

REPORT ON THE LACK OF  
ASSOCIATION BETWEEN EARLY  
INDUCED ABORTION AND  
MENTAL HEALTH

Australian Centre for Public and Population Health  
Research

UNIVERSITY OF TECHNOLOGY SYDNEY

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## PLAIN ENGLISH SUMMARY

High quality reproductive healthcare is based on research and puts the patient at the centre of decision making. Research studies have come to different conclusions on the question of whether there is a link between early abortion and mental health. The most recent review of all quality research studies was done in 2017 by Horvath and others. This review found that there was no difference in the rates of depression between women who had an abortion and those who were denied one. Women who were denied an abortion had higher rates of anxiety than those who were able to access an abortion. Since this review was published other research has been done that has studied abortion and mental health. This provided a chance to see if there was any new data.

We reviewed all new studies to see if women of reproductive age (14 to 49 years) who obtained an early induced abortion (<14 weeks) for an unintended pregnancy were more likely to have adverse mental health outcomes compared to women who continued the pregnancy to birth. We found five studies that had were not in previous reviews (1-5). But, all of these studies could not be included because they were poor quality.

Our new review of the literature does not provide any new data to show that there is a link between abortion and adverse mental health risks. Our findings are the same as the reviews with high quality studies, which show that if a women has an early abortion there is little or no increased risk of mental health issues.

There is a need for well-designed research that informs best practice and supports women centred decision making about pregnancy care.

# EXECUTIVE SUMMARY

## BACKGROUND

There are ongoing debates as to whether abortion triggers the development of adverse psychological responses including mental health disorders. Earlier studies examining the relationship between abortion and mental health have been inadequate due to issues related to methodological quality and research design, particularly the use of an appropriate comparison group. This report presents the findings of a review of existing evidence to determine whether early-induced abortion is associated with adverse mental health outcomes.

## REVIEW QUESTION

The objective of this review is to synthesise the best available evidence on the relationship between early-induced abortion and mental health disorders.

The specific review question that was addressed was:

- Are women of reproductive age (14 to 49 years) who obtain an early induced abortion (<14 weeks) for an unintended pregnancy more likely to have adverse mental health outcomes compared to women who proceed with the pregnancy to birth?

## FINDINGS

The findings of this review support those of previous reviews that suggest that methodologically rigorous studies demonstrate little or no increased risk of mental health issues resulting from induced abortion.

Our systematic search of the existing literature, identified 9,785 papers of which 67 articles were screened for full-text review, and 36 were included in the review. Five of the studies had not been included in previous systematic reviews (1-5). Most of the studies included in the review had several limitations.

These included: the use of inappropriate comparison groups (not accounting for pregnancy intention); the inadequate control of confounders; limited account of co-occurring risk factors/contextual information around the pregnancies; secondary analysis of national surveys; retrospective study designs; self-reporting of abortion (information bias); use of similar (or same) data sets when assessing mental health outcomes (potential for amplification of outcomes); and inadequate control of pre-existing mental health conditions.

Of the five new studies identified in the search, none were able to be included for the following reasons: one study used inappropriate comparison groups: abortion versus no

abortion groups (3); two studies did not account for pregnancy intention (4, 5); and two did not have specific data to answer the review question(1, 2). The latter two studies used data from a longitudinal cohort study in the United States known as the Turnaway which is of high quality and has a methodologically rigorous study design. The outputs of the Turnaway consistently establish little evidence of poorer mental health associated with abortion. The most recent review that analysed studies arising from this study cohort did not ascertain any differences in depression rates between women who had abortions compared to those who were denied abortions (6).

## CONCLUSION

This updated review of the literature does not provide new evidence to establish a relationship between abortion and adverse mental health risks. Our findings align with other reviews that after accounting for methodological rigor and quality of studies suggest there was little or no increased risk of mental health issues resulting from induced abortion.

Our overall review findings support recommendations for practice and research that best meets the individualised needs of women with unintended pregnancies, rather than how the pregnancy is resolved.

# INTRODUCTION

## BACKGROUND

In Australia, there is a lack of standardised national data collection mechanisms to capture the incidence of abortion, with compulsory notification of abortions occurring in only three jurisdictions (South Australia, Western Australia and the Australian Capital Territory) (7). Based on the existing data available in Australia, the national age-standardised abortion rates in 2003 and 2004 were 19.7 per 1000 women and 19.3 per 1000 women respectively (8-10). Compounding the complexities in service access is the variability in abortion laws and regulations across the States and Territories which further impedes accessibility for women with unintended pregnancies who are seeking comprehensive reproductive services (7). There is a lack of evidence to inform policy and service development of sexual and reproductive services to offer targeted management of unintended pregnancies among those in need in Australia.

One of the current areas of debate in reproductive health is whether an abortion procedure could potentially prompt an adverse psychological outcome. Various systematic reviews have explored this issue. Since 2013, several studies have been published that provide an opportunity to explore the possibility of an updated review to synthesise the best available evidence on the relationship between induced abortion and mental health disorders.

## SUMMARY OF KEY FINDINGS FROM PREVIOUS REVIEWS

Five systematic reviews have been conducted between 2008 and 2013 with markedly contrasting conclusions (11-15).

A review conducted by Charles et al (2008) employed five criteria to assess the methodological rigour and quality of studies: (1) use of an appropriate comparison group; (2) use of valid mental health measures; (3) control for pre-existing mental health status; (4) control for confounders; and (5) whether there was comprehensive exploration of the research question largely influenced the study outcomes (11). Based on their assessment, of the twenty-one included studies, only four were rated to be of very good quality (16-19), while the remaining studies were rated as fair (n=8), poor (n=8) and very poor (n=1). Those studies considered higher quality indicated no association between abortion and mental health risks while low quality studies (rated as poor and very poor) identified negative mental health outcomes due to abortion (11).

Another review conducted by the American Psychological Association (APA) (2008) similarly remarked that most of the studies were methodologically flawed. It deduced that the relative



risk of mental health problems among women who have a first elective abortion due to an unplanned pregnancy was no greater than those who deliver the unintended pregnancy (14).

By contrast, a review conducted by Coleman (2011) reported abortion to be associated with an increased risk of mental health problems when compared to term pregnancies (12). This review however has received extensive criticism due to significant methodological flaws including misclassification of comparison groups, violating guidelines for conducting a meta-analysis (not publishing either search strategies or exclusion criteria), failure to account for dependence of effect sizes and calculating population attributable risk factor inappropriately (20-25).

The following review published in 2011 undertaken by the National Collaborating Centre for Mental Health (NCCMH) for the Academy of Medical Royal Colleges concluded that there were no differences in the rates of mental health problems among women with unwanted pregnancies who have an abortion versus those that give birth (13).

A subsequent review which reappraised the evidence included in the Coleman (2011) and NCCMH (2011) reviews concluded that abortion may be associated with an increased risk of mental health problems (26). However, this review has similarly been refuted due to a) failing to control for prior mental health in the main analysis (21) and b) combining well-conducted and poorly conducted studies in their analysis, with studies included controlling for different confounders making the calculated effect sizes questionable (27).

Bellieni and Buonocore (2013) analysed 30 studies published between 1995 and 2011, and concluded that women who had experienced fetal loss either by miscarriage or abortion were at an increased risk for mental disorders with the risk being greater for the abortion group (15).

Two other reviews with relevance to this report have been conducted since 2013.

A 2016 systematic review of abortion-related stigma by Hanschmidt et al includes reference to its impact on mental health (28). This review found the majority of studies had limitations regarding generalisability and validity. It called for more research using validated measures in order to enhance the understanding of abortion stigma and reduce its impact on affected individuals.

The most recent review published in 2017 is a comprehensive study-specific (non-systematic) appraisal(6). This review, conducted by Horvath and Schreiber, only assessed studies from the Turnaway longitudinal cohort. The Turnaway study prospectively enrolled women seeking abortion in the USA between 2008 and 2010, examining the effects of unintended pregnancy on women's lives including their mental health over a five year follow-up (29). This significant study overcame major methodological limitations that existed in the majority of the earlier studies by using appropriate comparison groups which included women who sought, but

were denied abortions based on the facility's gestational age limit (6). The Horvath and Schreiber review concluded there were no differences in the rates of depression between women who had abortions compared to those who were denied abortions based on the Turnaway studies (6).

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## LIMITATIONS OF STUDIES

A summary of study design limitations in the research referred to in previous reviews include:

- 1) Inappropriate comparison groups (11, 13, 14)
- 2) Under-reporting of abortion (11, 13, 14)
- 3) Inadequate control of pre-existing mental health conditions (11-15)
- 4) Limited account of co-occurring risk factors/contextual information around the pregnancy (11-15)
- 5) Secondary analysis of data and retrospective study designs – subject to reporting and recall bias (11, 13-15).

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## LIMITATIONS OF REVIEWS

Significant methodological limitations from the Coleman 2011 (12) and National Collaborating Centre for Mental Health (NCCMH) 2011 (13) reviews are detailed below including:

1. Follow-up time of mental health issues not restricted to greater than 90 days (12)
2. Quality appraisal criteria for the included studies not indicated(12)
3. Most studies in review re used same data sources (12)
4. Noted key methodological issues in its review of mental health outcomes following abortion and birth of an unwanted pregnancy due to poor quality of included studies (13)
5. Included limited meta-analysis of four studies only due to these shortcomings, as well as systematic review and narrative synthesis (13)
6. Author commented that the meta-analysis added little to a well-done narrative review (21).

The two earlier reviews by Charles et al. 2008 (11) and the APA (14) similarly lack generalisability and included studies of variable quality as detailed below:

1. Review written from a US perspective hence may not be generalisable to other settings (11, 14)
2. Included studies not grouped by study quality rendering interpretation of the results difficult (14)
3. Mental health outcomes not categorised into specific disorders (14)
4. Follow-up time of mental health issues not restricted to greater than 90 days (14).

