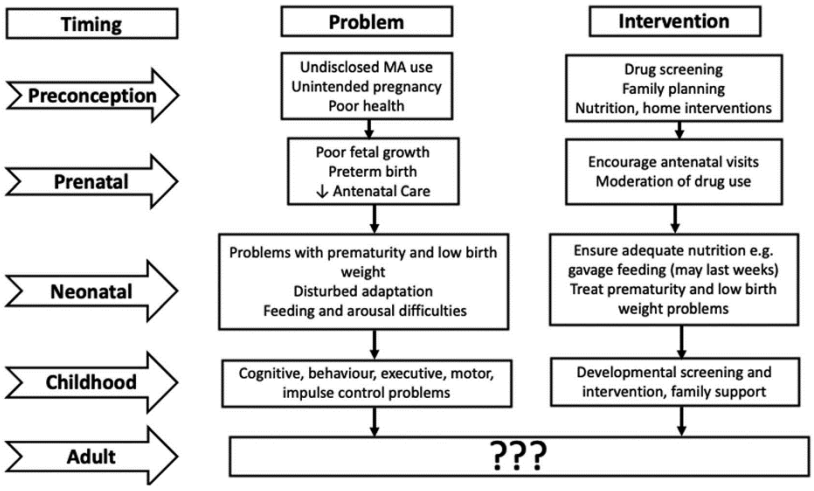

Figure 1 Illustration of the continuum of problems that must be addressed with prenatal MA. There is limited literature related to MA that considers maternal and infant outcomes beyond the biophysical. However, literature regarding opioid use and NAS is beginning to paint a more holistic perspective. Issues related to infant mental health and psychosocial attachments are increasingly being considered. Healthy attachment is foundational for infant neurological development; therefore, this aspect of health for infants born MA-exposed warrants similar attention

crystallized form of MA, also known as crystal meth. MA was one of the most widely used drugs during the early 20th century for its anti-fatigue, decongestant and anorectic effects [4]. Its addictive properties, however, were soon recognized in 1970, the United States (US) became the first country to make possession and use of MA, except for certain health purposes (e.g. obesity, sleep apnoea and attention deficit disorder) illegal through the Comprehensive Drug Abuse Prevention and Control Act [5].

MA: MECHANISMS OF ACTION

MA is a vasoconstrictor that decreases blood flow, leading to hypoxia [6]. Its psychoactive effects are mediated through neurotransmitter (dopamine, serotonin and norepinephrine) release [7] and blockage of intracellular vesicular monoamine transporter 2 (VMAT 2) activity [8]. Neuroinflammation [9] and neuronal cell necrosis and apoptosis, particularly in the mesolimbic regions [10], then ensues from a combination of oxidative stress from degradation of excess neurotransmitters [11], activation of innate immune responses such as the toll-like receptors [9] and DNA damage [12].

MA: Effects on the CNS

MA results in short lived (~6–12 hours) euphoria, increased alertness, libido, well-being and decreased appetite. Withdrawal (fatigue, somnolence and depression) and craving starts within a few hours and lasts up to 2 weeks [13]. Tolerance is rapid, leading to 'telescoping' of use, where more MA and shortened duration of use, is needed to maintain desired 'highs' [14]. Continued use leads to neuropsychiatric problems, including confusion, insomnia, mood disturbances, paranoia and violent behaviours and these may persist despite abstinence [15]. Cognitive deficits associated with MA dependence include aspects of executive control such as impulsive decision making and inhibitory control but poorer performance on memory processes appear to be related to IQ rather than MA use. [16].

MA: Effects on the cardiovascular system

MA is a cardiotoxin with direct sympathomimetic and vasoconstrictive effects, leading to increased cardiovascular activity and acute myocardial ischemia [17]. Cardiac disease is now the leading cause of deaths related to MA [18]. In a review of 894 MA-related deaths (average age 37.9 years) in Australia between 2009 and 2015, Darke *et al.* noted that 26.3% had enlarged hearts and 32.7% had histological evidence of hypertension [19]. In a population of 4407 MA-positive emergency attendees, 450 (10.2%) compared to 6.7% of the general population, had abnormal levels of B-type natriuretic peptide (BNP), a marker of heart failure [20]. The risk of dilated cardiomyopathy in a group of 19 MA users (ejection fraction mean 18.6%, range 10%–35%), were doubled in those with high

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activity scores of CYP2D6, the rate limiting enzyme in MA metabolism (OR = 2.33; 95% CI = 0.54–10.13) [21].

