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A Detailed Examination of the Data on Surgical Abortion and Preterm Birth

Overwhelming evidence from 168 studies over fifty years points to a clear dose-response relationship between surgical abortion and subsequent preterm birth. The 2018 National Academy of Sciences report considered only five of these 168 studies and represents a biased sample that underreports a significant association between surgical abortion and subsequent preterm birth. The purpose of this document is to review the quality of the data on this effect, review the size of this effect, and portray an accurate assessment of the data to improve informed consent prior to surgical abortion.

Background

Preterm Birth

An overview of preterm birth (PTB) and its relationship with abortion is provided separately (see Practice Guideline 5). However, the incidence of PTB is important to establish for the statistics presented in this deeper review.

PTB is defined as delivery before term, i.e. before 37 weeks and affects about one in ten deliveries in the United States. The majority (70%) of babies born before 37 weeks are born at 34 to 36 weeks. About 10% of PTB (1-2% of all U.S. deliveries) occur before 32 weeks and are termed "very preterm births." Very preterm births pose greater risks to the neonate and greater costs to the family and system. For this reason, some studies analyze deliveries before 37 weeks and deliver before 32 weeks (or even lower gestational ages) separately in order to give nuanced meaning to their results. In this document, very preterm birth will be specified as delivery before 32 or 28 weeks, and when PTB and these deliveries are discussed in quick succession, PTB may be spelled out specifically as delivery before 37 weeks.

The NAS Report

The National Academy of Sciences (NAS) recently released a report on the safety of abortion.[1] This report addressed the purported association between induced abortion and PTB, but limited the studies they used to assess this link. Their criteria for studies included:

- Objective documentation of prior abortion (excluding spontaneous abortion, i.e. miscarriage)

AAPLOG Practice Guideline. This document was developed by three authors on the Research Committee. Practice Guidelines are evidence-based documents informing pro-life providers with high-quality, peer-reviewed literature.

- Comparison of women with prior abortion (the study group) with women with no abortion history (a control group)
- Statistical methods that control for mental health prior to the abortion (if mental health is an outcome)
- Published in 2000 or later, including abortions performed in 1980 or later (studying current abortion methods)
- Similar clinical settings and care delivery to the United States

The authors further stated that the studies meriting attention and discussion should control for confounding variables, such as smoking status, maternal age at abortion, type of abortion (surgical or medication), weeks of gestation at abortion, and number of previous abortions.

The authors posited that, of 168 studies linking PTB to surgical abortion, only five met their criteria for inclusion. Even if the criteria set forth are appropriate, there over 70 studies that meet these criteria (see Appendix A). However, no explanation is provided for omitting such a large portion of the medical literature. While the report did admit that multiple abortions increase the risk for PTB, their conclusions about overall safety misrepresent the data.

The majority of the data on this topic is on surgical abortion, and that is the focus of this document is the association between PTB and surgical abortion, even though some medication abortion outcomes are included in the studies discussed. Here, for simplicity's sake, surgical abortion for termination of pregnancy is referred to as "abortion" Miscarriage and medication abortion will be specifically described as *spontaneous abortion* (SAB) and *medication abortion* respectively. "Induced abortion" is a term that appears in the literature on this topic because there is often mixing of outcomes between elective and spontaneous abortion. However, this document will simply use "abortion," and contrast it with SAB.

Woolner et al. (2014) is the major study that the NAS relies on to conclude there is no association between abortion and PTB in a subsequent pregnancy.[2] Woolner et al. 2014 includes data from a single site in Scotland from 1986 to 2010. However, this paper's conclusion *contradicts* the findings of other studies by two of its own coauthors. One of these studies (Battacharya et al. 2012) uses the same Scottish database examined by Woolner et al., but find an increased risk of preterm birth (PTB) among women after surgical abortion, compared to women with no abortion, with a relative risk (RR) of 1.37 (95% CI 1.32-1.42). [3] This increase in risk is statistically significant, meaning it is unlikely due to chance, as can be seen from the 95% confidence interval that does not cross 1.0 (1.0 represents no change from the baseline risk). The 95% confidence interval means we can be 95% sure that the true result falls between 1.32 and 1.42, and if it included 1.0, we could not be sure that abortion had any effect on PTB. This specific RR means that women with a prior abortion are 37% more likely to experience a subsequent PTB, increasing their rate from 10% to about 14%.

Battacharya et al. had several strengths over Woolner et al. First, it included a larger number of women (457,477 women without a prior abortion and 120,033 with a history of

abortion). Second, Bhattacharya et al. 2012 adjusted their analysis for smoking, but Woolner et al. was unable to adjust for this known confounder in PTB studies. Third, Bhattarya et al. also controlled for the type of abortion performed (medication or surgical). In contrast, Woolner et al. included failed medication abortions that required subsequent surgical completion with the total surgical abortion numbers. Fourth, Bhattarya et al. utilized known gestational age (i.e. < 13 weeks) to evaluate for risk of PTB on a national level, not a single site as had Woolner et al.[3] For these reasons, Woolner et al. is a poorer study to rely upon, given that a similar but larger dataset exists and contradicts the smaller, less well-designed study.

