Induced Abortion and Subsequent Preterm Birth: Evidence of Risk Association

Byron C. Calhoun, M.D., FACOG, FACS, MBA
Professor & Vice-Chair, Department of Obstetrics & Gynecology
West Virginia University-Charleston

Moira Gaul, M.P.H.
Director of Women’s and Reproductive Health
Family Research Council, Washington, D.C.

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The abstracts, referenced studies, and two papers contained in this document provide evidence of a causal link between surgical induced abortion (IA) and subsequent preterm birth. One of the two papers at the conclusion of the document gives further consideration to this causal link with respect to both cost consequences and impact on informed consent.

**ABSTRACTS**

The following abstracts represent six studies which demonstrate the strongest and most significant risk association between IA and later preterm birth.


**ABSTRACT**

Secular trends in the prevalence of preterm birth and international comparisons of the rates of preterm birth are difficult to interpret because of differences, both formal and informal, in the registration of extremely preterm births. Accurate estimation of gestational age is another problem in the measurement of preterm birth. Preterm birth is heterogeneous in several ways. It is heterogeneous in terms of the extent to which the birth is preterm (20-27 weeks, 28-31 weeks or 32-36 weeks of gestation); in whether the birth was elective or spontaneous; and among spontaneous idiopathic preterm births, in whether there was preterm labour or premature rupture of the membranes. Case-control study designs taking account of these subgroups have been a recent feature of epidemiologic approaches. The classic social associations of preterm birth--low socioeconomic status, extremes of maternal age, primiparity, being unmarried--apply to extremely preterm and moderately preterm births as well as to the mildly preterm group. The strength of these associations is small compared with factors in the prior reproductive history and with medical and obstetric complications of the current pregnancy. Recent epidemiological research activities have focused on the ways in which risk factors such as physical workload, drugs and alcohol, lack of social support and infection might be mediating factors between sociodemographic status and preterm birth. As Eastman (1947) pointed out almost 50 years ago, 'only when the factors causing prematurity are clearly understood can any intelligent attempt at prevention be made'. [References: 74]


**DISCUSSION** (in lieu of Abstract)

The evidence for and against a causal relationship between prior shortened pregnancies and preterm birth is as follows. Selection bias into the study can be excluded since the data are population-based with 99.6% of births captured in the data system. Measurement error of the exposures cannot be totally excluded. Though the data have been validated against hospital records there is likely to be incomplete reporting of prior induced abortions in hospital records. Non-differential under-reporting would result in the relative risk being too low. Differential under-reporting is which prior abortions were more completely ascertained when there was a preterm birth could have occurred but the timing of data collection on prior pregnancies is at the first antenatal visit, before the outcome is known. Chance (random error) is unlikely since the 95% confidence intervals for the association with prior abortions do not include 1.00.

Confounding is likely. Maternal age, marital status and the presence of a birth defect in the index birth can be excluded since the associations in Figures 1 to 3 are still present at a similar level in a restricted data stratum of married women, age 20-34 years, with no birth defect in the index birth (unpublished data). Data on socioeconomic status, occupation, smoking, alcohol
consumption and other substance use are not collected routinely. The strength of association of these factors with preterm birth, however, is much smaller than the associations in Figures 1 to 3. The association of abortions with preterm birth cannot be explained by gravidity because the relative risks for prior births are different from prior pregnancies. Data on the gestation of the prior abortions, indications, complications, and inter-pregnancy intervals are not available in the routine perinatal data.

Termination of pregnancy has been legal under case interpretation of legislation since 1969 and the procedure is covered by the federal government universal health insurance system [4].

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 which are outlined below. The other criteria cannot be fully met a present: the study design (a retrospective cohort) is rated as moderate. Reversibility of the exposure is not applicable to these exposures. No other papers have reported an analysis stratified by gestation and by number of prior pregnancies so that the consistency of the findings cannot be assessed.

One possible mechanism is that cervical instrumentation can facilitate the passage of organisms into the upper part of the uterus, increasing the probability of inapparent infection and subsequent preterm birth [5]. Another is the removal of the endometrium carries a small risk of damaging the decidual stroma in such a way as to impair trophoblast invasion, migration and the full transformation of the maternal spiral arteries [6].