## MENTAL HEALTH AND EARLY-INDUCED ABORTION: WHAT ARE THE RISKS?

Several conceptual frameworks present hypotheses concerning the relationship between abortion and mental health. Some of these include:

- a) Visualising abortion as a traumatic experience resulting in mental health issues. These views mainly emanate from qualitative interviews with women whose abortion experiences were stressful hence subjective (30, 31);
- b) Conceptualising abortion within a stress and coping model. This suggests that women are more predisposed to negative psychological outcomes being less likely to cope with life stressors(32); and
- c) Common risk factors approach wherein sociodemographic, structural, and other risk factors play a significant role in explaining post-abortion and post-pregnancy mental health (32).

The common-risk factors approach emphasises the need to take into account immediate circumstances such as: coping, personal, and economic resources, pregnancy intention, and social support, as well as other distal risk factors such as violence history, abuse and neglect, prior mental health(32), abortion-related stigma(28) and sociodemographic characteristics when comparing the mental health outcomes of women who have had abortions to those with other pregnancy outcomes. Stress related to abortion stigma may in turn be related to personal (perceived, internalised and/or enacted) stigma and/or mediated through external drivers such as community/societal, race, legal and religion-mediated contexts (28).

Therefore, when examining the relationship between abortion and mental health, these factors should be thoroughly controlled for. Figure 1 below indicates the interplay between these factors and mental health. It is in this context that the appraisal of included studies was undertaken in order to determine whether there was any relationship between abortion and mental health risks.

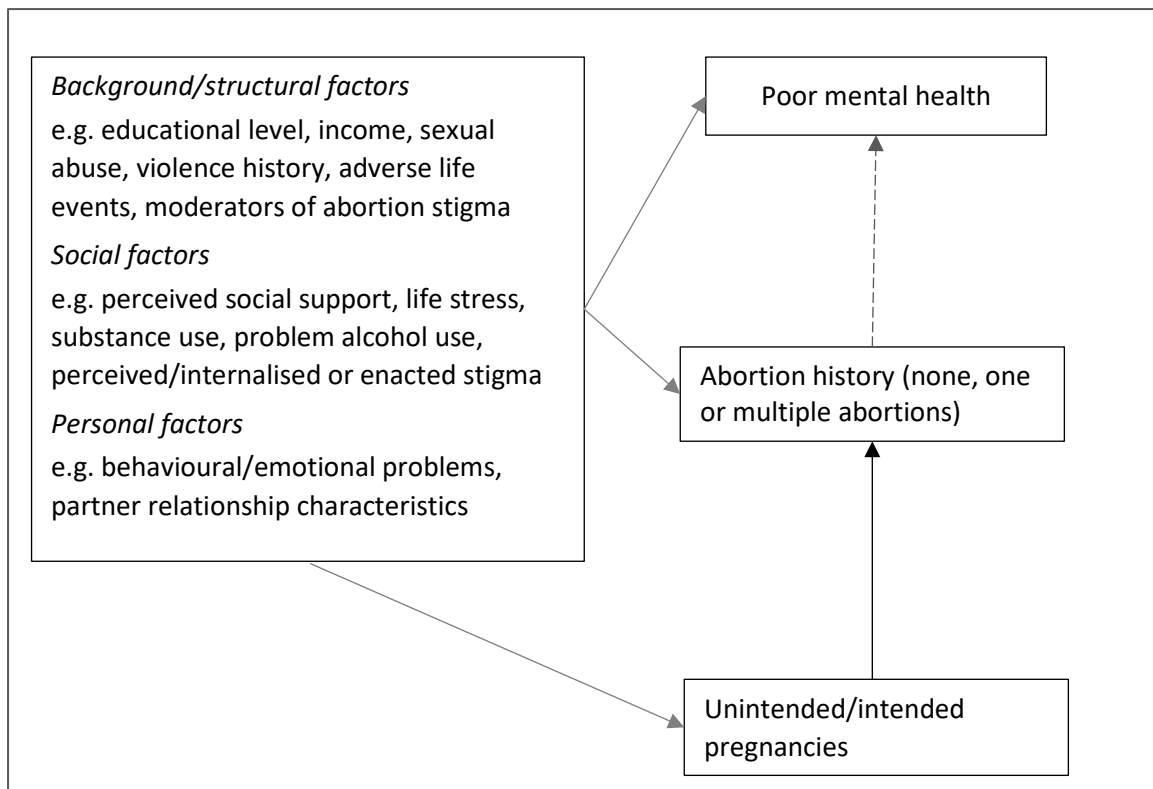


Figure 1 Interplay between common risk factors, abortion and mental health

*Adapted from Steinberg & Finer 2011 (32)) Risk factors*

**[Legend: solid line indicates significant association while a dashed line indicates potential for association should risk factors not be controlled for in analyses.]**

## METHODS

This review was conducted using the following steps:

- 1) A systematic review of the literature to identify pre-existing reviews in this area
- 2) Development of research protocol encompassing the search strategy, inclusion/exclusion criteria, data extraction and quality appraisal
- 3) A discussion around the implications for practice based on the quality appraisal findings

This review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (33) The study protocol is accessible at:

<http://www.crd.york.ac.uk/PROSPERO/> (registration no. CRD42018100333).

## SEARCH STRATEGY

A comprehensive systematic search of six databases (Pubmed, Medline, Embase, CINAHL, PsycInfo and Scopus) was carried out in June 2018 for relevant primary research. Manual searching of reference lists of the included articles was also undertaken to identify relevant articles. A search strategy was developed using controlled vocabulary key words (MeSH) and free-text words included “abortion” and “mental health” (Table 1). Two test articles were used to determine comprehensiveness of the search strategy. The full literature search strategy has been presented in Appendix 1.

Table 1 Key words used for comprehensive systematic search

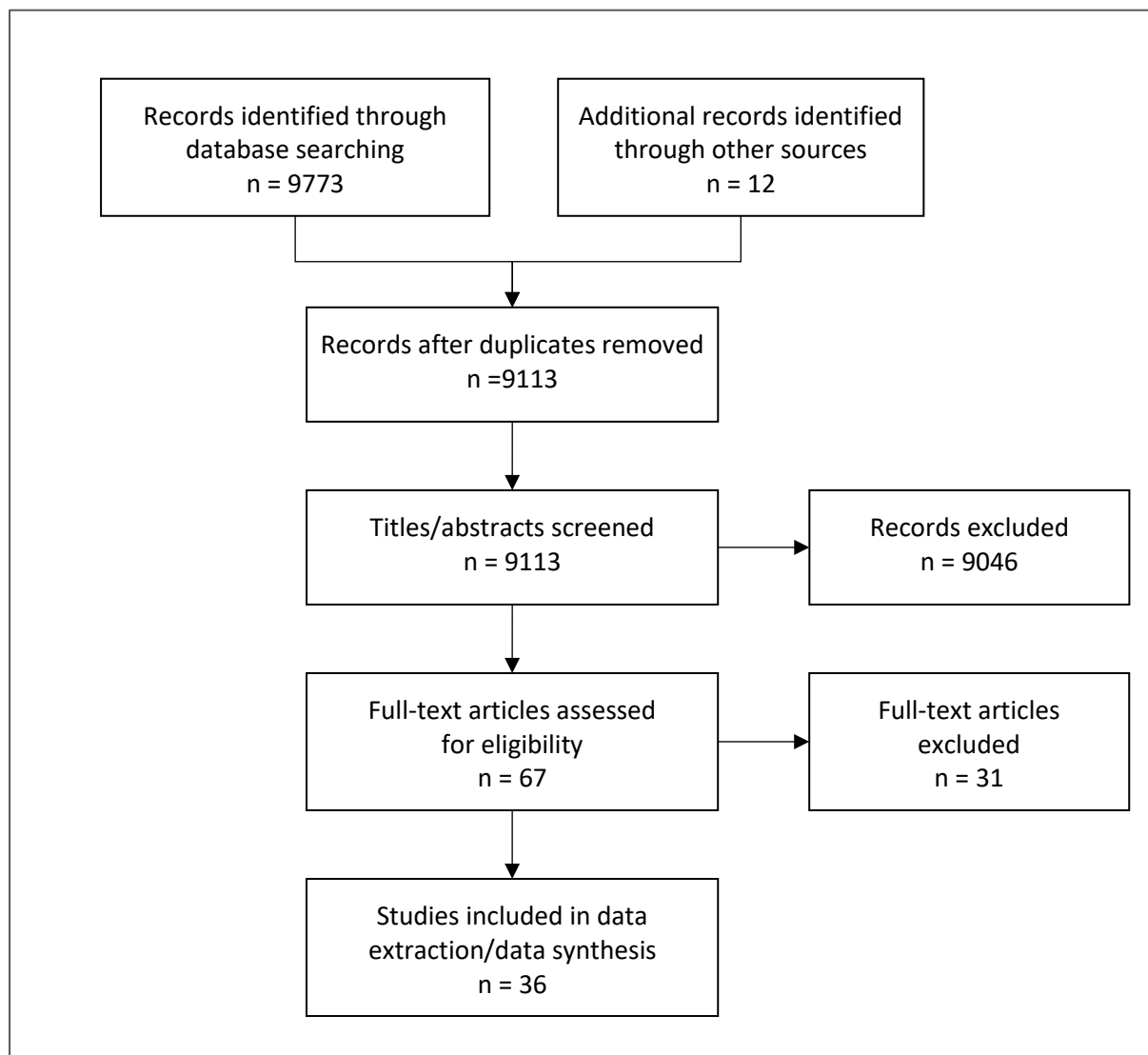
Keywords	Pubmed	Medline	Embase	CINAHL	Scopus	PsycInfo
Abortion	abortion; induced/legal abortion; elective/voluntary abortion; pregnancy termination/terminati on of pregnancy; post- conception fertility control	abortion; legal/induced abortion	abortion; legal/induced abortion	abortion; induced abortion	induced/legal abortion; pregnancy termination/termi nation of pregnancy	abortion; induced abortion
Mental health	mental health; mental disorders; mental health issue; adjustment; mental health services; psychiatric contact; psychiatric assessment; depression; anxiety/anxiety disorder; regret; emotion; emotional depression; relief; emotional relief; self- esteem; suicide; post- traumatic stress disorder; trauma; somatoform	mental health; anxiety disorders; depressive disorders; mental disorders; schizophrenia; substance-related disorders; mental health services/community mental health services; psychiatric assessment; self-esteem; suicide; post-traumatic stress disorder; trauma; substance-induced psychosis; psychotic disorders/ acute psychosis; domestic	mental health; anxiety disorders; depressive disorders; mental disorders; schizophrenia; substance-related disorders; mental health services/community mental health services; psychiatric assessment; self- esteem; suicide; post-traumatic stress disorder; trauma; substance- induced psychosis;	mental health; mental disorders; mental health services; community mental health services; anxiety; anxiety disorders/g eneralised anxiety disorders; depression,	mental health; mental disorder; depression; anxiety; mental health service; psychiatric assessment; self- esteem; suicide; post-traumatic stress disorder; trauma; psychotic disorders	mental health; mental disorders; mental health services; community mental health services; anxiety; anxiety disorders/gener alised anxiety disorders; depression, schizophrenia; self-concept; self-esteem; suicide/attempt ed suicide