Early Evidence of an Association

Papers that examined multiple smaller studies (reviews) on abortion and PTB first emerged in the United States in 2003.[10,11] Rooney and Calhoun (2003) reviewed studies from 1966-2003 and found 49 studies with a statistically significant risk for PTB after abortion.[11]

Meanwhile, the association between abortion and PTB has been known in the international community since at least 1973.[21] The Hungarian government was warned about the evidence of a link between abortion and PTB thanks to work by Dr. Jeno Sarkany.[12] As a result, Hungary passed restrictive legislation regarding elective abortion, citing increased social and medical burden from PTB. This legislation reduced the abortion rate in Hungary from 57% of all pregnancies in 1969 to 38% in 2000.[13]

Evidence in the Early 21st Century

The meta-analysis by Swingle et al. (2009) was performed authors who held different political beliefs on abortion, to reduce bias.[16] This team reviewed 7,891 titles, 349 abstracts, and 130 manuscripts, finally identifying 12 papers about the risk of PTB after abortion and 9 papers on PTB after spontaneous abortion (SAB) with data available for analysis.

Four of the 12 studies on abortion had data available for common odds ratios (OR) to calculate the odds of PTB less than 32 weeks associated with surgical abortion. The common OR for these studies was 1.64 (95% CI 1.38-1.91).[16] Odds ratios are different from relative risk, but this result is equivalent to a change in the rate of delivery before 32 weeks from about 1.5% (the U.S. baseline rate before 32 weeks), to about 2.3% after one abortion.

This study also found an increased risk of PTB after SAB. Out of the 9 studies available to pool a common odds ratio for PTB after SAB, 7 had data for use in calculations. The authors found that the odds of PTB less than 37 weeks after one SAB was 1.43 (95% CI 1.05-1.66), and with more than 2 SABs, 2.27 (95% CI 1.98-2.81).[16]

Of note, PTB after abortions is not related to PTB after SAB. The causes of SAB are internal to the woman or embryo, and may also predispose the mother to preterm birth, especially after recurrent SAB. However, this is different from the cause of abortion, which is a mechanical dilation and removal of the fetus despite the mother's capacity to carry him. Further, abortion is an avoidable

epidemiological risk factor for PTB; SAB, on the other hand, is an unfortunate, often unpreventable, outcome of a desired pregnancy for most women.

Shah et al. conducted a separate analysis in the same year as Swingle et al. (2009).[17] These authors screened 834 papers and identified 22 studies on PTB after abortion, which included 268,379 women.[17]

Shah et al. found a significantly increased risk for PTB after one abortion (OR 1.36, 95% CI 1.24-1.50).[17] These odds mean the rate of birth before 37 weeks after one abortion is 13%, compared to the baseline 10%. Seven of these 22 studies reported rates of PTB after two or more abortions, including 158,421 patients. Among these women, there was an increased risk for PTB (OR 1.93, 1.38-2.71).[17] This translates to an increase in risk from 10% to about 18%, nearly doubling the risk. These ORs and related increases in rate of PTB to between 13% and 18% demonstrate a dose effect of abortion: the more abortions, the higher the subsequent risk of PTB.

Oppenraaij et al. (also 2009) combined 13 studies and found increased risk of very PTB (birth before 32 weeks) as well as PTB before 37 weeks with one abortion. They also detected a dose effect with more than 2 abortions.[18] The authors conclude

> a history of TOP [termination of pregnancy] is associated with an increased risk for PPROM, PTD, and VPTD. These risks depend on the number of TOP.[18]

Lowit et al. (2010) also found an increased risk of PTB before 37 and 32 weeks in an analysis that combined 7 systematic reviews (including 4 meta-analyses), one prospective study, 12 retrospective studies, and five case-control studies.[19] The authors conclude that "[c]urrent evidence … suggest an association between IA [induced abortion] and pre-term birth."[19]

More Recent Evidence

Saccone et al. (2016) included 36 studies in a systematic review and meta-analysis; 31 of these looked at abortion, and 5 looked at dilation and curettage (D&C) after SAB. A total of 1,047,683 women were included among all these studies.[20] The authors controlled for bias with best practices including planning analyses before selecting included studies, having two authors select studies, using the Methodological Index for Non-Randomized studies, and performing the Higgins test for heterogeneity across studies. Women with one prior abortion had a significantly increased risk of PTB (OR 1.52, 95% CI 1.08-2.16), translating to a risk increase from 10% to 14%.[20] The authors concluded that "prior surgical evacuation of the uterus may be an independent risk factor for PTB."[20]

In 2020, Laelago et al. performed a systematic review and meta-analysis of abortion and PTB in East Africa. Their study included 58 studies with 134,801 participants. Pooled analysis of four studies found that prior abortion or stillbirth was significantly associated with PTB. The adjusted odds ratio of PTB in this study was 3.93 (95% CI 2.70-5.60), which is dramatically different from other ORs on this topic. This may be a result of the mixing of stillbirth (and possible SAB) and abortion, which are different physiological entities and result in different management. This is a weakness of this study. The strength

of this study consists of the inclusion of eleven East African countries finding similar increased PTB risks with abortion.[22] While this study needs confirmation, it suggests that affects from abortion on PTB may span across ethnicities and geographic regions.