MA: Effects on the pulmonary and other systems

Smoking MA damages lung parenchyma. Bronchitis, pneumonia and acute respiratory distress syndrome are not uncommon but a unique complication, pulmonary arterial hypertension (PAH), is increasingly recognized in MA users. MA-associated PAH has bleak outcomes. In a prospective cohort study, 90 patients with MA and PAH had decreased survival rates at 10 years (47.2%) compared to 97 patients with idiopathic PAH (hazard ratio = 2.04; 95% CI = 1.28–3.25) [22]. The exact aetiology of PAH is uncertain but functional loss of genes involved in drug detoxification may increase susceptibility to MA-associated vascular injury and trigger occlusive vasculopathy [22].

Activation of non-shivering thermogenesis in brown adipose tissue and macrophages causes dysregulation of signalling transcription and regulation of thermogenic genes [23,24] and hyperthermia, a potentially lethal side-effect of MA [25]. Vasoconstriction may cause short-lived acute kidney injury [26] and chronic kidney injury with changes consistent with thrombotic microangiopathic injury and advanced glomerulosclerosis have been noted. [27].

MA: EFFECTS ON PREGNANCY

Despite a growing prevalence of MA use among women of reproductive age, there is a paucity of research regarding the impact of MA on pregnancy itself [28,29]. There is little knowledge of the outcomes of high-functioning women who use MA on a recreational basis and it is difficult to determine whether reported outcomes are specific to MA or to other substances including 'amphetamine' and 'stimulants', some which may relate to other drugs including prescribed amphetamines and cocaine [30–34]. Extant literature predominantly focuses on the incidence and patterns of drug use and the impact of MA in pregnancy on the health and wellbeing of the child rather than maternal outcomes [28,35,36]. Potential harm is extrapolated from factors such as reduced antenatal care or the effects of withdrawal or intoxication in non-pregnant populations, rather than on establishing a direct link to poor maternal or childhood outcomes [37]. Post-partum access to care has been studied in MA-using women but these have excluded women whose children have been taken into statutory care, thereby confusing the issue of whether poor outcomes are because of MA or because of other factors such as poverty, nutrition, lack of a stable lifestyle or stressful social environments [38]. International policy and practice guidelines reflect this dearth of evidence. None directly address maternal or perinatal outcomes and only provide limited non-evidence based summaries of recommendations that are not evidence-based [39–42].

Pregnancy intention and contraception complicated by MA

Research on unintended pregnancy is not available specifically for populations affected by MA use [43–45]. A meta-analysis specific to MA use investigating risky sexual behaviours reported an increase in unprotected vaginal intercourse (OR = 2.22; 95% CI = 1.80–2.74) and inconsistent condom use (OR = 1.93; 95% CI = 1.62–3.72), both of which are likely to lead to increased rates of unintended pregnancy [46]. When pregnancy planning has been studied in women with other drug dependencies, such as opioid dependence, as many as 75% pregnancies are reported as unintended, increasing to 86% in women who continue the pregnancy to birth [47,48]. Given that MA use is associated with poor lifestyle stability [3], it is likely some parallels in terms of unintended pregnancy can be drawn from contributory factors including perception of low risk of pregnancy, sexual coercion, poor reproductive health knowledge, cost and access to contraception services and high rates of co-morbid mental illness [49–54].

Early pregnancy

Associations between MA use and early pregnancy loss have been demonstrated. A study in the United States showed that 41% of pregnancies in women who use MA ended in pregnancy loss before 26 weeks gestation. This is double the US national average. This study, however, did not make a distinction between miscarriage, termination of pregnancy and stillbirth [55]. Another study showed that 33% of pregnancies in women who use MA end in termination of pregnancy, compared to 18% in the general population in the United States [56,57].

Ongoing pregnancy and birth outcomes

MA use during pregnancy is associated with an increased risk of preterm birth and reductions in birth weight, head circumference and birth length [3] but whether these are of clinical importance and are directly related to MA and not because of confounders such as homelessness, nutrition or lifestyle is uncertain [58,59]. A 2019 systematic review specific to MA use found mean differences (MD) of -0.90 weeks (95% CI -0.11 to −1.69) in gestation, MD -245 g (95% CI -137 to −353) in birth weight, MD -0.88 cm (95% CI -0.48 to −1.28) in head circumference and MD -9.94 cm (95% CI -0.55 to −1.32 cm) in length [59]. Another review of amphetamine exposure showed increased risk of preterm birth <37 weeks gestation (OR = 4.11; 95% CI = 3.05, 5.550), small for gestational age (5.79; 95% CI = 1.39, 24.06) and low birth weight

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(OR = 3.29; 95% CI = 1.97, 5.47) but did not provide a sub-analysis specific to MA use [58]. Comparisons of outcomes between drug-using and drug-free women with comparable social vulnerabilities, such as poverty and homelessness, suggest that MA was associated with worse newborn parameters, even after adjustment for confounders [60,61].