ABSTRACT

Objectives: To evaluate the risk of very preterm birth (22-32 weeks of gestation) associated with previous induced abortion according to the complications leading to very preterm delivery in singletons. Design: Multicentre, case-control study (the French EPIPAGE study). Setting: Regionally defined population of births in France. Sample: The sample consisted of 1943 very preterm live-born singletons (< 33 weeks of gestation), 276 moderate preterm live-born singletons (33-34 weeks) and 618 unmatched full-term controls (39-40 weeks). Methods: Data from the EPIPAGE study were analysed using polytomous logistic regression models to control for social and demographic characteristics, lifestyle habits during pregnancy and obstetric history. The main mechanisms of preterm delivery were classified as gestational hypertension, antepartum haemorrhage, fetal growth restriction, premature rupture of membranes, idiopathic preterm labor and other causes. Main Outcome Measures: Odds ratios for very preterm birth by gestational age and by pregnancy complications leading to preterm delivery associated with a history of induced abortion. Results: Women with a history of induced abortion were at higher risk of very preterm delivery than those with no such history (OR + 1.5, 95% CI 1.1-2.0); the risk was even higher for extremely preterm deliveries (< 28 weeks). The association between previous induced abortion and very preterm delivery varied according to the main complications leading to very preterm delivery. A history of induced abortion was associated with an increased risk of premature rupture of the membranes, antepartum haemorrhage (not in association with hypertension) and idiopathic spontaneous preterm labour that occur at very small gestational ages (< 28 weeks). Conversely, no association was found between induced abortion and very preterm delivery due to hypertension. Conclusion: Previous induced abortion was associated with an increased risk of very preterm delivery. The strength of the association increased with decreasing gestational age.
(4.) Stang P, Hammond AO, Bauman P. \textit{Induced Abortion Increases the Risk of Very Preterm Delivery; Results from a Large Perinatal Database.} \textit{Fertility Sterility} Sept 2005;S159

\textbf{ABSTRACT}

\textbf{Objective:} 49% of pregnancies among American women are unintended; 1/2 of these are terminated by abortion. In 2000, 1.31 million abortions took place in the USA. There has been debate over the impact of induced abortions (VTP) on future pregnancy outcome, particularly the risk of very preterm birth (<28 weeks). Sequelae of very preterm delivery remain a major public health burden. The objective of our study was to evaluate the association between prior induced abortions and birth before 28 weeks gestation. \textbf{Design:} Retrospective analysis of a perinatal data base. \textbf{Materials and methods:} Setting: 29 delivery units in the State of Schleswig-Holstein, Germany, between 1991 and 1997. Patients: 170,254 women with singleton pregnancies. Intervention: Univariate cross table analysis and logistic regression were conducted to determine the association between previous induced first trimester abortions and delivery before 28 weeks gestation. Main outcome measures: Maternal age, smoking, cervical incompetence, preterm premature rupture of membranes (PPROM), history of uterine hemorrhage before 28 weeks, maternal hypertension, delivery before 28 weeks. \textbf{Results:} 64586 nulliparous women were included, 4572 (7.1 %) of whom had up to 9 VTPs. Maternal age was 27.4 $\pm$ 4.7 years in controls and 29.1 $\pm$ 5.2 in the subjects. There was no difference in gestational age[(25.9 $\pm$ 1.9 weeks (controls), 25.4 $\pm$ 2.1 (subjects)]. Univariate relations between VTP and risk factors for preterm delivery are shown in table 1. Logistic regression demonstrated the following associations with delivery before 28 weeks: Cervical incompetence OR 4.46, CI 3.18-6.27; hemorrhage $<$ 28 wks, OR 3.33, CI 2.37 - 2.69; hypertension, OR 3.18, CI 2.17-4.67; PPROM, OR 4.67, CI 3.45-6.33, first trimester miscarriage, OR 1.67, CI 1.25-2.21, and VTP, OR 1.55, CI 1.07-2.34. There was no association between smoking or AMA and very preterm delivery.