Another Approach to Preterm Birth

Since the NAS report is missing significant parts of the available body of data, another attempt at listing and assessing the quality of studies is provided in this document. A rubric was utilized to evaluate the quality of the studies linking abortion history with PTB (see Table 1). This rubric included nine criteria: sample size, generalizability, consent to participate rate, abortion concealment, control for potentially confounding variables, inclusion of a control group, strength of measures or preterm birth, prospective data collection, and attrition rate (longitudinal studies only). Each criterion was worth 0-4 points for a total of 36 points.

Studies on surgical abortion and delivery before 37 weeks are laid out in Table 2, and studies on very preterm birth are laid out in Table 3. A few are worth describing in more detail.

Freak-Poli, et al. (2009) used data from South Australia from 1998-2003 and included maternal smoking history. This study encompassed 42,269 deliveries with 39,191 term births and 3,078 PTBs.[23] They also demonstrated a dose effect: after one abortion, the adjusted odds ratio (aOR) for PTB was 1.35 (95% CI 1.08-1.68), and after two or more abortions, this jumped to 1.63 (95% CI 1.28-2.08).[23] These odds ratios translate to an increase in risk from the baseline 10% to

Voigt, et al. (2009) evaluated 8 German federal states in a retrospective cohort study of 247,593 women delivering their first child preterm.[24] The rate of PTB for women with one prior abortion was 7.8% and for more than 2 abortions, 8.5%. In contrast, only 6.5% of the control group, who had no prior abortion, delivered preterm, a statistically significant difference ($p = 0.015$).[24] A weakness of this study is that the data on prior abortion was self-reported, and some patients may have concealed this. However, concealment tends to weaken associations, because the women concealing their history distribute any effect of abortion into the control group, making the groups behave more uniformly. Thus, concealment in this case might be hiding an even larger effect of PTB. The evaluation of the quality of this study was 29 out of a possible 36 points.

Ancel et al. (2004) is a case control study of 2,938 PTBs and 4,781 controls at term from 10 European countries. This study found increased odds of preterm birth before 28 weeks after one abortion (OR 1.34, 95% CI 1.08-1.68), and even higher odds of delivery before 28 weeks with two or more abortions (OR 1.82, 95% CI 1.34-2.49).[25] These odds ratios are similar to those from other studies, but the corresponding elevation in risk of PTB will vary based on the baseline rate of PTB in each included country. The evaluation of the quality of this study was 21 out of a possible 36 points.

about 13% after one abortion, and about 15% with two or more abortions, which is consistent with other studies described earlier. One of the key strengths of the study was the internal validation of the database with patient records regarding

Table 1. Rubric for Evaluating the Scientific Merit of Studies on Abortion History and Subsequent Preterm Birth					
Score	**0**	**1**	**2**	**3**	**4**
Sample size	50 or fewer	51-199	200-399	400-999	1000 or more
Generalizability	Restricted to 1 city *or* self-selected *or* clinical *or* convenience sample	2-4 cities within 200 miles of each other	≥5 cities over 200 miles apart with no evidence the sample represents the population	≥5 cities over 200 miles apart with evidence that the sample approximates the population	≥5 cities over 200 miles apart with nationally representative sample *or* international study including 3 or more nations.
Consent to participate rate	Not available or < 20%	20 - 39%	40 - 59%	60 - 79%	≥80% *or* population-based
Abortion concealment	Includes women prone to concealment*	Concealment rates equivalent to typical studies on abortion	Methodology employed some effort to reduce concealment	Methodology employed extensive strategies to reduce concealment	No concealment *or* record-based data *or* data secured at an abortion clinic
Control for potentially confounding variables	No controls for potential confounders	≤5 demographic control variables	≥6 controls not restricted to demographic factors	≥6 controls, not restricted to demographic factors and including prior PTB	≥6 controls, not restricted to demographic factors and including prior PTB and pregnancy intendedness
Control group	No control group *or* control group had different abortions (medication/surgical or early/late) *or* control is partner	Women with no reproductive event or women from the general population	Women who gave birth without intendedness identified	Other form of perinatal loss (miscarriage, stillbirth, adoption placement)	Unintended pregnancy delivered with or without women having actively considered abortion
Strength of measures or preterm birth	Use of fewer than 10 self- reported measures of outcomes.	Use of fewer than 10 self-report measures with some evidence of PTB association	Use of ≥10 self-reported measures with established association with PTB	Use of ≥10 self-reported measures with established association with PTB *plus* another form of data other than self report.	PTB diagnosed by a trained professional using a well- developed linkage of data or protocol
Prospective data collection	One post-abortion assessment or retrospective	Two or more post-abortion assessments	Two or more assessments, with the first occurring between the time of abortion or within 6 month of the procedure	Pre and post- abortion assessments with ≥1 post- abortion assessment(s) < 1 year post- procedure	Pre-abortion assessment(s) and extensive assessments from ≥1 month before to ≥ 1 year post- procedure
Retention rate (longitudinal studies only)	≤ 44%	45 - 59%	60 - 74%	75 - 89%	90-100%
* Women at increased risk of concealment include minors, victims of domestic violence, highly religious or conservative background					

demographics, previous pregnancy outcomes, gestational age, hypertension, IUGR, and antepartum hemorrhage (see Table 2).[23] The evaluation of the strength of this study was 33 out of 36.