MA: Effects on access to pregnancy care and outcomes

Suboptimal antenatal care attendance is linked to poorer pregnancy outcomes [62,63] and MA users present later and attend fewer appointments than women not using MA [60]. In some settings, this may be related to fear of punitive measures if they disclosed MA (or indeed any illicit drug) use in pregnancy, [36] but regardless, MA users receive less antenatal care compared to other drug users [3]. There are limited data on the outcomes of pregnancies affected by MA. Extant studies are small, without meaningful control groups or control for social and lifestyle confounders [33,60,64]. To date, there is no definitive relationship between MA use and pregnancy problems such as pre-eclampsia, post-partum haemorrhage, placental abruption, chorioamnionitis and gestational diabetes. There are reports of maternal collapse, postulated to be because of vasoconstrictive crises [59] and increased rates of maternal admission to intensive care units (2% vs 0.3%, [63]), but no relationship to emergency caesarean delivery, another important risk in maternal morbidity [32,60,65].

Maternal mental illness

Women with MA use self-report more symptoms associated with paranoid ideation, depression and interpersonal sensitivity and are twice as likely to have a psychiatric disorder as a matched comparison group [66]. Up to 31% of MA users report psychiatric co-morbidities 1 month after birth [38,64]. Women with MA use do not access adequate specialist care for their mental illnesses, even in settings with publicly funded services such as New Zealand (NZ) [38]. This is a crucial service and knowledge gap because perinatal mental illness is one of the most important independent contributors to maternal morbidity and maternal death [67,68] and impact on maternal and infant bonding and childhood development and outcomes [69].

EFFECTS OF MA ON LACTATION

Almost all psychoactive drugs enter breast milk at variable amounts, depending on individual drug pharmacokinetics and maternal dosing. Amphetamine concentrations in breastmilk are 3 to 7 times higher than maternal plasma, suggesting concentration and storage within milk [70]. There is limited pharmacokinetic data in relation to timing of maternal MA ingestion but an analysis of milk from two mothers who occasionally used intravenous MA showed that average concentrations of MA in milk were up to 281 μg/L after 24 hours, leading to infant absolute doses of up to 44.7 μg/kg/day [71]. There are also reports of infant intoxication and death after acute maternal MA use without evidence of overlay from maternal intoxication [72,73]. Current practice guidelines recommend withholding breast feeding/breast milk feeds for 24 to 48 hours after MA use or until maternal toxicology is negative but there is no evidence that this improves childhood safety or outcomes [39–42].

EFFECTS OF MA ON THE CHILD

Congenital abnormalities

Prenatal MA is teratogenic to animals including rodents and rabbits [74], possibly via an oxidative stress-related pathway [75]. However, definitive teratogenicity between prenatal MA in humans is not established, although there are reports of various abnormalities, including CNS [76], ophthalmic [77] and abdominal wall [78] defects. Again, these studies are confounded by a lack of suitable comparators. There are also increasing reports of uncommon, but potentially serious neonatal complications probably secondary to direct drug toxicity, including encephalopathy, hepatic failure [79] and cholestasis [80], emphasizing the need to consider prenatal MA exposure as a differential diagnosis in unexpectedly unwell newborn infants.

Neonatal intoxication

Neonatal abstinence syndrome (NAS) refers to a pattern of withdrawal symptoms that may occur in infants exposed to substances of dependency. The most common cause of NAS is opioids. NAS is characterised by excessive sympathomimetic activity, including CNS irritability, gastrointestinal dysfunction, sneezing, yawning and fever [81]. The impact of MA on the newborn infant is different to NAS and usually characterised by poor neurological adaptation including poor feeding and drowsiness, much like adults after an episode of MA intoxication. MA withdrawal in adults is associated with excessive somnolence, depression and anxiety, and it is not inconceivable that the same pathology affects infant exposure to prenatal MA. The cause of this constellation of problems is multifactorial and most likely because of a combination of neurotransmitter depletion, inflammation [82], oxidative stress [83] and modulation of important neurotrophic factors such as brain-derived neurotrophic factor (BDNF) [84].