\textbf{ABSTRACT}

\textbf{Background:} Nulliparous women are at increased risk of spontaneous preterm birth. Other maternal and biochemical risk factors have also been described. However, it is unclear whether these associations are strong enough to offer clinically useful prediction. It is also unclear whether the predictive power of these factors varies in relation to the degree of prematurity. \textbf{Methods:} The risk of spontaneous preterm birth associated with maternal characteristics and second trimester serum screening data was analysed in a dataset of 84 391 first births in Scotland between 1992 and 2001 using Cox and logistic regression. Variation in the relative risk of preterm birth over the period 24–36 weeks was assessed using a test of the proportional hazards assumption. \textbf{Results:} The risk of spontaneous preterm birth was positively associated with maternal serum levels of alpha-fetoprotein, socioeconomic deprivation, number of previous therapeutic abortions, smoking, and being unmarried and was negatively associated with height and body mass index. The risk of preterm birth at 24–28 weeks, but not later gestations, was increased in association with maternal levels of human chorionic gonadotrophin $>$95th percentile, maternal age $<$20, and two or more previous miscarriages. The area under the receiver operating characterise curve (95% CI) for models based on these factors was 0.67 (0.63–0.71) for 24–28 weeks, 0.65 (0.62–0.68) for 29–32 weeks, and 0.62 (0.61–0.63) for 33–36 weeks. \textbf{Conclusions:} Time to event analytic methods can identify factors that are differentially associated with spontaneous preterm birth according to the
degree of prematurity. However, models based on maternal and biochemical data perform poorly as a screening test for any degree of spontaneous preterm birth.


**ABSTRACT**

We compared prior pregnancy histories of two groups of multigravidas--240 women having a pregnancy loss up to 28 weeks' gestation and 1,072 women having a term delivery. Women who had had two or more prior induced abortions had a twofold to threefold increase in risk of first-trimester spontaneous abortion, loss between 14 to 19 and 20 to 27 weeks. The increased risk was present for women who had legal induced abortions since 1973. It was not explained by smoking status, history of prior spontaneous loss, prior abortion method, or degree of cervical dilatation. No increase in risk of pregnancy loss was detected among women with a single prior induced abortion. We conclude that multiple induced abortions do increase the risk of subsequent pregnancy losses up to 28 weeks' gestation.

**BIBLIOGRAPHY**

The following list provides 51 peer-reviewed studies demonstrating a significant risk between IA and subsequent preterm birth since 1989. This list is not exhaustive.

* studies that included spontaneous and induced abortions but did not report preterm birth and low birth weight (LBW) risk separately for each.

+ studies that found a dose response effect (signifying an increased risk of preterm birth following increased number of induced abortions.)

**1990s**


Mandelson MT, Maden CP, Daling JR. Low Birth Weight in Relation Multiple Induced Abortions. Am J Public Health 1992;82;391-394


2000-2007


A30  Foix-L'Helias L, Ancel, Blondel B. Risk factors for prematurity in France and


*A42* Conde-Agudelo A, Belizan JM, Breman R, Brockman SC, Rosas-Bermudez.

A43  Stang P, Hammond AO, Bauman P. Induced Abortion Increases the Risk of Very Preterm Delivery; Results from a Large Perinatal Database. *Fertility Sterility* Sept 2005;S159.


A51  Reime B, Schuecking BA, Wenzlaff P. Reproductive Outcomes in Adolescents Who Had a Previous Birth or an Induced Abortion Compared to Adolescents' First Pregnancies. *BMC Pregnancy and Childbirth* 2008;8:4.
Induced Abortion and Risk of Later Premature Births

Brent Rooney
Byron C. Calhoun, M.D.

ABSTRACT

At least 49 studies have demonstrated a statistically significant increase in premature births (PB) or low birth weight (LBW) risk in women with prior induced abortions (IAs). This paper will focus on the risk of early premature births (EPBs) (< 32 weeks gestation) and extremely early premature births (XPBs) (< 28 weeks gestation). Large studies have reported a doubling of EPB risk from two prior IAs. Women who had four or more IAs experienced, on average, nine times the risk of XBP, an increase of 800 percent.

These results suggest that women contemplating IA should be informed of this potential risk to subsequent pregnancies, and that physicians should be aware of the potential liability and possible need for intensified prenatal care.