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disorders; acute psychosis; schizophrenia; psychiatric symptom; post abortion syndrome; post abortion adjustment	violence, spouse abuse; intimate partner violence; stigma/social stigma; quality of life; personal satisfaction; life satisfaction; psychological adaptation; employment	psychotic disorders/ acute psychosis; domestic violence, spouse abuse; intimate partner violence; stigma/social stigma; quality of life; personal satisfaction; life satisfaction; psychological adaptation; employment	schizophrenia; self-concept; self-esteem; suicide/attempted suicide
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Figure 2 PRISMA flowchart for the selection of studies



## STUDY SELECTION

The study inclusion and exclusion criteria are outlined in Table 2. Screening was supported by the Covidence™<sup>1</sup> software tool. Two researchers screened articles, independently, based on title and abstract then full-text to determine if they met the inclusion criteria. The two reviewers resolved any conflicts, if consensus could not be made it was brought to the larger group. The search yielded 9,773 articles and an additional 12 articles found through hand searching. Sixty-seven articles were full-text reviewed, and 36 were included in the review (Figure 2). Table 2 outlines datasets by number of studies and outcomes. Appendix 2 details background information for included studies.

<sup>1</sup> Web-based software platform that streamlines the production of systematic reviews.  
<http://www.covidence.org>



Table 2 Inclusion and exclusion criteria

Inclusion	Exclusion
Primary research (observational studies: cohort and case-control studies)	Commentaries, reviews, editorials, case-reports
High-income countries	Low- and middle-income countries
Women of reproductive age	
Induced legal abortion	Miscarriages; abortions due to medical reasons (diagnosed birth defects, genetic abnormalities)
First trimester abortion (both medical and surgical termination methods)	Second/third trimester abortions
Comparator groups:	No comparator group
– women who seek an induced abortion but are unable to receive one	Comparator groups:
– women who proceed with unintended pregnancy	– women who were not pregnant
	– women who did not have an abortion
Mental health measured $\geq$ 90 days post-abortion or post-delivery	
Published in English	
Published after 2000	Published before 2000

#### DATA EXTRACTION AND QUALITY APPRAISAL

Each study was reviewed using the Johanna Briggs (JB) critical appraisal tools(34). A standardised form in Excel was developed by the team to extract relevant data, summarise review findings and document assessment of study quality.

The critical appraisal review process was conducted by two reviewers. After independent appraisal, the reviewers resolved any conflicts, which were brought to the larger group if consensus could not be made. A percentage grading of overall strength was calculated by averaging the JB criteria. A subjective strength scaling was then applied based on the following.

Table 3: Subjective strength categories

JB quality appraisal: overall percent	Subjective strength
>80%	Very good
71%-80%	Good
61%-70%	Moderate
51%-60%	Poor
<51%	Very poor

Appendix 3 summarises the quality appraisal of each study, categorised by country and region. Table 5 groups the studies by subjective strength.

## FINDINGS

We have identified 36 studies in the literature review process, including 9 Turnaway studies and 27 non-Turnaway studies. Most of the studies in the review had several limitations. These included: the use of inappropriate comparison groups (not accounting for pregnancy intention); inadequate control of confounders; limited account of the co-occurring risk factors/contextual information around the pregnancies; secondary analysis of national surveys; retrospective study designs; self-reporting of abortion (information bias); use of similar data sets when assessing mental health outcomes (potential for amplification of outcomes); and inadequate control of pre-existing mental health conditions.

### QUALITY OF INCLUDED STUDIES

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#### NEW STUDIES NOT INCLUDED IN PREVIOUS SYSTEMATIC REVIEWS

Of the 36 included studies, five had not been included in previous systematic reviews (1-5). Of the five new studies identified in the search, one used inappropriate comparison groups: abortion versus no abortion groups (3) while two studies did not account for pregnancy intention (4, 5). The remaining two studies report findings from the Turnaway study in the United States but did not have specific data that answered the review question (1, 2). As referred to in the Introduction, the Turnaway is a longitudinal study that prospectively enrolled women seeking abortion in the USA between 2008 and 2010, examining the effects of unintended pregnancy on women's lives including their mental health over a 5 year period (29). The study compared Turnaways (women who sought abortions later in pregnancy, up to 3 weeks over a facility's gestational limit and were denied abortions); and women who received first-trimester abortions with the Near-limits (women who sought and obtained abortions later in pregnancy).

This study used the most appropriate study design and overcame major methodological limitations that existed in the majority of the earlier studies by using appropriate comparison groups which included women who sought but were denied abortions based on the facility's gestational age limit (6).

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#### TURNAWAY STUDIES

However, studies based on the Turnaway cohort used a reference group (the 'Near-limits') which were essentially an abortion group. To answer our research question, we would need to compare the first-trimester abortion group with the Turnaway birth group, data which were not available in the publications. Upon consultation with the Turnaway project developers via email, we were advised that comparing the first trimester abortion and Turnaway birth groups would be methodologically problematic due to the fact that the

Turnaways are seeking abortion later in pregnancy and thus, not ideally comparable to women seeking a first trimester abortion, who are different from those seeking later procedures.

Consequently, the nine papers based on the Turnaway study were assessed for quality but not included in the summary review of studies as they were out of scope and or did not have the data for the review question (Table 5).

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## KEY LIMITATIONS OF INCLUDED STUDIES

Key limitations of the majority of the studies are further described below. Study-specific limitations are detailed in Appendix 3 and Table 5 groups the studies by subjective strength.

### 1) Comparators

*Group 1: Women who seek and complete an induced abortion compared with those that seek an induced abortion but are unable to receive one*

Most of the included studies did not explicitly identify women who sought induced abortions but were unable to receive one hence in actuality not meeting our inclusion criteria (31, 35-44). The exceptions were publications arising from the Turnaway study (1, 2, 45-51).

*Group 2: Women who seek and complete an induced abortion compared with those that proceed with an unintended pregnancy to birth*

For this comparator, there were issues with both the numerator and the denominator. Eighteen studies did not clearly state whether the pregnancies carried to term were unintended or not (3-5, 31, 32, 35, 37-39, 41-43, 52-57). Furthermore, information is not provided on whether women who proceeded with unintended pregnancies had accessed any abortion services. This could potentially lead to significant selection and information biases (13).

### 2) Use of similar data sets when assessing mental health outcomes

Some of the studies included in the review used similar data sets to assess similar mental health outcomes. Warren et al (2010) (44) and Sullins (2016) (3) analysed retrospective and cross-sectional data on depression collected as part of the National Longitudinal Study of Adolescent Health for study periods 1994-2002 and 1994-2009 respectively. Schmiege and Russo (2005) (18) and Reardon & Cogle (2002) (58) analysed retrospective data on depression collected as part of the National Longitudinal Survey of Youth for study periods 1970-1992 and 1980-1992 respectively. Fergusson et al (2006) (36) and Fergusson et al (2008) (59) prospectively analysed data on depression, anxiety, suicidal ideation, alcohol dependence and illicit drug dependence as part of the Christchurch Health and Development Study for study periods 1977-2002 and 1977-2007 respectively.

Hence, there is a likely potential for amplification of mental health outcomes between the comparison groups leading to inaccurate deductions. Table 2 below gives a breakdown of the datasets by country and region, number of studies and outcomes measured:

Table 4: Dataset by number of studies and types of outcomes

Dataset / Study	Country/ Region	Number of studies	Outcomes
Victorian Adolescent Health Cohort Study	Australia	1	Depression, psychosocial, substance abuse
Danish Civil Registration system linkage to Danish Psychiatric Central Register and the Danish National Register of Patients	Denmark	2	Psychiatric contact x 1, Psychiatric re-admission x 1
Statistics Finland registers data linkage	Finland	2	Pregnancy-associated death x 1, Psychiatric disorder various x 1
Christchurch Health and Development Study	New Zealand	2	Major depression, anxiety, suicidal ideation, drug alcohol dependence x 2
Young in Norway Longitudinal Study	Norway	2	Substance abuse x 1, Depression x 1
National Birth Registry and National Death Certification Registry & National Health Insurance Research Database + data from Household registration database	Taiwan	1	Suicide (attempted or successful) x 1
California Medi-Cal data linkage	USA	3	Psychiatric treatment/admission x 2; deaths x 1
National Comorbidity Survey NCS	USA	3	Multiple mental health x 3
National Longitudinal Study of Adolescent to Adult Health (Add Health)	USA	3	Depression x 1, depression & other mental health x 2
National Longitudinal Study of Youth (NLSY)	USA	4	Depression x 3 Substance abuse x 1
National pregnancy and health survey (NPHS)	USA	1	Substance abuse
National Survey of Family Growth	USA	1	Anxiety
National Survey of Family Growth (NSFG) & National Comorbidity Survey (NCS) secondary data analyses	USA	1	Anxiety