In adults, the acute after-effects of MA abstinence peaks at 24 hours from last use, reducing over a week. This period is characterised by somnolence, increased appetite and a cluster of depression, anxiety and craving related

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symptoms [13]. Cognitive improvement may take longer but usually improves within 6 months with continued abstinence [85]. In the IDEAL study, MA-exposed infants exhibited poorer quality of movement, more total signs of stress abstinence, physiological stress and CNS stress when examined with the NICU Network Neurobehavioral Scale [86,87]. Heavy MA use, in particular, was associated with lower arousal and excitability. The drowsiness characteristic of MA exposure was noted to persist in some infants for up to a few months, impairing feeding behaviour, (e.g. poor sucking abilities and poor growth). When assessed with the opioid-centric Finnegan's Score [81], it is important to note that MA exposure may lead to 'low' scores [3] and misconception that the infant is not withdrawing or not affected by prenatal MA exposure. The negative effects of prenatal MA on growth may persist over the first 3 years of life [87] and continued care beyond the newborn period is vital to ensure early detection and intervention of growth and developmental problems.

Therefore, because there is no other standardised measure of MA effects, we suggest that the Finnegan's Score [81] can be used, however, the outcomes have to be taken into context, including aspects of well-infant outcomes: appropriate feeding, sleeping and growth.

Drug screening and testing to diagnose prenatal MA exposure

Maternal history is notoriously unreliable in diagnosing prenatal drug exposure, especially in situations where there is no rapport with the clinicians [88] or if there are legal implications with drug-use disclosure [89]. Some women may have difficulties recalling precise drug use histories even if there is no risk of repercussions [90]. Drug testing of the newborn and the mother are increasingly conducted, especially in high-use areas, to verify or diagnose prenatal drug exposure [89]. There are currently no specific guidelines for maternal or newborn MA-testing and most institutions and expert committees use risk-based assessment protocols combining discrete aspects of maternal history and newborn clinical presentation to decide on toxicology testing [39–42].

The most easily accessible specimens are maternal and neonatal urine, meconium and umbilical cord tissue [90]. Newborn toxicology also presents unique procedural and analytical challenges. Toxicology tests, for example, may only be conducted in certain reference laboratories and timely return of tests for appropriate and prompt clinical management may not be possible. Test yields also depend on timing of maternal exposure. For example, urine is continuously produced and filtered by the infant and only recent MA use (e.g. a few days before delivery) will be detected in early newborn urine specimens. Meconium is formed in the 2nd trimester and will not contain drugs or metabolites ingested by a mother in the 1st trimester. Furthermore, meconium tests must be confirmed by gas chromatography mass spectrometry (GCMS). MA is frequently under-detected. In 210 MA-exposed infants in the IDEAL study, 71% were identified by maternal self-report compared to 3.8% by meconium alone [91]. Other matrixes, including newborn hair, are increasingly used in forensic or chain of custody settings but these tests may not be widely available or accessible [92].

Self-report, especially if there are no punitive repercussions, may be a more reliable indicator of prenatal MA exposure. However, clinician bias remains a major obstacle to obtaining unbiased and timely drug histories. Useful reports may be impeded by stigma, parental fear of legal repercussions or feelings of shame and guilt [93]. Some clinicians report that they conduct histories only on women of certain ethnic or socioeconomic groups because they perceive these groups as more likely to use drugs during pregnancy [93,94].

Neurocognitive and behavioural outcomes

The neurotoxic effects of MA are some of the most important concerns of prenatal MA exposure. Prenatal MA is associated with reduced brain growth in human infants [95] but again, there is insufficient data to definitively implicate MA as a cause. Animal studies suggest that CNS effects are because of a combination of inflammatory stress [82] and alternations in neurotransmitter [96] and genetic expression [97] but in humans, studies are small and hampered by lack of dose exposure information. Billing *et al.* followed 65 amphetamine-exposed (not MA specific) Swedish children born between 1976–1977 to 14–15 years. At age 8, children with MA-exposure had more problems relating to their peers, particularly with aggression [98]. At age 14, they had poorer school performance, specifically, math, language and physical fitness [99]. A small cross-sectional study of 23 children specifically exposed to MA compared to 22 unexposed children at 6 to 7 years found an association between MA and lower IQ, sequential and simultaneous processing, planning and learning ability [100]. At 6–15 years, MA-exposed children were more likely to have lower scores on the Full-Scale IQ of the Wechsler Intelligence Scale in Childhood, and the individual indices of Verbal Comprehension, Perceptual Reasoning, Working Memory and the Processing Speed Index, even after adjustment for other drug exposure [101].