Informed consent for an elective surgical procedure must generally cover long-term consequences and not just immediate risk. A woman considering an induced abortion (IA) should thus expect to be informed of potential effects on her fertility and the health of future infants, as well as her own future health. An elevated risk of bearing a child afflicted with a serious disability such as cerebral palsy might influence her decision, as well as future liability determinations by courts.

Low birth weight (LBW) and premature birth (PB) are the most important risk factors for infant mortality or later disabilities as well as for lower cognitive abilities and greater behavioral problems and thus contribute importantly to the liability exposure of obstetricians.

A literature review retrieved 49 studies that demonstrated at least 95 percent confidence in an increased risk of preterm birth (PB), or surrogates such as low birth weight or second-trimester spontaneous abortion, in association with previous induced abortions. A list of these studies, which probably does not comprise all such studies, is appended to this article. If these 49 statistically significant associations were the result of chance alone, as may happen in 5 of 100 tests, IA should be associated with a reduction in PBs, with P<.05, in an equivalent number of tests. Not one such instance has been found in the literature.

A MedLine search from 1966 to March, 2003, retrieved 8 studies that purportedly failed to show a significant increase in premature births after IA. Most showed an increase that did not reach statistical significance because of the small sample size: fewer than 1,000 pregnancies following an IA. In one, an increased risk of PB in women who had had an IA was nonsignificant when controlled for parity. These studies did not consider separately the risk of EPBs or XPBs, or the effect of multiple IAs, except one that showed a statistically significant increase of EPB, despite the statement in the abstract that “in the Netherlands there are no significant indications that spontaneous midtrimester abortions or premature deliveries are caused by a previous induced abortion.”

A 1986 review concluded that “more research is needed before it is clear whether multiple induced abortions carry an increased risk of adverse pregnancy outcomes.” The more recent, large studies discussed here help supply this lack.

Australian Study

A 1993 study in Victoria, Australia, involved 121,305 total births and compared the risk of PB and XBP in women with various numbers of IAs, compared with a control group of women who had no prior pregnancies (see Table 1, derived from data in this report).

Table 1: Premature birth risk by number of prior induced abortions (IAs) compared with outcome of first pregnancies, Victoria, 1986-1990

<table>
<thead>
<tr>
<th>Number of prior IAs</th>
<th>1</th>
<th>2</th>
<th>3 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestational age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-27 weeks (XPBs)</td>
<td>1.6</td>
<td>2.5</td>
<td>5.6</td>
</tr>
<tr>
<td>28-31 weeks</td>
<td>1.6</td>
<td>1.1</td>
<td>2.6</td>
</tr>
<tr>
<td>32-36 weeks</td>
<td>1.1</td>
<td>1.6</td>
<td>2.4</td>
</tr>
</tbody>
</table>

[RR = relative risk]

As Lumley explains:

The associations are different in the three gestation categories (20-27, 28-31, and 32-36 weeks), being particularly striking for births before 28 weeks. In this category, there is also evidence for a dose-response relationship between number of prior lost pregnancies and the prevalence of preterm birth: relative risks of 1.66 and 1.55 for one spontaneous or induced abortion, of 2.94 and 2.46 for two, and of 5.89 and 5.58 for three or more. These last four relative risks are substantially greater than any of those associated with maternal age, marital status, parity or socioeconomic status: that is, the association is most unlikely to be explained by confounding factors of a sociodemographic kind.

Lumley’s argument that “small single possible confounders cannot explain big risk factors such as 2.46 and 5.58” would also apply to any attempt to pose smoking or drug abuse as an explanation for the entire abortion-premature birth association.

The great majority of the Australian IAs were via vacuum aspiration; thus the PB risk cannot be attributed to dilation & curettage IAs.

The author noted that cross-sectional studies show that the relative risk of preterm delivery increases with the number of the previous preterm births, but that the risk of subsequent preterm births diminishes with each full-term delivery. Thus, IA removes the protective potential of a full-term delivery, as others have also observed.
In 1998, with twice the number of births (243,679) to analyze as in 1993,14 Lumley validated her 1993 results and additionally showed that women with four or more prior IAs had an XPB risk nine times that of primigravida.