Dataset / Study	Country/ Region	Number of studies	Outcomes
Turnaway	USA	9	PTSD x 1, Depression & anxiety x 2 (+ other mental health x 1), Suicide ideation x 1, Substance abuse x 4
Urban Longitudinal study. Fragile Families and Child Wellbeing Survey	USA	1	Depression x 1

A breakdown of the studies by subjective strength (referencing the Johanna Briggs quality assessment tools as detailed in the Methods section) is given below in Table 5:

Table 5: Quality appraisal: studies summarised by subjective strength

Subjective strength	Number of studies	Studies (n=27, excludes Turnaway studies)
Very good	1	Gomez (2018)(60)
Good	4	Steinberg and Russo (2008) (19) Steinberg and Finer (2011)(32) Fergusson et al (2008)(59) Weng et al (2018)(4)
Moderate	6	Cogle, Reardon and Coleman (2005)(40) Steinberg, Becker, Hendersen (2011)(57) Steinberg, McCulloch and Adler (2014)(5) Sullins (2016)(3) Munk-Olsen et al (2011)(37) Leppalahti et al (2016)(54)
Poor	8	Coleman, Reardon et al (2002)(35) Cogle, Reardon and Coleman (2003)(39) Reardon et al (2003)(31) Reardon, Coleman and Cogle (2004)(61) Schmiege and Russo (2005)(18) Olsson et al (2014)(55) Munk-Olsen et al (2012)(38) Karalis et al (2017)(53)
Very poor	8	Coleman, Reardon et al (Dec 2002)(52) Reardon and Cogle (2002)(58) Reardon et al (2002)(42) Rees and Sabia (2007)(43) Warren, Harvey and Henderson (2010)(62) Fergusson et al (2006)(36) Pedersen (2007)(56) Pedersen (2008)(41)

**Note:** Of the nine studies that analysed Turnaway data, five were classified as 'very good' and four were classified as 'good' in the JB critical appraisal.

## DISCUSSION

The findings of our review are consistent with other reviews (6, 11, 13, 14) that found most pre-2013 studies are methodologically flawed due to one or more of the following : a lack of comparison groups, co-occurring risk factors, sampling issues, gaps in the measurement of reproductive history and problems of underreporting, attrition, gaps in outcome measures (timing, source, and clinical significance), other statistical issues and interpretational problems and logical fallacies(6).

Moreover, based on the quality of available studies, meta-analysis reviews are themselves prone to bias, suggesting limited value (12-14, 63).

At this point, the best available insights on the association between abortion and mental health are provided by narrative synthesis(21).

The Turnaway study meets many of the requirements for well-designed research as outlined nearly a decade ago by Major et al: prospective, longitudinal research that includes appropriate comparison groups and minimises bias through careful attention to adequately assessing the common risk factors known to be associated with both abortion and mental health(14). However, as noted, the Turnaway references a comparison group of 'Near-limits' which is essentially an abortion group, thus papers from this study could not be used to answer our review question.

Our findings concur with others that suggest women with unwanted pregnancies seeking termination would benefit from a shift in focus from 'what all too often appears to be morally and politically influenced concerns about abortion'(21) to the provision of individualised care that addresses all health needs as required.

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### LIMITATIONS OF THIS REVIEW

Limitations of our review are consistent with previously conducted systematic reviews that in turn highlight methodological weaknesses of included studies.

The study considered most rigorous in addressing these methodological aspects (ie the Turnaway) did not have specific data related to early induced abortion that could answer our review question. Nonetheless, this study and its associated papers are referred to in our report as they highlight key issues related to the association of mental health risk and abortion.

## CONCLUSION

Our findings agree with studies that have controlled for methodological factors: that, for a woman experiencing an unwanted pregnancy, current evidence suggests that mental health is largely unaffected whether she chooses to have an abortion or to continue to birth.

A woman seeking pregnancy termination can best be supported by health services through appropriate, individualised, responsive care, including the provision of accurate information about mental health and treatment access for antecedent sexual, physical and emotional violence, mood disorders, and substance use disorders(6).

We suggest, based on current evidence of studies that control for factors that impact on methodological quality, the mental health of women carrying an unintended pregnancy is largely unaffected whether she chooses to have an abortion or to continue to birth(21).

We recommend to:

- Focus practice and research on the individual needs of women with an unintended pregnancy, rather than how the pregnancy is resolved.
- Consider the physical health outcomes for women with an unintended pregnancy, which have improved greatly by making abortion legal, affordable and integrated as part of comprehensive sexual and reproductive health care.

# APPENDICES

## APPENDIX 1: SEARCH STRATEGIES

### Database: Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>

1	exp ABORTION, LEGAL/ or exp ABORTION, INDUCED/ or abortion*.mp.	87346
2	mental health.mp. or exp Mental Health/	156853
3	exp Anxiety Disorders/ or exp Depressive Disorder/ or exp Mental Disorders/ or mental disorder*.mp. or exp Schizophrenia/ or exp Substance-Related Disorders/	1167238
4	exp Mental Health Services/ or mental health service*.mp. or exp Community Mental Health Services/	95293
5	exp Depressive Disorder, Major/ or psychiatric assessment.mp.	28026
6	self esteem.mp.	17754
7	suicide.mp. or exp SUICIDE/ or exp SUICIDE, ATTEMPTED/	75922
8	PTSD.mp. or exp Stress Disorders, Post-Traumatic/	33538
9	trauma.mp.	232103
10	exp Psychoses, Substance-Induced/ or exp Psychotic Disorders/ or acute psychosis.mp.	48802
11	domestic violence.mp. or exp Domestic Violence/	42518
12	exp Spouse Abuse/ or exp Intimate Partner Violence/ or exp Battered Women/	9358
13	exp RAPE/	6029
14	exp Substance-Related Disorders/	259848
15	exp SOCIAL STIGMA/ or stigma.mp.	19151
16	exp "Quality of Life"/ or exp Personal Satisfaction/ or life satisfaction.mp. or exp Adaptation, Psychological/	285776
17	exp EMPLOYMENT/	78378
18	2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14	1577202
19	1 and 18	4915



**Database: Embase <1974 to 2018 June 21>**

1. exp ABORTION, LEGAL/ or exp ABORTION, INDUCED/ or abortion\*.mp.
2. mental health.mp. or exp Mental Health/
3. exp Anxiety Disorders/ or exp Depressive Disorder/ or exp Mental Disorders/ or mental disorder\*.mp. or exp Schizophrenia/ or exp Substance-Related Disorders/
4. exp Mental Health Services/ or mental health service\*.mp. or exp Community Mental Health Services/
5. exp Depressive Disorder, Major/ or psychiatric assessment.mp.
6. self esteem.mp.
7. suicide.mp. or exp SUICIDE/ or exp SUICIDE, ATTEMPTED/
8. PTSD.mp. or exp Stress Disorders, Post-Traumatic/
9. trauma.mp.
10. exp Psychoses, Substance-Induced/ or exp Psychotic Disorders/ or acute psychosis.mp.
11. domestic violence.mp. or exp Domestic Violence/
12. exp Spouse Abuse/ or exp Intimate Partner Violence/ or exp Battered Women/
13. exp RAPE/
14. exp Substance-Related Disorders/
15. exp SOCIAL STIGMA/ or stigma.mp.
16. exp "Quality of Life"/ or exp Personal Satisfaction/ or life satisfaction.mp. or exp Adaptation, Psychological/
17. exp EMPLOYMENT/
18. 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14
19. 1 and 18

**Database: CINAHL**

#	Query	Limiters/Expanders
S12	S1 AND S11	Search modes - Boolean/Phrase
S11	S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10	Search modes - Boolean/Phrase
S10	(MH "Psychoses, Substance-Induced") OR (MH "Psychotic Disorders+") OR (MH "Affective Disorders, Psychotic") OR "psychoses"	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S9	(MH "Trauma+") OR "trauma"	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S8	(MH "Stress Disorders, Post-Traumatic+") OR "PTSD"	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S7	(MH "Suicide+") OR "suicide" OR (MH "Suicide, Attempted")	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S6	(MH "Self Concept+") OR "self esteem"	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S5	(MH "Schizophrenia+")	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S4	(MH "Depression+") OR "depression"	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S3	(MH "Anxiety+") OR "anxiety" OR (MH "Anxiety Disorders+") OR (MH "Generalized Anxiety Disorder")	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S2	(MM "Mental Health") OR "Mental Health" OR (MH "Community Mental Health Services+") OR (MH "Mental Health Services+") OR (MH "Mental Disorders+")	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S1	"abortion" OR (MM "Abortion, Induced+")	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects

Search modes - Boolean/Phrase

**Database: PsycInfo**

#	Query	Limiters/Expanders
S12	S1 AND S11	Search modes - Boolean/Phrase
S11	S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10	Search modes - Boolean/Phrase
S10	(MH "Psychoses, Substance-Induced") OR (MH "Psychotic Disorders+") OR (MH "Affective Disorders, Psychotic") OR "psychoses"	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S9	(MH "Trauma+") OR "trauma"	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S8	(MH "Stress Disorders, Post-Traumatic+") OR "PTSD"	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S7	(MH "Suicide+") OR "suicide" OR (MH "Suicide, Attempted")	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S6	(MH "Self Concept+") OR "self esteem"	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S5	(MH "Schizophrenia+")	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S4	(MH "Depression+") OR "depression"	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S3	(MH "Anxiety+") OR "anxiety" OR (MH "Anxiety Disorders+") OR (MH "Generalized Anxiety Disorder")	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
S2	(MM "Mental Health") OR "Mental Health" OR (MH "Community Mental Health Services+") OR (MH "Mental Health Services+") OR (MH "Mental Disorders+")	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase

S1	"abortion" OR (MM "Abortion, Induced+")	Expanders - Apply related words; Also search within the full text of the articles; Apply equivalent subjects Search modes - Boolean/Phrase
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**Database: Scopus**

( TITLE-ABS-KEY ( abortion\* ) OR TITLE-ABS-KEY ( "induced abortion\*" ) OR TITLE-ABS-KEY ( "pregnancy termination" ) OR TITLE-ABS-KEY ( "termination of pregnancy" ) OR TITLE-ABS-KEY ( "legal abortion" ) AND TITLE-ABS-KEY ( "mental health" ) OR TITLE-ABS-KEY ( "mental disorder" ) OR TITLE-ABS-KEY ( depression ) OR TITLE-ABS-KEY ( anxiety ) OR TITLE-ABS-KEY ( "mental health service\*" ) OR TITLE-ABS-KEY ( "Psychiatric assessment" ) OR TITLE-ABS-KEY ( "self esteem" ) OR TITLE-ABS-KEY ( suicide ) OR TITLE-ABS-KEY ( ptsd ) OR TITLE-ABS-KEY ( trauma ) OR TITLE-ABS-KEY ( "psychotic disorder\*" ) )

**Database: Pubmed**

(((((("pregnancy termination" [Title/Abstract]) OR ("termination of pregnancy" [Title/Abstract]) OR ("postconception fertility control" [Title/Abstract]) OR (abortion, legal [MeSH Terms]) OR ("menstrual regulation" [Title/Abstract]) OR (abortion\*[Title/Abstract]) OR (abortion, induced [MeSH Terms])) NOT (("in vitro fertilization"[Title/Abstract]) NOT ("in vitro fertilisation" [Title/Abstract]) NOT (in vitro fertilization[MeSH Terms]) NOT ("threatened abortion" [Title/Abstract]) NOT (animals [MeSH Terms]) NOT (miscarriage [MeSH Terms]))) AND (((((((((((((((((((((((mental health[MeSH Terms]) OR "mental health" [Title/Abstract]) OR disorder, anxiety [MeSH Terms]) OR depression [MeSH Terms]) OR disorder, mental [MeSH Terms]) OR "mental disorder" [Title/Abstract]) OR mental health service [MeSH Terms]) OR "mental health service" [Title/Abstract]) OR mental health services, community [MeSH Terms]) OR "psychiatric assessment" [Title/Abstract]) OR "self esteem" [Title/Abstract]) OR suicide [MeSH Terms]) OR attempted suicide [MeSH Terms]) OR ptsd [MeSH Terms]) OR depression [Title/Abstract]) OR anxiety [Title/Abstract]) OR trauma [MeSH Terms]) OR schizophrenia [MeSH Terms]) OR substance related disorders [MeSH Terms]) OR disorder, psychotic [MeSH Terms]))))

APPENDIX 2: BACKGROUND INFORMATION ON STUDIES (N=36)

Reference	Country/Region	Design	Study Period	Setting	Sample	Intervention Group	Comparison Group	Unintended pregnancy	Aim	Outcome
Biggs et al (2015)	United States	Prospective longitudinal cohort study	Jan 2008 to Dec 2010 (+3 years)	Turnaway study <sup>1</sup>	Baseline N= 956 English- or Spanish-speaking women aged 15 years or older with no fetal anomalies or demise Final N= 877 participants	First-trimester abortion n=254 'Turnaway' - live birth n=160	Near-limit abortion n=413	Yes	To assess the occurrence of new depression and anxiety diagnoses in women 3 years after they sought an abortion.	Depression, Anxiety
Biggs et al (2016)	United States	Prospective longitudinal cohort study	Jan 2008 to Dec 2010 (+ 4 years)	Turnaway study <sup>1</sup>	Baseline N= 956 English- or Spanish-speaking women aged 15 years or older with no fetal anomalies or demise Final N= 877 participants	First-trimester abortion n=254 'Turnaway' - live birth n=160	Near-limit abortion n=413	Yes	To prospectively assess women's risk for post-traumatic stress disorder and of experiencing post-traumatic stress symptoms over 4 years after seeking an abortion and to assess whether symptoms are attributed to the pregnancy, abortion or birth, or other events in women's lives.	Post-traumatic stress disorder (PTSD) and Post-traumatic stress symptoms (PTSS)
Biggs et al (2017)	United States	Prospective longitudinal cohort study	Jan 2008 to Jan 2016	Turnaway study <sup>1</sup>	Baseline N= 956 English- or Spanish-speaking women aged 15 years or older with no fetal anomalies or demise Final N= 877 participants	First-trimester abortion n=254 'Turnaway' - live birth n=160	Near-limit abortion n=413	Yes	To assess women's psychological well-being 5 years after receiving or being denied an abortion.	Depression, Anxiety, Self-esteem and Life satisfaction
Biggs et al (2018)	United States	Prospective longitudinal cohort study	Jan 2008 to Dec 2010 (+5 years)	Turnaway study <sup>1</sup>	Baseline N= 956 English- or Spanish-speaking women aged 15	First-trimester abortion n=254	Near-limit abortion n=413	Yes	To assess the effects of receiving compared with being denied an abortion on women's	Suicidal Ideation

Reference	Country/Region	Design	Study Period	Setting	Sample	Intervention Group	Comparison Group	Unintended pregnancy	Aim	Outcome
					years or older with no fetal anomalies or demise Final N= 877 participants	'Turnaway' - live birth n=160			experiences of suicidal ideation over 5 years.	
Coleman et al (2002)	United States	Retrospective cohort study	1989 to 1994	MediCal	N=54419 women, with no prior psychiatric history 1 year prior to history	Pregnancy ended in abortion n=14297	Pregnancy ended in live birth n=40122	Not stated	To compare the rates of first-time outpatient psychiatric claims for 4 years following either an abortion or a birth among women receiving medical assistance through the state of California	Outpatient psychiatric treatment
Coleman et al (Dec 2002)	United States	Retrospective cohort study	not stated	National Pregnancy and Health Survey	N= 607 women who recently delivered a child with either a previous pregnancy resulting in abortion or live birth.	Gravida 2, para 1 (induced abortion) n=74	Gravida 2, para 2 (live birth) n=531	Not stated	To examine the correlation when substance use is measured specifically during a subsequent pregnancy.	Substance use
Cogle, Reardon and Coleman(2003)	United States	Retrospective cohort study	1980 to 1992	NLSY	N=1884 women who experienced their first pregnancy even (abortion or childbirth)	Abortion n=293	Live-birth n=1591	Not stated	To compare women with a history of abortion vs. delivery relative to depression.	Depression
Cogle, Reardon and Coleman (2005)	United States	Retrospective cohort study	1995	NSFG - Cycle V	N = 10847 women aged 15-44 years of age	Abortion n=1033	Live-birth n=1813	Yes	To determine if symptoms of anxiety reported by some women who have induced abortions are significant enough to be observed in a nationally representative sample.	Anxiety

Reference	Country/Region	Design	Study Period	Setting	Sample	Intervention Group	Comparison Group	Unintended pregnancy	Aim	Outcome
Fergusson Horwood and Ridder	New Zealand	Longitudinal cohort study.	1977 to 2002	Christchurch Health and Development Study	N=520 women aged 15-18 years N=510 women aged 18-21 years N=506 women aged 21-25 years	Live-birth 15-18 years n=28 18-21 years n=84 21-25 years n=131	Abortion 15-18 years n=14 18-21 years n=51 21-25 years n=74	Yes	To examine the linkages between having an abortion and mental health outcomes over the interval from age 15-25 years.	Major depression, anxiety, suicidal ideation, alcohol dependence, illicit drug dependence
Fergusson, Horwood and Boden (2008)	New Zealand	Longitudinal cohort study	1977 to 2007	Christchurch Health and Development Study	N=534 women at age 30 with information on pregnancy history and mental health outcomes.	Abortion	No pregnancy	Yes	To examine the links between pregnancy outcomes and mental health outcomes.	Major depression, anxiety, suicidal ideation, alcohol dependence, illicit drug dependence
Foster et al (2015)	United States	Prospective longitudinal cohort study	Jan 2008 to Dec 2010	Turnaway study <sup>1</sup>	Baseline N= 956 English- or Spanish-speaking women aged 15 years or older with no fetal anomalies or demise Final N= 877 participants	First-trimester abortion n=254 'Turnaway' - live birth n=160	Near-limit abortion n=413	Yes	To assess the mental health outcomes among women seeking abortions, by comparing women having later abortions to women denied abortions, up to two years post-abortion seeking.	Depression, anxiety
Gomez (2018)	United States	Retrospective cohort study	2001-2008	National Longitudinal Study on Adolescent Health (Add Health) 80 schools were selected by urban city, region, school type, racial/ethnicity	N= 848 students recruited in grade 7-12 during 1994-1995, wave 3 interviews N=438 students recruited in grade 7-12 during 1994-1995. wave 4 interviews	Unwanted first-pregnancy ending in abortion wave 3 n=204 wave 4 n=121	Unwanted first-pregnancy ending in live-birth wave 3 n=644 wave 4 n=317	Yes	To understand whether there was a relationship between having an abortion and subsequent depressive symptoms among women who experienced unwanted first pregnancies in young adulthood.	Depression