Motor development

The Infant Development and Lifestyle (IDEAL) cohort is the largest longitudinal cohort of children with prenatal MA exposure, recruiting from the USA and NZ [102]. Differences in outcomes, postulated to be because of non-MA

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related issues including health and legal services are noted. Although there was no overall impact on cognition, as measured by the Mental Development Index (MDI) of the Bayley Scales of Infant Development, Second Edition, the US IDEAL cohort demonstrated lower scores on the grasping subtest of the Peabody Developmental Motor Scale before ($P = 0.027$) and marginally after ($P = 0.54$) after adjusting for covariates. Performance deteriorated with heavy MA exposure (≥3 times per week) compared to some (<3 times per week) or no exposure. In the NZ cohort, MA-exposure predicted gross motor delay across the first three years and gross and fine motor delay in boys [103]. A direct causative link cannot be established because of the small number but animal studies suggest that motor problems may be because of depletion of dopamine from the caudate nucleus and of serotonin from the frontal cortex [104], which in rats persists despite abstinence [105].

Executive function and behaviour

Early externalizing and internalizing behaviour and symptoms of ADHD were also examined by the IDEAL cohort [106]. No differences were found between MA exposed ($N = 142$) and unexposed ($N = 148$) children at 1 and 3 years but decreased internalizing and externalizing behaviours were found in children with easy temperaments compared to children with difficult temperaments. Notable was the finding that children living in more adverse environments were more likely to display internalizing and externalizing behaviours than living in less adverse environments [106]. In a further study investigating parent-rated behaviour problems at 3 and 5 years of age, MA exposure was associated with increased anxiety, depression and emotional reactivity. At age 5, heavy prenatal exposure to MA (≥3 times per week) was associated with decreased inhibitory behaviour [107], an aspect of executive function, an umbrella term for a group of cognitive or mental processes that are required for the control of behaviour that enables the attainment of chosen goals. Adversity in early environments has been shown to prevent the optimal development of executive function, particularly inhibitory behaviour and predict lifelong physical health, substance dependence, socioeconomic status and criminal conviction after controlling for IQ and social class [108].

Neuroimaging studies

A complete review of the neurostructural and functional impact of prenatal exposure to MA is beyond this review but there is considerable evidence that specific regions of the brain are persistently altered in children with prenatal MA exposure. Affected children have lower cortical [109] and striatal [110] volumes that persist even until school age, which are related to functional deficits such as attention processing and cognitive difficulties [111,112]. Diffusion tensor imaging (DTI) studies show alteration in white matter microstructure and fractional anisotropy (FA), especially between the striatum and midbrain, orbitofrontal cortex and associated limbic structures, which could play a role in the deficits in attention and inhibitory control commonly seen in prenatal MA exposure [113]. The impact of prenatal MA may be gender dependent. In a study of 139 MA exposed infants, the 72 females were noted to have persistently lower FA in the anterior corona radiata although persistently lower axial diffusion in the thalamus and internal capsule were noted in both males and females [113], which may have significant impact on working memory and other subtle influences on executive function [114]. Finally, even without structural sequelae, prenatal MA has been shown to impact on brain metabolism and neurological performance. In a study of 101 children at age 3–4 after prenatal MA exposure, Chang *et al.* found an association between prenatal MA and higher total creatine (tCr: +7%, $P = 0.003$), N-acetyl compounds (NA: +4.3%, $P = 0.004$) and glutamate/glutamine (GLX: +9.6%, $P = 0.02$) concentrations in the frontal white matter, but lower myoinositol (MI: −7%, $P = 0.01$) and MI/tCr (−7.5%, $P = 0.03$) in the thalamus, than control children. This suggested higher neuronal density or cellular compactness in the white matter, especially girls and lower thalamic glial content, which could be related to poorer performance on visual motor integration tasks [115]

ADULT OUTCOMES AFTER PRENATAL MA EXPOSURE

There is almost no information of adult outcomes after prenatal MA exposure. Preclinical studies with rodents have identified persistent neurological alterations as well as cognitive and behavioural difficulties. For example, MA prenatally exposed adult rats have significantly reduced concentration and recognition memory [116] and a slower acquisition related to spatial learning [117], which may be gender dependent [118].