**German Study**

Another large study of 106,345 births in Bavaria,16 including 85 percent of births in the state and 1,146 EPBs, showed a comparable dose-response curve (see Table 2, extracted from Table 2 in the Bavarian study), confirming the Australian finding of the greatest increased risk for the earliest premature infants.

In a multivariate analysis that included many of the possible confounding variables, including previous stillbirths, infertility treatment, age under 18 or over 35 years, malpresentation, premature rupture of membranes, and preeclampsia, the effect of even a single IA remained significant.

### Table 2: Odds ratio (OR) for premature births by number of prior induced abortions (IAs)

<table>
<thead>
<tr>
<th>Gestational age</th>
<th>1</th>
<th>2</th>
<th>3 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;32 weeks</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td></td>
<td>2.5 (1.96-3.27)</td>
<td>5.2 (3.28-8.34)</td>
<td>8.0 (3.89-16.6)</td>
</tr>
<tr>
<td>&lt;37 weeks</td>
<td>1.5 (1.35-1.76)</td>
<td>2.1 (1.54-2.81)</td>
<td>3.6 (2.25-5.62)</td>
</tr>
</tbody>
</table>

**Danish Study**

A 1999 study of Danish women14 is especially important because it used an IA registry, thus eliminating recall bias, the hypothesis that women with prior IAs who deliver prematurely are more accurate in reporting reproductive history than women who deliver at full term, as a possible explanation for the results.

This study of 61,753 women found an odds ratio for preterm birth at <34 weeks gestation of 1.99 (95% CI 1.64-2.43) for one prior IA and 2.03 (95% CI 1.36-3.04) for two or more prior IAs. Vacuum aspiration (VA) was the method used in 92.3 percent of all abortions. For VA, PB (gestation <37 weeks) odds ratios for 1, 2, 3 or more IAs were: 1.82, 2.45, and 2.00, respectively.

Dilation and evacuation increased the risk substantially. One evacuation was associated with a PB odds ratio of 2.27 whereas two prior evacuations had a very large odds ratio of 12.55.

**Mechanisms for Abortions Causing a Premature Birth Risk**

An accepted risk of surgical IA is incompetent cervix, which is a PB risk factor. Nulliparous women who have multiple IAs boost their odds of being over age 35 at their first term delivery, a risk factor for PB.14,15 Additional risk factors for PB that may be increased by abortion include uterine adhesions,14,15 infection,14,15 and mental distress.17

The evidence meets four of the criteria for determining causality:14 (1) the abortions preceded the premature births; (2) the association is strong; (3) there is a dose-response relationship; and (4) the association is plausible. A criterion for causality that could not be met in 1998 was confirmation by a prospective study. However, the Danish study identified all subsequent pregnancies until 1994 of the women under study, whose first pregnancies occurred in 1980, 1981, and 1982.14 Reversibility of the exposure is not applicable to this circumstance. Consistency of findings with earlier studies cannot be assessed because these were not stratified by length of gestation, number of prior pregnancies, and number of IAs.14 However, the large studies in Germany, Denmark, and Australia consistently support multiple prior IAs as boosting EPB risk.14,15 Only the Australian studies included an XPB category.14,15

**Liability and Informed Consent**

Recent litigation by women who claim that they were not fully informed about all the risks of an elective abortion, especially a possible increased lifetime risk of breast cancer, has drawn attention to the process of obtaining informed consent for this procedure. Moreover, even a signed consent form does not suffice to relieve a physician in the U.S. or Canada of the responsibility to withhold a treatment that he knows, or ought to know, is medically contraindicated.18 What level of risk will courts determine to constitute a medical contraindication?

Liability costs are especially high in cases involving damaged babies. The median damage award in cases of medical negligence in attending at childbirth was $2,050,000 between 1994 and 2000.21 Women are warned in a classic book covering 50 risk factors for PB that “if you have had one or more induced abortions, your risk of prematurity with this pregnancy increases by about 30 percent.”22 As shown here, the risk could be substantially higher than that, depending on the number of abortions and the method used.