Reference	Country/Region	Design	Study Period	Setting	Sample	Intervention Group	Comparison Group	Unintended pregnancy	Aim	Outcome
				composition, and school size						
Karalis et al (2017)	Finland	Retrospective cohort study	2001-2012	Statistics Finland; Finnish Cause-of-death Register; National Institute for Health and Welfare (THL)	N= 10427 deceased women of reproductive age (15-49 years) N=268 pregnancy associated deaths	Abortion 2001 - 2012 n=87	Abortion 1987 - 2000	Not stated	To investigate mortality in the non-pregnant fertile female population, and mortality during pregnancy and up to 1 year after the end of pregnancy, in Finland from 2001 to 2012 and compare the results with those of 1987–2000.	Pregnancy-associated death
Leppalahti et al (2016)	Finland	Retrospective cohort study	1987-2012	Finnish Medical Birth Register; Finnish Hospital Discharge Register; Register on Induced Abortions; Register on Social Assistance; Register on Child Welfare Central; Population Register	N=26,747	Abortion n=1041	No pregnancy n=25312	Yes	To assess whether underage induced abortion is associated with adverse early adulthood outcomes.	Psychiatric disorder, psychoactive substance use disorder, mood disorder, neurotic or stress-related disorder, injury, and poisoning by medication and drugs.
Munk-Olsen et al (2011)	Denmark	Population-based cohort study	1997 - 2007	Danish Civil Registration system; Danish Psychiatric Central Register; Danish National Register of Patients	N = 84620 women who had a first time first-trimester induced abortion	Before Abortion n=868	After Abortion n =1277	Not stated	To assess the risk of a first psychiatric contact after first-trimester induced abortion, as compared with before the event; we also looked at the risk of a first psychiatric contact after, as compared with before, childbirth.	Psychiatric contact for affective disorder, psychiatric contact for neurotic, stress-related, or somatoform



Reference	Country/Region	Design	Study Period	Setting	Sample	Intervention Group	Comparison Group	Unintended pregnancy	Aim	Outcome
										disorder, psychiatric contact for personality or behavioural disorder, and psychiatric contact for any other diagnosis
Munk-Olsen et al (2012)	Denmark	Population-based cohort study	Jan 1994, to Dec 2007	Danish Civil Registration system; Danish Psychiatric Central Register; Danish National Register of Patients	N= 2838 Women born in Denmark between 1962 and 1992 with a record of a mental disorder and had a first-time first-trimester induced abortion.	Before Abortion	After abortion	Not stated	To study whether having a first-trimester induced abortion influenced the risk of psychiatric readmission and compare findings with readmission risk in women with mental disorders giving birth.	Psychiatric re-admission
Olsson et al (2014)	Australia	Population-based longitudinal study	2001 to 2003	Victorian Adolescent Health Cohort Study, 44 government, independent, and Catholic schools were chosen to represent each school stratum in the state of Victoria.	N=821 female participants both pregnancy history and psychosocial data at 24 years	Abortion	No pregnancy	Not stated	To compare social and emotional adjustment including educational attainment and substance use in women who had a child, pregnancy termination, or miscarriage by young adulthood.	Depressive symptoms, psychosocial, substance abuse
Pedersen (2007)	Norway	Retrospective cohort study	1992, 1994, 1991 and 2005	Young in Norway Longitudinal Study - 11-year follow-up of a representative sample of	N=761 representative sample of young women, monitored at intervals over a	Abortion n=76	No pregnancy n=461	Not stated	To investigate the possible linkages between deliveries, abortions and subsequent nicotine dependence, alcohol	Substance use

Reference	Country/Region	Design	Study Period	Setting	Sample	Intervention Group	Comparison Group	Unintended pregnancy	Aim	Outcome
				Norwegian adolescents and young adults.	period of 11 years.				problems and use of cannabis and other illegal drugs from the ages of 15–27 years.	
Pedersen (2008)	Norway	Retrospective cohort study	1992, 1994, 1991 and 2005	Young in Norway Longitudinal Study, an 11-year follow-up of a representative sample of Norwegian adolescents and young adults.	N=761 representative sample of young women, monitored at intervals over a period of 11 years.	Abortion	No pregnancy	Not stated	The aim of the study was to investigate whether induced abortion was a risk factor for subsequent depression.	Depression
Reardon and Cogle (2002)	United States	Retrospective cohort study	1980-1992	NLSY	N=421 had their first abortion or first unintended delivery between 1980 and 1992	Abortion n=293	Live-birth (unintended pregnancy) n=128	Yes	To examine whether prior psychological state is equally predictive of subsequent depression among women with unintended pregnancies regardless of whether they abort or carry to term.	Depression
Reardon et al (2003)	United States	Retrospective cohort study	Jul 1988 to Jun 1994	MediCal Records of women aged 13–49 years at the time of either abortion or childbirth during 1989.	N=56741 women who had no psychiatric admissions or pregnancy events during the year before the target pregnancy event	Abortion n=15299	Live-birth, no subsequent abortion n=41442	Not stated	To compare psychiatric admission rates of women in time periods from 90 days to 4 years after either abortion or childbirth.	Psychiatric admission
Reardon, Coleman and Cogle (2004)	United States	Retrospective cohort study.	1979 to 1988	NLSY	N=1852 cross-sectional sample of noninstitutionalized civilian citizens of the United States, born between Jan 1,	Abortion n=213	Live-birth (unintended pregnancy) n=535	Yes	The purpose of this study was to explore any differences in subsequent substance use between women who carry an unintended pregnancy to term and those who	Substance use

Reference	Country/Region	Design	Study Period	Setting	Sample	Intervention Group	Comparison Group	Unintended pregnancy	Aim	Outcome
					1957, and Dec 31, 1964, with a supplementary oversample of blacks, Hispanics, and poor whites.				have an induced abortion, while controlling for potential confounding factors including pre-pregnancy psychological state.	
Reardon et al (2002)	United States	Retrospective cohort study.	1989 to 1997	MediCal California death certificates for 1989 to 1997	Women who had an induced abortion or a delivery in 1989 and linked to death certificates for 1989 to 1997.	Abortion n=50,260	Live-birth n=83,690	Not stated	To examine this association using an American population over a longer period.	Deaths associated
Rees and Sabia (2007)	United States	Longitudinal cohort study.	1998 to 2003	Fragile Families and Child Wellbeing Study, publicly available secondary data on approximately 4900 new mothers living in 20 large cities in the United States.	N= 2844 mothers who participated in all three waves of the study who had a child between February 1998 and September 2000.	Abortion n=99	No pregnancy n=1732	Not stated	To test if abortion is associated with a different risk of major depression (MD) symptomatology than other pregnancy outcomes after adjusting for prior depression.	Depression
Roberts, Rocca, Foster (2014)	United States	Prospective longitudinal cohort study	Jan 2008 to Dec 2010 (+2 years)	Turnaway Study <sup>1</sup>	Baseline N= 956 English- or Spanish-speaking women aged 15 years or older with no fetal anomalies or demise Final N= 877 participants	First-trimester abortion n=254 'Turnaway' - live birth n=160	Near-limit abortion n=413	Yes	To examine the relationship between receiving versus being denied abortion and trajectories (or changes over time) of drug use from one-week through two-years after seeking abortion.	Substance use
Roberts et al (2015)	United States	Prospective longitudinal cohort study	Jan 2008 to Dec 2010 (+2 and a half years)	Turnaway Study <sup>1</sup>	Baseline N= 956 English- or Spanish-speaking women aged 15 years or older with no fetal	First-trimester abortion n=254 'Turnaway' -	Near-limit abortion n=413	Yes	To examine the relationship between receiving versus being denied a pregnancy termination and trajectories of alcohol	Alcohol use

Reference	Country/Region	Design	Study Period	Setting	Sample	Intervention Group	Comparison Group	Unintended pregnancy	Aim	Outcome
					anomalies or demise Final N= 877 participants	live birth n=160			consumption from one week through two and one-half years after seeking termination.	
Roberts and Foster (2015)	United States	Prospective longitudinal cohort study	Jan 2008 to Dec 2010 (+2 and a half years)	Turnaway Study <sup>1</sup>	Baseline N= 956 English- or Spanish-speaking women aged 15 years or older with no fetal anomalies or demise Final N= 877 participants	First-trimester abortion n=254 'Turnaway' - live birth n=160	Near-limit abortion n=413	Yes	To investigate the relationship between receiving versus being denied an abortion and subsequent tobacco use through 2 years after abortion-seeking.	Tobacco
Roberts et al (2018)	United States	Prospective longitudinal cohort study	Jan 2008 to Dec 2010 (+5 years)	Turnaway Study <sup>1</sup>	Baseline N= 956 English- or Spanish-speaking women aged 15 years or older with no fetal anomalies or demise Final N= 877 participants	First-trimester abortion n=254 'Turnaway' - live birth n=160	Near-limit abortion n=413	Yes	To examine whether alcohol, tobacco, or drug use findings persist over the study's entire 5-year period.	Alcohol use, tobacco use, drug use
Schmiege and Russo (2005)	United States	Longitudinal cohort study	1970 to 1992	NLSY	N=1247 youth who aborted or delivered an unwanted first pregnancy.	Abortion n=479	Live-birth n=768	Yes	To examine the outcomes of an unwanted first pregnancy (abortion v live delivery) and risk of depression and to explain discrepancies with previous research that used the same dataset.	Depression
Steinberg and Russo (2008)	United States	Retrospective cohort study	Jan to Oct 1995	NSFG NCS	N=3482 women unintended first pregnancies (N=6694 women first pregnancies)	Abortion n=1166	Live-birth n=2316	Yes	To examine the relation of anxiety after first pregnancy outcome (abortion vs. delivery) controlling for pre-pregnancy anxiety,	Anxiety