In the last decade, researchers have endeavoured to develop medications for the treatment of MA addiction. Vocci and Appel [119] summarised a variety of approaches researchers are using in an effort to develop effective pharmacotherapies. Medications that limit brain exposure to MA, modulate MA effects, or affect the neuro-chemical pathways, which are known to reinforce MA use, are being actively explored. However, much of this research remains pre-clinical and largely focuses on the adult using MA. Whether these pharmacologic strategies are safe or effective for a pregnant woman and her foetus, or a neonate is entirely unknown.

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Finally, it must be remembered that children born to parents who use MA are also at serious risk of developing additional physical, developmental and emotional problems even without intrauterine exposure [120]. MA interferes with parents' ability to provide appropriate day-to-day care for children. Subsequent child abuse and neglect, related to parental MA use, often leads to the involvement of child protective services and children's placement into the out-of-home care (OOHC) system even in non-punitive and supportive societies [121]. Indeed, recent research has demonstrated MA has led to increasing numbers of children being placed into OOHC [122], which was more likely in marginalized populations and was associated with significantly poorer child developmental outcomes compared to children who remained with their parents.

KNOWLEDGE GAPS

There has been a noticeable increase in the amount of research being undertaken in relation to MA and pregnancy as well as infant/child outcomes. However, much of this examines correlations between MA exposure and children's physiological outcomes with multiple studies confirming cognitive, behavioural and emotional difficulties. Urgent research is needed to investigate and as a result, improve outcomes to adulthood for children with MA exposure.

Declaration of interests

none

Author contributions

Fatima Anne Perez: Validation. **Stacy Blythe:** Data curation; validation. **Trecia Wouldes:** Data curation; investigation; supervision; validation. **Kelly McNamara:** Investigation; validation. **Kirsten I. Black:** Methodology; supervision; visualization. **Ju Lee Oei:** Conceptualization; formal analysis; investigation; methodology; project administration; resources; supervision; validation; visualization.

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Figure 9-2: Manuscript: Murnion B, Chase V, Masters K, Carniato G, McNamara K. Integrating routine screening for pregnancy intention and contraceptive use in women who use alcohol or other drugs. Drug Alcohol Rev. Under Review.

TITLE: Integrating routine screening for pregnancy intention and contraceptive use in women who use alcohol or other drugs

Short title: Pregnancy intention screening integration

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Abstract

Background: There are high rates of unplanned pregnancy and low rates of contraceptive use in women with substance use disorders. Women who use drugs experience many barriers to health. In addiction treatment services in NSW, Australia, patients undergo routine health screening on treatment entry and annually thereafter.

Methods: A pregnancy intention screening (PIS) tool was developed and integrated into the electronic medical record and routine screening. We report preliminary outcomes of this tool.

Results: 100 women were offered and completed the survey. There were low rates of effective or highly effective contraceptive use (23.7% of eligible participants). 70% of participants wanted further information on contraception.

Discussion: As with other studies, our studies demonstrate low rates of contraceptive use, and high rates of interest in contraception use among women who use drugs. The PIS tool was completed by all women to whom it was offered, suggesting high levels of patient acceptability.

Conclusion: Integration of a PIS tool was effective in identifying women with contraceptive needs, and was acceptable to women.

INTRODUCTION

There are high rates of unplanned pregnancy and low rates of contraceptive use in women with substance use disorders.(1-3) In the general population up to 44% of pregnancies and 22% of live births are unplanned compared to 75% of pregnancies in women who attend Drug and Alcohol Services (DAS).(1, 4). In reproductive aged Australian women with substance use disorders, less than half of women who do not wish to conceive are using contraception.(1) However, in Australian women in the general population, 95% of women who do not wish to conceive use some form of contraception, with almost 30% using highly effective methods, including long acting reversible contraception (intra-uterine devices or hormonal implants) or sterilisation.(5)

People who use drugs can find it difficult to access healthcare. For women, this can mean poor access to contraception, and high rates of unplanned pregnancy.(1) There are myriad negative consequences of unplanned pregnancies.(1,4) Moreover studies identify that women who use drugs want to make informed choices about contraception.(6)

Patients attending DAS in New South Wales have a comprehensive health and psychosocial screen undertaken using a template in the electronic medical record (eMR). This screen has domains relating to physical health, mental health, drug health, child protection and domestic violence. The screen is undertaken at the beginning of each treatment episode and annually thereafter. It is a reportable quality indicator in DAS in NSW.