There were 3 informative studies on PTB (before 37 weeks) and abortion in 2011.[23,26,27] The Di Renzo et al. database-linked study was a multicenter cross-sectional evaluation of preterm vaginal delivery in 9 centers in Italy.[27] The authors eliminated cesarean deliveries from their analysis due to the inability to control for the varying trends in indication for these deliveries. The records were linked to outcomes at each center within the central database. The investigators performed a power analysis prior to beginning the research. They determined that 6,000 women would be necessary in their population to see a statistically significant difference in the PTB rate in their population. Their sample included 7,634 vaginal deliveries. The authors performed a multivariable regression to assess confounding variables, but did not differentiate between number of prior abortions or types of obstetric history (e.g. did all prior pregnancies end in abortion, or was there one abortion after prior full-term deliveries).

Di Renzo et al. found an increased odds of PTB of (OR 1.954, 95% CI 1.162-3.285), which corresponds to an increase from their baseline PTB of 5% to about 9%. The evaluation of the quality of this study was 33 out of a possible 36 points.

The evaluation of the quality of Bhattacharya et al. (2012) previously discussed, was 27 out of 36 points.

Finally, Malosso et al. (2018) studied the rate of PTB compared to abortion between 2003 to 2012 in U.S. databases (which are not linked).[38] Specifically, this study used data from National Vital Statistics Reports and Center of Disease and Prevention. This study found the progression toward more medication abortion and fewer surgical abortions was significantly associated with the decrease in PTB in the U.S. since 2001 ($p < 0.05$).[38] The study suffered from lack of linkage of the data and correlation coefficients as a quantitative assessment. The correlation coefficient only assesses the co-variation as opposed to causation. Also, the authors did not address the magnitude of the secular trend to decrease iatrogenic preterm births during the study period. This could bring bias into the data collected as a result of changes in general practice not related to induced abortion. The evaluation of the quality of this study was 22 out of a possible 36 points.

A comprehensive list of studies on surgical abortion and preterm birth is provided in Appendix A.

Another Approach to Very Preterm Birth

Just as delivery before 37 weeks needed a comprehensive approach, so too does very preterm birth, or delivery before 32 weeks (in some studies, 28 weeks). Very preterm birth only represents about 1-2% of PTB in the U.S. but results in significant cost and morbidity due to infant prematurity. The same rubric was utilized to evaluate studies on very preterm birth (see Table 3).

Levin et al. (1980) compared pregnancy loss and PTB before 28 weeks with those who

Table 2. Application of Criteria to Published Studies from 2004 to 2018 Preterm Birth < 37 weeks

Citation and Synopsis	Sample size	Generalizability	Consent to participate rate	Abortion concealment	Attrition (Retention)	Control for confounders	Control group	Strength of PTB measures	Prospective data collection	**Total**
Liao et al., 2011 Cohort study from 7 hospitals in Chendu, China including 4 years of study from January 2006-December 2009. OR 1.4 (95% CI 1.1-1.8) of PTB after 1 surgical abortion. OR 1.62 (95% CI 1.27-3.42) of PTB after 3 or more surgical abortions (dose effect). OR 2.18 (95% CI 1.51-4.42) of PTB with medication and surgical abortions	4	0	4	2	1	3	1	2	4	21
Di Renzo et al., 2011 Database-linked study; multicenter, observational, cross-sectional study of PTB and vaginal deliveries in 9 centers in Italy. OR 1.95 (95% CI 1.16-3.29) of PTB after any previous abortion(s) no matter when the abortions occurred in the patients' reproductive history.	4	4	4	3	4	3	4	3	4	33
Freak-Poli et al., 2009 Data from South Australia about preterm birth < 37 weeks and with induced abortion with adjusted (aOR) of 1.63 (95% CI 1.28-2.08) of PTB after one abortion, aOR 1.35 (95% CI 1.08-1.68) of PTB after 2 or more abortions (dose effect).	4	4	4	4	4	3	4	2	4	33

Table 2, continued

Citation and Synopsis	Sample size	Generalizability	Consent to participate rate	Abortion concealment	Attrition (Retention)	Control for confounders	Control group	Strength of PTB measures	Prospective data collection	**Total**
Voigt, et al 2009 Evaluation of 8 German federal states in a retrospective cohort study with increased risk of PTB < 36 weeks and < 31 weeks.	4	4	4	2	3	3	3	3	3	29
Ancel, et al 2004 Case control study from 10 European countries OR 1.34 (95% CI 1.08-1.68) PTB before 28 weeks with 1 abortion and OR of 1.82 (95% CI 1.34-2.49) after two or more abortions.	4	4	0	2	2	1	3	1	4	21
Laelago, et al 2020 Systematic review and meta-analysis of East African countries finding aOR of 3.93 (95% CI 2.70-5.70) for PTB before 37 weeks after abortion/stillbirth.	4	4	1	2	3	2	3	1	1	21

delivered at term (after 37 weeks).[28] Women who had two or more induced abortions had a 2- to 3-fold risk of very preterm birth. The evaluation of the quality of this study was 25 out of a possible 36 points.