It has been claimed that “induced abortion...is directly responsible for many thousands of cases of cerebral palsy—in North America alone—that otherwise would not have occurred.”23 Supporting this assertion is the fact that the cerebral palsy risk in XPB is about 38 times higher than in the overall population of newborns,16 in which the risk of cerebral palsy is approximately 2-3 per 1,000 births.20 As the liability costs for cerebral palsy are exceptionally high, induced abortion, particularly without very detailed informed consent, may carry an unsupportable legal liability. Courts may not require definitive proof of causation; the existence of a number of positive studies, in the absence of definitive refutation, may be sufficient reason to include discussion of a potential serious adverse effect in obtaining informed consent.

A consent form that simply lists such items as “incompetent cervix” or “infection” as potential complications, but does not inform women of the elevated future risk of a preterm delivery, and that the latter constitutes a risk factor for devastating complications such as cerebral palsy, may not satisfy courts.

The authors of a recent CME review survey article, which evaluated 24 studies of abortion and PB, strongly affirmed the need for informed consent. They stated that prior IAs boost the risk of PB and that 7 of 12 significant studies that they reviewed identified a dose-response effect, with risks increasing with the number of IAs.24

Brent Rooney is a medical researcher. He may be contacted at the Reduce Preterm Risk Coalition, 3456 Dunbar St. (146), Vancouver, Canada V8S 2C2. Email address: stopcancer@yahoo.com or whatsup@vcon.bc.ca.

Byron C. Calhoun, M.D., F.A.C.O.G., F.A.C.S., is Director, Perinatal Assessment Unit, Rockford Memorial Medical Center in Rockford, IL; Visiting Clinical Professor in Obstetrics and Gynecology, University of Illinois at Chicago; and Adjunct Professor of Obstetrics and Gynecology, Midwestern University, Chicago College of Osteopathic Medicine.

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APPENDIX: Studies that showed a statistically significant increase in preterm birth after induced abortion


Puyenbroek J, Stolte L. The relationship between spontaneous and induced abortions and the occurrence of second-trimester abortion in subsequent pregnancies. *Eur J Obstet Gynecol Reprod Biol* 1983;14:299-309.[This is the only study in this complete list that uses second-trimester abortion as a surrogate for PTB.]


*Studies that included spontaneous and induced abortions but did not report PTB/LBW risk separately for each

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**Medical Controversy**

“Since among practitioners there will prove to be so much difference of opinion about acute diseases that the remedies which one physician gives in the belief that they are the best are considered by a second to be bad, laymen are likely to object to such that their art resembles divination; for diviners too think that the same bird, which they hold to be a happy omen on the left, is an unlucky one when on the right, while other diviners maintain the opposite.”

**Hippocrates Regimen in Acute Diseases**

[Fortunately AAPS can discern right from left, and open debate is welcome.]

— Lawrence R. Huntoon, M.D., Ph.D.
Cost Consequences of Induced Abortion as an Attributable Risk for Preterm Birth and Impact on Informed Consent

Byron C. Calhoun, M.D., M.B.A., Elizabeth Shadigian, M.D., and Brent Rooney, B.Sc.

OBJECTIVE: To investigate the human and monetary cost consequences of preterm delivery as related to induced abortion (IA), with its impact on informed consent and medical malpractice.

STUDY DESIGN: A review of the literature in English was performed to assess the effect of IA on preterm delivery rates from 24 to 31½ weeks to assess the risk for preterm birth attributable to IA. After calculating preterm birth risk, the increased initial neonatal hospital costs and cerebral palsy (CP) risks related to IA were calculated.

RESULTS: IA increased the early preterm delivery rate by 31.5%, with a yearly increase in initial neonatal hospital costs related to IA of >$1.2 billion. The yearly human cost includes 22,917 excess early preterm births (EPB) (<32 weeks) and 1,096 excess CP cases in very-low-birth-weight newborns, <1,500 g.

CONCLUSION: IA contributes to significantly increased neonatal health costs by causing 31.5% of EPB. Providers of obstetric care and abortion should be aware of the risk of preterm birth attributable to induced abortion, with its significant increase in initial neonatal hospital costs and CP cases. (J Reprod Med 2007;52:929-937)

Keywords: abortion, induced; malpractice; preterm birth.