Despite the recognised risks and significant adverse consequences of inadequate access to contraception, and women's desire to make informed choices, there was no domain for assessing contraception or pregnancy plans as a component of the screening template. A pregnancy intention screening (PIS) tool consisting of four questions was therefore developed (**Figure 1**) and a template was inserted into the eMR in November 2020 (**Supplementary Figure 1**). This was supported with education for the nursing staff who undertake regular screening.

Q1. Are you pregnant?

Q2. Are you planning a pregnancy?

Q3. Are you using contraception?

Q4. What type of contraception are you using?

Figure 1: Questions of the screening tool

If this integrated tool can be demonstrated to be an effective way of screening for contraceptive needs, it has broader applicability for example, early identification of women planning a pregnancy, providing the opportunity to optimise pre-conception health.(7) The aim of this project therefore is to assess the feasibility and outcomes of this integrated screening tool.

METHODS

Routine administrative data of all women between the ages of 15 and 49 presenting to a regional DAS out-patient clinics(OPC) between 1.11.2020 and 1.6.2021 will be reviewed for baseline demographic information. The eMR of all women who have undertaken the PIS tool over the same time period will be identified.

In subjects who commenced the PIS, data to be extracted from the eMR includes:

(a) age
(b) completion of screening
(c) responses to the screening questions
(d) outcome of screening
(e) Primary drug of choice.

Ethics approval was provided through the Research Governance Office of the Central Coast Local Health District, number 0621-060C.

RESULTS

Demographics

At the time of undertaking the project, there were 278 women aged between 15 and 50 receiving treatment in Central Coast Local Health District DAS OPC. 20% of these women identified as Aboriginal or Torres Strait Islander. The average age was 33.15 years. The majority (n=172) identified opioids as their primary drug of choice. 140 were receiving BPN and 79 methadone.

Of this population, in the 7 months of the study, 100 women were offered and underwent contraceptive screening. No one offered screening declined to participate. All 100 women completed the screen. Average age was 31.6. Primary drug of choice was opioids for the majority (63%).

Screening Responses and Outcomes

Of the 100 women who underwent screening, 97 were not planning a pregnancy. Of these 66 women (68%) were not using any contraception (**Figure 1**). Of the 31 women using contraception, 8 were using the less effective form of contraception of the male condom, 9 the effective forms of the combined oral contraceptive pill or injectable contraception and 14 were using highly effective contraception(**Figure 2**). 70 women (72%) accepted referral to the women's health project, a separate initiative providing contraceptive counselling and supply.

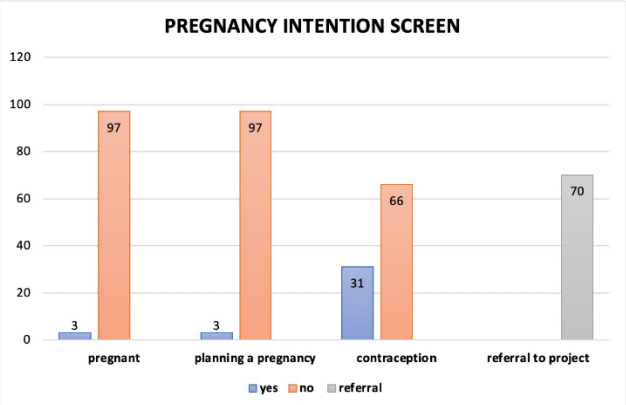

Figure 2: Pregnancy intention and contraceptive use in women using AOD

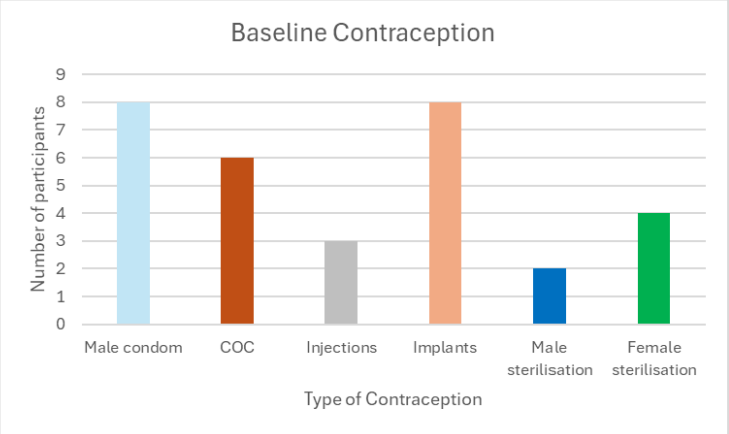

Figure 3: Contraceptive methods used by the 31 women using contraception (COC=Combined Oral Contraceptive Pill)

DISCUSSION

In this study, we have uniquely demonstrated the feasibility of a pregnancy intention screening tool integrated into routine health screening to identify contraceptive, preconception, and antenatal treatment needs in women in AOD. That all women who were offered the tool completed it, suggests this brief screening tool to be acceptable to this group.