Lumley (1998) provided the RR of very preterm birth of a woman's first singleton according to her prior obstetric history (no prior pregnancy, prior abortion, or prior miscarriage).[29] The paper includes 243,679 deliveries between 1983 to 1992 in Australia. Women who had an abortion had a higher risk of delivery before 28 weeks and before 32 weeks compared to women with no prior pregnancy. This demonstrated a dose effect.[29] Weaknesses of the study included possible confounding with regard to maternal age, marital status, birth defect, tobacco, socioeconomic status, and alcohol use. In spite of this, the author notes:

> The data meet four of the criteria for causality. The temporal sequence is clear: the abortions preceded the preterm birth. The association is a strong one. There is a dose-response relationship: the greater the number of prior pregnancies the higher the relative risk. The association is plausible: possible mechanisms exist.[29]

The evaluation of the quality of this study was 33 out of a possible 36 points.

Moreau et al. used data from the EPIPAGE study, which evaluated delivery between 22 and 32 weeks in nine French regions.[30] The study included 1,943 deliveries before 33 weeks, 276 deliveries between 33 and 34 weeks, and 618 unmatched term controls (39-40 weeks). After abortion, women had increased odds of delivery between 22 and 27 weeks (OR 1.8, 95% CI 1.1-2.8) and between 28 and 32 weeks (OR 1.7, 95% CI 1.0-2.8). The study's strength was its control for confounding variables. The evaluation of the quality of this study was 28 out of a possible 36 points.

Smith et al. (2006) analyzed risk with induced abortion and spontaneous PTB in 84,391 first births in Scotland between 1992 and 2001.[31] A strength of this study is the use of Cox proportional hazards modeling to determine the association between abortion and the increase in risk of PTB. The authors found an increased risk of PTB at 24-32 weeks with a hazard rate of 1.19 (95% CI 1.06–1.34) with one abortion and a 1.9 (95% CI 1.44–2.49) with two or more abortions, demonstrating a dose effect with a positive trend test ($p < 0.001$).[31] The evaluation of the quality of this study was 33 out of a possible 36 points.

Klemetti et al. (2012) compared 300,858 women experiencing their first delivery between 1996 and 2008 and used the Finnish abortion registry between 1983 and 2008 to understand which women had undergone abortions prior to this delivery.[32] 31,083 women had one abortion before their first continued pregnancy, 4513 had two abortions, and 93 had three or more abortions. Women with one prior abortion had nonsignificantly increased odds of delivery before 28 weeks (aOR 1.19, 95% CI 0.98-1.44), but this became significant after 2 abortions (aOR 1.69, 95% CI 1.14-2.51) and for more than 3 abortions (aOR 2.78, 95% CI 1.48-5.24).[32] The study's strength was its completeness of records (excludes recall bias or concealment), and their exhaustive adjustment for confounders. The evaluation of the

Table 3. Application of Criteria to Published Studies from 1980 to 2018 for Very Preterm Birth <28-32 weeks

Citation and Synopsis	Sample size	Generalizability	Consent to participate rate	Abortion concealment	Attrition (Retention)	Control for confounders	Control group	Strength of PTB measures	Prospective data collection	**Total**
Levin, et al 1980 Compared pregnancy loss/preterm birth < 28 weeks with those who delivered at term. Women who had 2 or more induced abortions had 2-3 fold risk of PTD < 28 weeks.	2	0	4	3	3	4	3	3	3	25
Lumley, 1998 Data from Victoria, Australia demonstrating increased risk of delivery < 28 weeks and delivery < 32 weeks after surgical abortion. Demonstrated a dose effect noted with increasing risk of PTB with increasing numbers of induced abortions.	4	4	4	4	4	3	3	3	4	33
Moreau, et al 2005 Evaluated delivery between 22-32 weeks of gestation in 9 French regions. OR for PTB was 1.8 for 22-27 week delivery and 1.7 for 28-32 week delivery after surgical abortion.	4	4	1	3	3	3	3	3	4	28
Smith, et al 2006 Analyzed risk of spontaneous PTB after surgical abortion. Risk of PTB at 24-32 weeks increased of PTB with hazard ratio (HR) of 1.19 after one surgical abortion, 1.90 with two or more surgical abortions.	4	4	4	4	4	3	3	3	4	33

Table 3, continued

Citation and Synopsis	Sample size	Generalizability	Consent to participate rate	Abortion concealment	Attrition (Retention)	Control for confounders	Control group	Strength of PTB measures	Prospective data collection	**Total**
Klemetti et al., 2012 Registry study from Finland comparing birth outcomes after surgical abortion. Found increased risk of delivery < 28 weeks with OR 1.22 for PTB after one abortion, OR 1.86 after two abortions, and 3.38 after 3 or more abortions. Adjusted ORs found increased risk with two or more abortions.	4	4	4	4	3	3	4	4	4	34
Bhattacharya et al., 2012 Registry study from Scotland which found that women with previous medication or surgical abortion adjusted RR or PTB of 2.30 (95% CI 2.27-2.33). Missing smoking data on 50% patients and 25% of abortion type not listed (i.e. surgical/medication).	4	4	4	3	2	2	3	3	2	27
Scholten et al., 2013 National registry study from the Netherlands, interview-based. OR 1.52 (1.26-1.85) for delivery < 32 weeks. OR 1.67 (95% CI 1.30-2.15) for delivery < 28 weeks after abortion.	4	4	4	2	4	3	4	2	4	27
Hardy et al., 2013 Registry from Canadian database looking at deliveries <32, <28, and <26 weeks after abortions. Adjusted ORs after abortion were 1.45 (95% CI 1.11-1.90) for delivery < 32 weeks, 1.71 (95% CI 1.21-2.42) for delivery < 28 weeks, and 2.17 (95% CI 1.41-3.35) for delivery < 26 weeks.	4	1	4	2	3	2	2	3	4	25

Table 3, continued.