Reference	Country/Region	Design	Study Period	Setting	Sample	Intervention Group	Comparison Group	Unintended pregnancy	Aim	Outcome
									violence exposure, and other relevant covariates.	
Steinberg, Becker, Hendersen (2011)	United States	Retrospective cohort study	1990 to 1992	NCS	N=1765 women who have had either an abortion or delivered a first pregnancy (N=2062 women reported having been pregnant at least once.)	Abortion n=218	Live-birth n=1547	Not stated	To examine the prevalence of clinically diagnosed major depression and its most serious complication, suicidal ideation, and the level of self-esteem in a nationally representative sample of women in the United States, after an abortion.	Depression, suicidal ideation, lower self-esteem
Steinberg, McCulloch and Adler (2014)	United States	Retrospective cohort study	Feb 2001 to Apr 2003	NCS - Replication	N= 936 English-speaking women aged 18 to 42 years living in non-institutionalized civilian population	Abortion n=259	Live-birth n=677	Not stated	To examine whether a first abortion increases risk of mental health disorders compared with a first childbirth with and without considering pre-pregnancy mental health and adverse exposures, childhood economic status, miscarriage history, age at first abortion or childbirth, and race or ethnicity.	Anxiety disorder, mood disorder, impulse-control disorder, substance use disorder, eating disorder, suicidal ideation
Steinberg and Finer (2011)	United States	Retrospective cohort study	1990 to 1992	NCS	N= 3045 women who reported having a pregnancy end in delivery, miscarriage/stillbirths, or abortion	Abortion n=399	No abortion n=2646	Not stated	To test the replicability of the previous National Comorbidity Survey findings that “The results of this study revealed that women who have aborted are at a higher risk for a variety	Anxiety disorder, mood disorder, substance use disorder

Reference	Country/Region	Design	Study Period	Setting	Sample	Intervention Group	Comparison Group	Unintended pregnancy	Aim	Outcome
									of mental health problems including anxiety (panic attacks, panic disorder, agoraphobia, PTSD), mood (bipolar disorder, major depression with and without hierarchy) and substance abuse disorders when compared to women without a history of abortion after controls were instituted for a wide range of personal, situational, and demographic factors” (Coleman et al 2009).	
Sullins (2016)	United States	Retrospective cohort study	1994 to 2009	National Longitudinal Study of Adolescent to Adult Health	N=3152 ever pregnant women	Abortion	No abortion	Not stated	To examine the links between pregnancy outcomes (birth, abortion, or involuntary pregnancy loss) and mental health outcomes for US women during the transition into adulthood to determine the extent of increased risk, if any, associated with exposure to induced abortion.	Depression, anxiety, suicidal ideation, alcohol abuse, drug abuse, cannabis abuse, nicotine dependence
Warren, Harvey and Henderson (2010)	United States	Retrospective cohort study	1994 to 2002	National Longitudinal Study of Adolescent to Adult Health, adolescents	N= 289 women with at least one pregnancy between Wave 1 and Wave 2	Abortion n=69	No abortion n=220	Yes (identified however intended pregnancy not excluded)	To examine whether abortion in adolescence was followed by depression and low self-esteem, using data from the National Longitudinal Study of	Depression, low self-esteem

Reference	Country/Region	Design	Study Period	Setting	Sample	Intervention Group	Comparison Group	Unintended pregnancy	Aim	Outcome
				interviewed at home					Adolescent Health (Add Health).	
Weng et al (2018)	Taiwan	Case-control study	2000 to 2012	National Health Insurance Research Database, National Birth Registry, and National Death Registry	N= 485 women who attempted suicide N=350 women who completed suicide	Abortion Attempted suicide n=40 Completed suicide n=29	Live birth Attempted suicide n=200 Completed suicide n=107	Not stated	To investigate the risks of attempted and completed suicide in women who experienced a stillbirth, miscarriage, or termination of pregnancy within 1 year postnatal and compare this risk with that in women who experienced a live birth.	Attempted suicide, completed suicide

MediCal, California Department of Health Services; NCS, National Comorbidity Survey; NLSY, National Longitudinal Survey of Youth; NSFG, National Survey of Family Growth

1 Turnaway study 30 abortion facilities in 21 U.S. states.

## APPENDIX 3: QUALITY ASSESSMENT OF STUDIES

Table 6: Quality assessment of comparable cohort studies: USA

Reference	Study design	Data set/cohort reference	Outcomes	JBI overall score	Strengths	Weaknesses	Strength*
Biggs et al (2015)	Prospective longitudinal cohort study	Turnaway study	Depression, anxiety	91%	Appropriate comparison group (women who presented for abortions up to 3 weeks over a facility's gestational limit and who were denied abortions) and women who had received first-trimester abortions to Near-limits (women who were also seeking abortion later in pregnancy); accounts for pregnancy intention; control for pre-existing mental health illness; thorough confounder control	Low participation rate (selection bias); some mental health outcomes are self-reported; differential participation by study groups	Very good
Biggs et al (2016)	Prospective longitudinal cohort study	Turnaway study	Post-traumatic stress disorder (PTSD), post-traumatic stress symptoms (PTSS)	86%	Appropriate comparison groups; thorough confounder control, thorough account of the contextual environment contributing to the mental health outcomes is provided; abortion is not self-reported; accounts for pregnancy intention	Findings limited to symptoms of PTSD and not clinical diagnosis; low participation rate (selection bias)	Very good
Biggs et al (2017)	Prospective longitudinal cohort study	Turnaway study	Depression, anxiety, self-esteem, life satisfaction	84%	Appropriate comparison groups; thorough confounder control, abortion is not self-reported; validated mental health measures; controlled for pre-existing mental health illnesses; accounts for pregnancy intention	Low participation rate (selection bias); differential loss to follow-up during the final phases of the study	Very good
Biggs et al (2018)	Prospective longitudinal cohort study	Turnaway study	Suicidal ideation	84%	Appropriate comparison groups; validated mental health measures; abortion is not self-reported; thorough confounder control; accounts for pregnancy intention	Self-reported mental health outcomes (potential for reporting/information bias); reasons for loss to follow-up not provided (potential for selection bias)	Very good
Coleman, Reardon et	Retrospective cohort study	National Pregnancy and Health Survey	Substance use	40%	Follow-up time long enough for outcomes to occur	Inappropriate comparison groups; no control for pre-existing mental health illness; abortion is self-reported (reporting bias),	Very poor



Reference	Study design	Data set/cohort reference	Outcomes	JBI overall score	Strengths	Weaknesses	Strength*
al (Dec 2002)						mental health outcomes self-reported (reporting bias); does not account for pregnancy intention	
Coleman , Rue et al (2002)	Retrospective cohort study	California Department of Health Services	Outpatient psychiatric treatment	55%	Physician diagnosis of mental health outcomes using specific diagnostic codes, abortion not self-reported	Inappropriate comparison groups; does not account for intention of pregnancy; multiple confounders not adjusted for; limited contextual information: no data on race, marital status assistance through the state of California	Poor
Cogle, Reardon and Coleman (2003)	Retrospective cohort study	National Longitudinal Survey of Youth	Depression	55%	Validated mental health measures	Inappropriate comparison groups; does not account for intention of pregnancy; pre-existing mental health measured using an invalidated tool (Rotter scale, a weak control for pre-existing mental health illnesses), differential exclusion criteria (excluded women with subsequent abortions only from the delivery group and not the abortion group (potential for selection bias)	Poor
Cogle, Reardon and Coleman (2005)	Retrospective cohort study	National Survey of Family Growth	Generalised anxiety	63%	Appropriate comparison groups, controlled for pre-existing mental health illnesses (however, subject to recall bias)	Self-reported - subject to recall bias. Limited confounders. Differential exclusion criteria (excluded women with subsequent abortions from the delivery group but not from abortion group - selection bias.	Moderate
Foster et al (2015)	Prospective longitudinal cohort study	Turnaway study	Depression, anxiety	84%	Appropriate comparison group (women who presented for abortions up to 3 weeks over a facility's gestational limit and who were denied abortions) and women who had received first-trimester abortions to Near-limits (women who were also seeking abortion), late), thorough confounder control, controlled for pre-existing mental health issues; conducted sensitivity analyses to address incomplete follow-up; accounts for pregnancy intention	Reasons for loss-to-follow-up not provided; low participation rate (selection bias);	Very good

Reference	Study design	Data set/cohort reference	Outcomes	JBI overall score	Strengths	Weaknesses	Strength*
Gomez (2018)	Retrospective cohort study	National Longitudinal Study on Adolescent Health (Add Health)	Depression	85%	Appropriate comparison groups, accounts for pregnancy intention; controlled for pre-existing mental health illness	Potential for information bias due to under-reporting of abortion, classification of pregnancy intention is retrospective and subject to recall bias, limitations on the validity of the tool used to measure depression	Very good
Reardon and Cogle (2002)	Retrospective cohort study	National Longitudinal Study of Youth	Depression	50%	Validated mental health measures, appropriate comparison groups; accounts for pregnancy intention	Pre-existing mental health measured using an invalidated tool, abortion is self-reported (reporting bias), differential exclusion criteria (excluded women with subsequent abortions from the delivery group only and not the abortion group (potential for selection bias)	Very poor
Reardon et al (2003)	Retrospective cohort study	California Medicaid (Medi-Cal) records of women aged 13–49 years at the time of either abortion or childbirth during 1989.	Psychiatric admission	60%	Abortion is not self-reported; controlled for pre-existing mental health illness	Inappropriate comparison groups; does not account for pregnancy intention; limited contextual information; limited confounder control	Poor
Reardon, Coleman and Cogle (2004)	Retrospective cohort study.	National Longitudinal Survey of Youth (NLSY)	Substance use	55%	Appropriate comparison group, accounts for pregnancy intention	Abortion is self-reported (reporting bias); questionable control for pre-existing mental health issues; use of invalidated scales for measuring mental health outcomes; differential exclusion criteria (excluding women with subsequent abortions only from the delivery group)	Poor
Reardon et al (2002)	Retrospective cohort study	California Medicaid records linked to death certificates for 1989 to 1997	Deaths associated with induced abortions	45%	Abortion is not self-reported	Inappropriate comparison groups; does not account for pregnancy intention; limited contextual information; limited confounder control; limited control for pre-existing mental health issues	Very poor
Rees and Sabia (2007)	Longitudinal cohort study	Fragile Families and Child Wellbeing Study	Depression	41%	Controlled for pre-existing mental health illness; validated mental health measures	Inappropriate comparison groups; does not account for pregnancy intention; abortion is self-reported (reporting bias)	Very poor