Previous studies have consistently demonstrated women with substance use disorders have high rates of unplanned pregnancies.{1, 3, 8} Additionally, previous studies have consistently demonstrated women with substance use disorders have low rates of contraception use, and when using contraception typically use less effective methods, such as condoms.{9} Our study again demonstrates that despite almost all of our sample indicating they were not planning a pregnancy, 68% were not using contraception, higher than the 50% demonstrated in previous studies within Australian DAS.{1} Use of more effective methods such as pills, hormonal injections, hormonal implants, intra-uterine devices, and male and female sterilization is typically lower in women with substance use disorder, and our study supports this finding, with only 23% using these methods.{9} The screen also identified 3% of women were pregnant and 3% were planning a pregnancy, slightly lower than existing research which indicates about 10% of reproductive aged women with substance use disorder would like to be pregnant.{10-15}

Our study assessed a pregnancy intention screening tool embedded into the eMR in a drug and alcohol service. Pregnancy intention tools have been tested in DAS before, with the 'Desire to Avoid Pregnancy Scale' being evaluated within an opioid treatment program.{16} Whilst the Desire to Avoid Pregnancy Scale has been validated for use in clinical settings as screening tool, it is a 14 point tool, that does not assess contraception use.{17, 18} One Key Question is another pregnancy intention screening tool, that consists of a single question that stimulates a conversation about preconception care or contraception, however it has not been tested in a DAS. We suggest our tool is simpler to use in drug and alcohol settings, where clinical staff may not have advanced skills in reproductive health care.{19}

Women with substance use disorders are known to experience barriers to accessing sexual and reproductive health. This includes real and perceived stigma, risk of institutional re-traumatisation following sexual violence and shame over personal hygiene, such as lack of showering facilities, prior to an appointment, and the cost of appointments.(20-22) Additionally, women from rural and regional Australia are known to experience additional barriers to accessing contraception care.(23, 24) The regional setting in our study may in part explain the lower use of contraception compared to other Australian DAS.(1)

The United Nations considers access to contraception a human right and has prioritized this in the sustainable development goals.(25) Additionally, the WHO guidelines identify access to contraception as a priority in providing facilitating health care autonomy care for women with substance use disorders.(13) Sexual health and contraception programs for women with substance use disorders have improved access, and are most effective when they provide free services and are co-located on-site at drug and alcohol services.(20, 21) This screening tool allows early identification of women with unmet needs, who may then be referred to parallel programs contraception programs.

Women with substance use disorders are considered priority groups for preconception and antenatal care.(12, 13) Preconception care for women with substance use disorder focuses on maternal health optimization and may include adjustments to AOD treatment, prenatal vitamins, and optimisation of co-morbid conditions physical or psychological conditions.(12) Substance use disorder is associated with delayed or reduced access of antenatal care.(14) Systems issues, including a delay in referral to maternity services is one of the reason women provide in delayed access to antenatal care, and our screening tool represents an opportunity to provide early referral.(15)

The strengths of our project were that the screener was integrated into pre-existing systems, simple and easy to perform, although acceptability not formally evaluated no women declined to participate. The limitations were that was a small, single centre, quality improvement project, and this it did not use a validated screening tool.

Future research should examine incorporating the screening tool into a program of referral for preconception or antenatal care. The screening tool could be rolled out amongst other settings. The tool needs to be included in routine screening of this cohort, and this could be done by evaluating the tool embedded into other routine screening tools in DAS, such as effectiveness of inserting a screening tool into the annual health screening tool identify contraceptive needs. Evaluation of the rate of completion of the tool, including linking to contraceptive planning with quality indicators. Implementation of the tool beyond the current DAS and comparison with other pregnancy intention screens.(19)

Conclusion

It is feasible to integrate this simple screening tool into existing systems. High rates of completion indicate consumer acceptability. If this tool were to be integrated into the eMR as a component of routine screening it could enhance pregnancy and contraceptive planning in this priority group of women.

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