Citation and Synopsis	Sample size	Generalizability	Consent to participate rate	Abortion concealment	Attrition (Retention)	Control for confounders	Control group	Strength of PTB measures	Prospective data collection	**Total**
Zhou et al., 2014 Population–based prospective study in 14 cities in China that found OR 2.75 (95% CI 1.66-4.56) of pre-term premature rupture of membranes (PPROM) < 28 weeks after abortion.	4	4	4	4	4	3	4	3	4	34
Usynina et al., 2016 Registry of all births in a Russian county, found that after abortion, the adjusted OR was 1.96 (1.32-2.91) for delivery < 28 weeks and of 1.36 (95% CI 1.06-1.76) for delivery between 28 and 32 weeks.	4	4	4	3	3	3	4	3	4	32
Situ et al., 2017 Study from Finland demonstrating OR 1.51 (95% CI 1.03-2.23) of extremely preterm birth < 28 weeks after abortion.	4	4	4	4	3	3	4	4	4	34
Malosso et al., 2018 Study of abortion from 2003-2012 from National Vital Statistics Reports and Center of Disease and Prevention which found increased risk for PTB with surgical abortion and decreased PTB rates with medical abortion.	4	4	2	2	3	2	2	1	2	22

quality of this study was 34 out of a possible 36 points.

Scholten et al. (2013) investigated PTB after abortion using national registry study from the Netherlands.[33] In 16,000 women with a prior abortion, there were increased odds of delivery before 32 weeks (aOR 1.52, 95% CI 1.26-1.85) and before 28 weeks (aOR 1.67, 95% CI 1.30-2.15). A weakness of the study was its use of self-report of abortions, rather than registry data. The authors concluded that

> [w]omen who have had a termination of pregnancy have an increased risk of preterm delivery, cervical incompetence treated by cerclage, placental problems, and PPH [postpartum hemorrhage]

The evaluation of the strength of the quality of the study was 27 out of a possible 36 points.

Hardy et al. (2013) used a Canadian database (the McGill Obstetric and Neonatal Database) to examine deliveries before 26, 28, and 32 weeks after a prior abortion.[34] The study included 17,916 women between 2001 and 2006, of whom 2,276 (13%) had undergone one prior abortion, and 862 had undergone two or more abortions. The study described increased adjusted odds of delivery before 32 weeks (aOR 1.45, 95% CI 1.11-1.90), before 28 weeks (aOR 1.71, 95% CI 1.21-2.42), and before 26 weeks (aOR 2.17, 95% CI 1.41-3.35).[34] A limitation of the study was self-report to disclose a history of induced abortion. However, self-reporting tends to favor the null hypothesis if women do not disclose abortion. This would sort themselves incorrectly into the control group, equalizing the effects in both groups. A second limitation was the failure to differentiate whether the abortions were medication or surgical abortion, and whether they were done in the first or second trimester. The evaluation of the quality of this study was 25 out of a possible 36 points.

Zhou et al. (2014) performed a population–based prospective study of preterm prelabor rupture of membranes (PPROM) in 14 cities in China from 2001 to 2012.[35] 112,439 women were included in the analysis, of whom 3,077 (2.7%) had PPROM. Women were at increased odds of PPROM before 28 weeks after abortion (OR 2.75, 95% CI 1.66-4.56). The strength of the study is the ability to control for smoking, alcohol, medical history comorbidities, a family history of medical diseases, history of spontaneous miscarriage, fetal death, and fetal anomalies. The evaluation of the quality of this study was 34 out of a possible 36 points.

Usynina et al. (2016) using registry data from all 52,806 live births in a Russian county from 2006 to 2011.[36] Women who had undergone surgical abortion were at increased odds for delivery before 28 weeks (aOR 1.96, 95% CI 1.32-2.91) and delivery between 28 and 32 weeks (aOR 1.36, 95% CI 1.06-1.76). The strengths of this study were the ability to control for the morbidities of educational level, marital status, alcohol abuse, and diabetes and the large size. Limitations include possible under-reporting of alcohol abuse, pre-pregnancy BMI, and the lack of separation of induced and spontaneous miscarriages. The evaluation of the quality of this study was 32 out of a possible 36 points.

Situ et al. (2017) reported on 419,879 first deliveries with a singleton between 1996

and 2003.[37] Women who had a prior abortion had increased odds of delivering before 28 weeks (OR 1.51, 95% CI 1.03-2.23). Strengths of the study include the large number of first-time mothers with singleton births over an 18-year time frame, use of national registry linked data, and ability to analyze for induced abortions in multiple categories. Limitations of the study include lack of data on interpregnancy intervals and socioeconomic status. The authors attempted use smoking as a proxy for socioeconomic status. The evaluation of the quality of this study was 34 out of a possible 36 points.

A comprehensive list of studies on abortion and very preterm birth is provided in Appendix B.