Preterm delivery continues to confound all countries, with a significant impact on health care costs and society. The latest complete statistics on preterm birth in the United States note that the rate of preterm birth, at <37 weeks, increased again to 12.1% in 2002. Preterm deliveries with the most severe neonatal morbidity and mortality include those from 24 to 28½ weeks’ gestation: 41% did not survive to 1 year. These figures contrast with the 5% death rate at 1 year for those preterm deliveries at 29 to 31½ weeks’ gestation and the 1% death rate at 1 year for >32 weeks’ gestation.

The effects of induced abortion (IA) on preterm delivery rates, including the human and monetary cost consequences, need to be more fully investigated. In a recently published large study of preterm births, an increased risk of birth <33 weeks was demonstrated in women with a history of IA. The subjects were French women, with key findings as follows: 50% higher relative odds of birth <33 weeks in women with prior IAs, 160% higher relative odds birth at <33 weeks in women with >1 prior IA (with dose/response confirmed) and a 70% higher relative odds of birth before 28 weeks’ gestation in women with prior IAs. This 2005 French study replicates previous findings in Europe.
The epidemic of handicapped newborns in Hungary in the 1960s and 1970s due to increases in premature deliveries forced its Communist government to restrict elective surgical abortion access in January 1974 (Addendum).

Women, the public and public health officials must be made aware of the huge costs (some $1.2 billion per year in the U.S.) of even an increase of 31.5% in the risk of EPB will have on initial neonatal care.

In the United States the low-birth-weight (LBW) newborn (<2,500 g) delivery rate in 2002 (with most LBW infants at <35 weeks' gestation) increased to 7.8% from 6.8% in 1985. This marks the highest rate in over 30 years. The rate of increase in newborn born at <32 weeks' gestation, early preterm births (EPB), in singletons increased 5% since the 1980s as compared to the overall increase, 15%, in preterm deliveries. The majority of the increased EPB appears as a result of multiple gestations due to assisted reproduction. The incidence of newborn born at <1,500 g, very low birth weight (VLBW), was 1.46%, which reflected little change from the 1.44% rate of 2001. This paper addresses all infants delivering after 24 weeks and <32 weeks as EPB.

Although extensive maternal demographic and preterm delivery risk data exist in the United States, induced abortion statistics, especially prior to first desired pregnancy, are absent from the National Vital Statistics Reports for deliveries in 2002. In a Rooney-Calhoun paper, a previous extensive review of 49 studies in 2003 of induced abortion as a risk factor for preterm delivery, higher RRs were demonstrated for preterm delivery occurring at gestations at <31/7 weeks as compared to after 32 weeks. Further, a recent 2004 study from Europe involving 60 maternity units in 10 countries with 2,838 cases of preterm birth and 4,781 term controls found a 34% increase in EPB infant deliveries (OR 1.34) in patients with prior induced abortions. Another study by St. John et al in 2000, which used the national March of Dimes delivery database on preterm, live-born infants (which included 33, 516 preterm infants from the year 2000), noted that >$10.2 billion was spent on neonatal care; some 57%, or $6 billion, went to care for infants at <37 weeks. Further breakdown of their data showed that care of neonates born between 24 and 28/7 weeks' gestation cost over $1.6 billion in 2000. The average hospital cost per survivor ranged from a high of $145,892 at 24 weeks' gestation to $63,714 at 28 weeks.

Against the backdrop of litigious obstetric practice and in the interest of improving informed consent for induced abortion, the impact of induced abortion on preterm delivery rates was assessed, and the initial yearly hospital cost consequences in the United States were analyzed.

Methods

Fifty-nine studies in the English language were reviewed for preterm birth and links to abortion using preterm birth, elective abortion or a combination of both utilizing the MEDLINE/PubMed electronic database from the National Library of Medicine (Appendix B). From this review, we selected 5 of the most recent, representative studies with an association between induced abortion and preterm birth as detailed examples of the 59 studies listed in Appendix B to provide information for calculating induced abortion's contribution to preterm birth (Appendix A). The total number of births in the United States from 2002 included 4,021,726 births. Of this number, 1.81%, or 72,751, were EPB (24 to 31/7 weeks), and 1.46%, or 58,717, were VLBW (<1,500 g). The total number of EPB due to induced abortions for 2002 are estimated using the following assumptions: (1) birth rates and the survivorship rates for each week for EPB <32 weeks in 2002 U.S. delivery data approximate those of St. John et al (data from 1989-1992, University of Alabama, Birmingham, and neonatal survivorship data for 1999, March of Dimes database); and (2) the survivorship rates would certainly not be lower than the ones we used in the 2002 data (Table I).