Reference	Study design	Data set/cohort reference	Outcomes	JBI overall score	Strengths	Weaknesses	Strength*
Roberts, Rocca, Foster (2014)	Prospective longitudinal cohort study	Turnaway study	Substance use	80%	Appropriate comparison groups; no differential loss-to-follow up; accounts for pregnancy intention; thorough confounder control	Reasons for loss-to-follow-up not provided; low participation rate (selection bias)	Good
Roberts et al (2015)	Prospective longitudinal cohort study	Turnaway study	Alcohol use	80%	Appropriate comparison groups; accounts for pregnancy intention; thorough confounder control	Reasons for loss-to-follow-up not provided; low participation rate (selection bias)	Good
Roberts and Foster (2015)	Prospective longitudinal cohort study	Turnaway study	Tobacco use	80%	Appropriate comparison groups; abortion is not self-reported; accounts for pregnancy intention, thorough confounder control	Reasons for loss-to-follow-up not provided; low participation rate (selection bias)	Good
Roberts et al (2017)	Prospective longitudinal cohort study	Turnaway study	Alcohol use, tobacco use, drug use	73%	Appropriate comparison groups; abortion is not self-reported; accounts for pregnancy intention	Reasons for loss-to-follow-up not provided; low participation rate (selection bias); health outcomes self-reported	Good
Schmiege and Russo (2005)	Longitudinal cohort study	National Longitudinal Survey of Youth (NLSY)	Depression	55%	Appropriate comparison groups, validated mental health measures, better variable coding and sampling methods; abortion is not self-reported; accounts for pregnancy intention	Limited contextual information is provided, questionable control of pre-existing mental health issues, abortion is self-reported (reporting bias)	Poor
Steinberg and Russo (2008)	Retrospective cohort study	USA National Survey of Family Growth (NSFG) and National Comorbidity Survey (NCS) secondary data analyses	Anxiety	73%	assessment of multiple forms of violence and the measurement of 3 clinical anxiety disorders.	STUDY 1: NSFG Controlled for pregnancy intention but mental health variables didn't include valid diagnostic measure; whereas STUDY 2 NCS didn't control for pregnancy intention. Retrospective secondary data analysis.	Good
Steinberg, Becker, Hendersen (2011)	Retrospective cohort study	USA National Comorbidity Survey	Depression, suicidal ideation, lower self-esteem	61%	Controlled for most known confounders inc violence abuse. Validated mental health measures	Underreporting likelihood (but ref eg Schmiege). Pregnancy intention not controlled for. Analysis adjusted for marital status, education, and income only at the time of the interview and not at the time of the first pregnancy. Inappropriate comparison groups	Moderate

Reference	Study design	Data set/cohort reference	Outcomes	JBI overall score	Strengths	Weaknesses	Strength*
Steinberg, McCulloch and Adler (2014)	Retrospective cohort study	USA National comorbidity survey NCS replicated	Anxiety disorder, mood disorder, impulse-control disorder, substance use disorder, eating disorder, suicidal ideation	61%	Validated mental health measures, controlled for pre-existing mental health; appropriate comparison groups	Reporting bias - self-reported. Likely inaccuracy mental health diagnoses. Limitations of comparison groups.	Moderate
Steinberg and Finer (2011)	Retrospective cohort study	USA National Comorbidity Survey - reanalysis of data from Coleman et al 2006	Anxiety disorder, mood disorder, substance use disorder	73%	Validated mental health measures. Detailed confounder control. Useful review of various conceptual frameworks: Abortion as trauma; abortion as stress; common risk factors approach.	Secondary data. Inappropriate comparison group (does not account for pregnancy intention), abortion is self-reported (reporting bias)	Good
Sullins (2016)	Retrospective cohort study	National Longitudinal Study of Adolescent to Adult Health	Depression, anxiety, suicidal ideation, alcohol abuse, drug abuse, cannabis abuse, nicotine dependence	68%	Theory driven, thorough confounder control, controlled for pre-existing mental health issues	Inappropriate comparison groups, does not account for pregnancy intention; abortion is self-reported (reporting bias), subject to recall bias due to use of cross-sectional data	Moderate
Warren, Harvey and Henderson (2010)	Retrospective cohort study	National Longitudinal Study of Adolescent to Adult Health	Depression, low self-esteem	45%	Validated mental health measures; accounts for pregnancy intention	Inappropriate comparison groups (abortion group included miscarriages and stillbirths; analysis included unintended and wanted pregnancies) , abortion is self-reported (reporting bias); low statistical power (due to a small sample size)	Very poor

Table 7: Quality assessment of a cohort study: Australia

Reference	Study design	Data set/cohort reference	Outcomes	JBI overall score	Strengths	Weaknesses	Strength*
Olsson et al (2014)	Population-based longitudinal study	Victorian Adolescent Health Cohort Study (VAHCS). 44 government, independent, and Catholic schools were chosen to represent each school stratum in the state of Victoria.	Depressive symptoms, psychosocial, substance abuse	55%	Validated mental health measures; controlled for pre-existing mental health illness	Inappropriate comparison groups; does not account for pregnancy intention; abortion is self-reported (reporting bias)	Poor

Table 8: Quality assessment of comparable cohort studies: Denmark

Reference	Study design	Data set/cohort reference	Outcomes	JBI overall score	Strengths	Weaknesses	Strength*
Munk-Olsen et al (2011)	Population-based cohort study	Danish Civil Registration system; Danish Psychiatric Central Register; Danish National Register of Patients	Psychiatric contact for affective disorder, psychiatric contact for neurotic, stress-related, or somatoform disorder, psychiatric contact for personality or behavioural disorder, and psychiatric contact for any other diagnosis	64%	Abortion is not self-reported; controlled for pre-existing mental health illness; physician diagnosis of mental health outcomes using specific diagnostic codes	Inappropriate comparison groups; does not account for pregnancy intention; limited contextual information due to use of record-linkage data; limited confounder control	Moderate
Munk-Olsen et al (2012)	Population-based cohort study	Danish Civil Registration system; Danish Psychiatric Central Register; Danish National Register of Patients	Psychiatric re-admission	55%	Abortion is not self-reported; physician diagnosis of mental health outcomes using specific diagnostic codes	Inappropriate comparison groups; does not account for pregnancy intention; abortion and childbirth groups not mutually exclusive); limited contextual information due to use of record-linkage data; limited confounder control (potential for selection bias).	Poor

Table 9: Quality assessment of comparable cohort studies: Finland

Reference	Study design	Data set/cohort reference	Outcomes	JBI overall score	Strengths	Weaknesses	Strength*
Karalis et al (2017)	Retrospective cohort study	Statistics Finland; Finnish Cause-of-death Register; National Institute for Health and Welfare (THL)	Pregnancy-associated death	55%	Abortion is not self-reported	Inappropriate comparison groups; does not account for pregnancy intention; limited contextual information; limited confounder control	Poor
Leppalahti et al (2016)	Retrospective cohort study	Finnish Medical Birth Register; Finnish Hospital Discharge Register; Register on Induced Abortions; Register on Social Assistance; Register on Child Welfare Central; Population Register	Psychiatric disorder, psychoactive substance use disorder, mood disorder, neurotic or stress-related disorder, injury, and poisoning by medication and drugs.	64%	Thorough confounder control	Inappropriate comparison groups; does not account for pregnancy intention; limited information on contextual factors, limited generalisability due to liberal abortion laws which are unlikely to impact the outcome of pregnancy; included women with multiple pregnancies	Moderate

Table 10: Quality assessment of comparable cohort studies: New Zealand

Reference	Study design	Data set/cohort reference	Outcomes	JBI overall score	Strengths	Weaknesses	Strength*
Fergusson et al (2006)	Prospective longitudinal cohort study	Christchurch Health and Development Study	Major depression, anxiety, suicidal ideation, alcohol dependence, illicit drug dependence	45%	Validated mental health measures; thorough confounder control; accounts for pregnancy intention	Inappropriate comparison groups, abortion is self-reported (reporting bias), limited control for pre-existing mental health illness (up to 15 years of age), restrictive abortion laws (potential for selection bias, increased likelihood of mental disorders among abortion group).	Very poor
Fergusson et al (2008)	Prospective longitudinal cohort study	Christchurch Health and Development Study	Major depression, anxiety, suicidal ideation, alcohol dependence, illicit drug dependence	73%	Validated mental health measures; thorough confounder control; accounts for pregnancy intention	Abortion is self-reported (reporting bias), limited control for pre-existing mental health control (up to 15 years of age), and restrictive abortion laws (potential for selection bias).	Good



Table 11: Quality assessment of comparable cohort studies: Norway

Reference	Study design	Data set/cohort reference	Outcomes	JBI overall score	Strengths	Weaknesses	Strength*
Pedersen (2007)	Retrospective cohort study	Young in Norway Longitudinal Study - 11-year follow-up of a representative sample of Norwegian adolescents and young adults.	Substance use	50%	Adequate confounder control; controlled for pre-existing mental health illness	Inappropriate comparison groups; does not account for pregnancy intention; abortion is self-reported (reporting bias)	Very poor
Pedersen (2008)	Retrospective cohort study	Young in Norway Longitudinal Study, an 11-year follow-up of a representative sample of Norwegian adolescents and young adults.	Depression	45%	Validated mental health measure	Abortion is self-reported (reporting bias), inappropriate comparison groups; does not account for pregnancy intention; limited control of pre-existing mental health	Very poor

Table 12: Quality assessment of a case-control study: Taiwan

Reference	Study design	Data set/cohort reference	Outcomes	JBI overall score	Strengths	Weaknesses	Strength*
Weng et al (2018)	Population-based case-control study	National Health Insurance Research Database, National Birth Registry, and National Death Registry	Attempted suicide, completed suicide	71%	Population-based case-control study	Inappropriate comparison groups; does not account for pregnancy intention; inadequate control for critical confounding variables, abortion group could potentially include women who terminated pregnancies due to medical reasons	Good

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