Clinical Questions and Answers

Q *What about the increased risk of PTB due to D&C alone, regardless of abortion?*

Lemmers et al. (2016) confirmed the association between PTB and D&C. This meta-analysis reviewed 21 studies, including a total of 1,853,017 women who had undergone D&C for abortion or SAB.[21] Compared to women with no history of D&C, women with a prior D&C for any reason had an adjusted odds ratio of 1.29 for PTB (95% CI 1.17-1.42), and an adjusted odds ratio of 1.69 for PTB before 32 weeks (95% CI 1.20-2.38). This translates to an increased rate of birth before 37 weeks of 13% (from 10%) or birth before 32 weeks of 2.5% (from 1.5%). These results for very preterm birth are consistent with 31 other studies demonstrating a significantly increased risk of PTB with surgical abortion and D&C in general. (See Appendix B.)

Women with a history of multiple D&Cs compared with those with no D&C had an OR of 1.74 for PTB (95% CI 1.10-2.76), meaning an increase from 10% to 16%.

Lemmers concluded, "D&C is associated with an increased risk of subsequent preterm birth. The increased risk in association with multiple D&Cs indicates a causal relationship. Despite the fact that confounding cannot be excluded, these data warrant caution in the use of D&C for miscarriage and termination of pregnancy, the more so since less invasive options are available."[21]

This conclusion also concurs with Malosso et al., which finds that the rate of PTB has declined as medication abortions replace some surgical abortions.[38]

Rather than allowing us to dismiss the association between surgical abortion and PTB as "just due to D&C," this data confirms that the very procedure we are using to end pregnancy is the cause of increased risk of PTB. We, as women's healthcare professionals, must critically hold ourselves and our profession accountable for counseling women about risks related to the procedure or intervention.

Q *What about the increased risk of PTB due to short interval pregnancy after abortion?*

Short interval pregnancy, or short interpregnancy interval, is defined as a new pregnancy less than six months after the end of the prior pregnancy. The NAS report investigated whether the increased risk of

PTB after abortion is due to short interval pregnancy. That report concluded that the association between PTB and short interval pregnancy is inconsistent and may be related to other factors found in other studies.[6]

A recent examination of short interpregnancy interval using a better statistical model (within-mother analysis vs. between mother analysis) is thought to better assess confounding risk factors, like abortion. When within-mother analysis is used, the risk of PTB attributed to short interpregnancy interval alone is not significant (OR 1.07, 95% CI 0.86-1.34). This means that the higher ORs seen for abortion and PTB cannot be due to short interpregnancy interval alone.[7] The same result was shown with the use of conditional logistic regression, another technique meant to assess for confounding factors: short interpregnancy interval was not associated with PTB in 38,178 Canadian deliveries.[8]

Interestingly, the interval between pregnancies tends to be longer after abortions as shown in a 2017 analysis of 173,205 U.S. birth certificates. The same study showed that the number of previous abortions was not correlated with interpregnancy interval.[9]

Q *Observational studies cannot prove causality by definition, so how can the association between abortion and PTB ever be proven as causal?*

Prospective controlled studies cannot be done on autonomy-related behaviors such as abortion or tobacco use, since this would be unethically coercive.

The authors of some studies on abortion and PTB openly assert that their study cannot aid in proving causality because they are observational,[32] but the same assertion may be made regarding tobacco's association with lung cancer. Clinicians must act on the statistically sound observational data to establish reasonable certitude in clinical practice with regard to causation and guide their recommendations accordingly.

Q *Does the increased rate of PTB after abortion concur with low birth weight outcomes?*

Low birth weight (LBW) is defined as birth weight less than 2500 grams and occurs in 8% of deliveries in the United States. Out of the 18 studies on LBW analyzed by Shah et al. (2009), there were 280,529 patients available to compare at the level of individual patient data. The authors compared women with no abortions prior to their first delivery to women with one abortion prior to their first delivery. There was a significantly increased risk for LBW after one abortion (OR 1.35, 95% CI 1.20-1.52).[17] This means that from a baseline rate of 8%, the rate of LBW rises to about 11% after one abortion. Only 5 of 18 studies included LBW findings after two or more abortions, representing 49,347 patients. Using these patients, the pooled OR for LBW after two or more abortions was 1.72 (95% CI 1.45-2.04), meaning an increased rate from 8% to 13%. This difference in the rate of LBW after one (11%) and two or more (13%) abortions shows a dose

effect: the more abortions a woman undergoes prior to her first delivery, the higher the risk that her first neonate will have LBW.[17]

Saccone et al. (2010) also looked at LBW, and found an OR of 1.41 (95% CI 1.22-1.62) after one abortion. While Shah et al. did not find a statistically significant increase in small for gestational age (SGA) infants after abortion, Saccone et al. found a significant increase, with an odds ratio of 1.19 (95% CI 1.01-1.42).

Q *Most of the above data is about first trimester surgical abortion. What is the evidence for second trimester abortion and preterm birth?*

The NAS authors used the study by Woolner et al. 2014[2] and the study by Jackson et al. 2007[4] to evaluate the risk of PTB following medication and surgical abortion done later than 13 weeks. Both studies are unable to state whether later abortions are associated to an increase risk for PTB, but the NAS report does not include this disclaimer. Mirmilstein et al. 2009, a small study of 77 women who underwent second-trimester abortion with misoprostol, did find that this type of second trimester abortion was an independent risk factor for PTB.[5]

Q *What is the cost of abortion-related prematurity?*

A 2007 analysis reviewed studies done through 2005 on this topic, finding 59 studies that demonstrated an increased rate of PTB after abortion and translated the costs of abortion-related prematurity to $1.2 billion annually.[14, 23] Ten years later, McCaffrey (2017) estimated there had been a total of $52-57 billion in abortion-related hospital costs due to very preterm birth between 1973 and 2016.[15] These calculations did not include any of the costs after discharge related to the morbidity of prematurity, including cerebral palsy, retinopathy, bronchopulmonary dysplasia, deafness, and early intervention programs. As of December 2021, no one has yet to dispute these estimates of the impact on healthcare dollars by abortion.

Q *Have authors on this subject minimized their positive findings?*

Oppenrajj et al. (2009) attempts to attribute the increased rate of PTB after surgical abortion to confounders (smoking, unemployment, socioeconomic status, short interpregnancy interval), but later admit that there is an association.[18]

Lowit et al. (2010) write that the "effects of IA [induced abortion] on subsequent reproduction is sparse and conflicting" despite their review of 7 systematic reviews (including 4 meta-analyses), one prospective study, 12 retrospective studies, and five case-control studies, and their own conclusion that abortion is associated with PTB.[19]

Liao et al., (2011) buried an important clinical and statistical findings in their paper about medication abortions. Medication abortion before 7 week that requires D&C for completion was associated with increased odds of preterm birth (OR 1.69, 95% CI 1.02-3.16) and very preterm birth (OR 3.61, 95% CI 1.43-4.93). Combined, these outcomes occurred in 1 out of 10

patients who needed D&C after medication abortion, but this finding did not make it into the abstract.

Finally, the NAS report itself ignores the substantial body of literature regarding induced abortion and its association with PTB. About 77 studies meet their stated criteria, but are ignored in their analysis, while other studies (e.g. Woolson et al 2014) are included, despite not fulfilling these criteria perfectly.

Q *If the NAS Report admits that abortion is getting safer, shouldn't we expect to see some increased risk of PTB in past studies?*

Yes, an increased rate of PTB in past studies and a disappearance of this effect in more recent studies would be consistent with an improvement in the technique of abortion, making it less risky to women's future reproductive health.

There are a very few old studies (e.g. Levin et al. 1980) which demonstrate a very high increase in the rate of PTB after surgical abortion, but these are outliers. The majority of the meta-analyses and individual studies from the 1970s through the 2020s have demonstrated a significant, consistent increase in the risk of PTB after surgical abortion, regardless of the purported modernity of the method.

Summary of Recommendations and Conclusion

The following recommendations are based on good and consistent scientific evidence (Level A):

1. The report on abortion safety by the National Academy of Sciences does not reflect the majority of the literature on the increased risk of preterm birth after abortion.
2. One prior surgical abortion is associated with a statistically significantly higher odds of subsequent preterm birth (PTB), corresponding to a 13-14% risk, compared to the baseline rate of 10% in the United States.
3. Surgical abortions are associated with a "dose effect," meaning an increased number of abortions confer increasing risk of PTB.
4. Two or more prior surgical abortions is associated with significantly higher odds of subsequent preterm birth, corresponding to a 18% risk of subsequent preterm birth, compared to the baseline rate of 10% in the United States.
5. One prior surgical abortion is associated with significantly higher odds of having a subsequent very preterm birth (either 32 or 28 weeks' gestation), corresponding to a 2.3% risk, compared to the baseline rate of 1.5% in the United States.
6. One prior surgical abortion is associated with significantly higher odds of low birth weight (LBW), corresponding to an 11% risk of subsequent LBW

compared to the baseline rate of 8% in the United States.

7. Two or more prior surgical abortions is associated with is associated with significantly higher odds of low birth weight (LBW), corresponding to a 13% risk of subsequent LBW compared to the baseline rate of 8% in the United States.
8. The odds and corresponding risk of delivery before 37 weeks and before 32 weeks after D&C for any reason, are similar to the respective rates of delivery before 37 weeks and before 32 weeks after surgical abortion: 13% for one procedure, and 16% for multiple procedures.

The following recommendations are based on limited and inconsistent scientific evidence (Level B):

1. The etiologies of subsequent preterm birth after surgical abortion, compared to miscarriage or stillbirth, are different and should be approached differently.
2. Abortion-related prematurity has cost the United States more than $50 billion dollars since *Roe v. Wade.*
3. The increased rate of preterm birth after surgical abortion is likely related to the surgical procedure itself.

The following recommendations are based primarily on consensus and expert opinion (Level C):

1. The increased risk of preterm birth after surgical abortion should be included in informed consent for surgical abortion.

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Appendix A: Studies on Surgical Abortion and Preterm Birth

☒ *Denotes studies that included miscarriages and stillbirths as well as surgical abortions but did not report separate PTB/LBW risks*

🗠 *Denotes studies that found dose/response (the more abortions, the higher the risk)*

2010-2020

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Appendix B: Studies on Surgical Abortion and Very Preterm Birth

☒ *Denotes studies that included miscarriages and stillbirths as well as surgical abortions but did not report separate PTB/LBW risks*

🖂 *Denotes studies that found dose/response (the more abortions, the higher the risk)*

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