In addition, the risk of preterm birth from a single elective abortion prior to the first delivery was calculated by estimating the avoidable preterm birth risk due to prior IA and the prevalence of prior IA among women delivering their first infant. Five large, recent, international studies have shown an association of prior induced abortions to preterm delivery (Table IV), and 59 studies over the last 50 years have shown a statistically significant association (Appendix B). All the studies found a statistically significant increase risk in preterm birth before 32 weeks for women undergoing at least 1
Table 1  Summary of Costs of Induced Abortion from 24–28 and 29–32 Weeks’ Gestation

<table>
<thead>
<tr>
<th>Gestational age (wks)</th>
<th>Live birth rates (%)</th>
<th>Survival rates (%)</th>
<th>No. of survivors</th>
<th>No. of nonsurvivors</th>
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<tbody>
<tr>
<td>24</td>
<td>0.087</td>
<td>43</td>
<td>1,504</td>
<td>1,994</td>
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<td>25</td>
<td>0.137</td>
<td>53</td>
<td>2,920</td>
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<tr>
<td>26</td>
<td>0.152</td>
<td>47</td>
<td>4,096</td>
<td>2,017</td>
</tr>
<tr>
<td>27</td>
<td>0.221</td>
<td>73</td>
<td>6,488</td>
<td>2,400</td>
</tr>
<tr>
<td>28</td>
<td>0.209</td>
<td>81</td>
<td>6,808</td>
<td>1,597</td>
</tr>
<tr>
<td>29</td>
<td>0.245</td>
<td>91</td>
<td>8,966</td>
<td>887</td>
</tr>
<tr>
<td>30</td>
<td>0.364</td>
<td>94</td>
<td>13,761</td>
<td>878</td>
</tr>
<tr>
<td>31</td>
<td>0.394</td>
<td>96</td>
<td>15,212</td>
<td>633</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>59,755</td>
<td>12,996</td>
</tr>
</tbody>
</table>

Assumes 4,021,726 births.1
*From St. John EB, et al.3

first-trimester abortion, with the ORs ranging from 1.3 to 2.5.3,6,9 Women undergoing ≥ 2 abortions had an even larger risk of preterm birth, with ORs ranging from 1.8 to 5.2.3,6,9

In 2003 the Alan Guttmacher Institute estimated that 1 in 3 women born in the U.S. will have an IA in her lifetime. Prior to 2003 almost all abortions were done surgically.10 Therefore, we assume that all the IAs were surgical in this paper. The calculation in Appendix A, which uses this Guttmacher data, estimates that approximately 20% of women delivering a newborn have had an IA (14% with 1 IA plus 6% with > 1). We use a risk model termed Calhoun-Shadigian-Rooney (CSR) in Appendix A that is very close to that of Martius et al.6 Combining the CSR relative risks with the 20% IA prevalence among delivering women yields a figure of 31.5%. Therefore, 31.5% of preterm deliveries may be attributed to prior early elective surgical IAs; if the effect of multiple IAs is ignored, the percentage would be 23. Of the 12,996 preterm infants who died, 31.5% of the deaths can be attributed to IA. Thus, the "excess" death toll due to IA is 4,094 per year (Table II).

Finally, excess cerebral palsy (CP) cases attributable to VLBW due to induced abortion were calculated by using the total U.S. births from 2002. Most VLBW newborns result from gestations at < 30 weeks. Since preterm birth ORs due to prior IAs increase as the gestation length declines,3,9,10 it is reasonable to conclude that > 31.5% of VLBW in newborns is attributable to prior induced abortions. However, for consistency’s sake, 31.5% was used to compute excess cases of CP due to VLBW as a result of induced abortions. Using the 31.5% attributable risk applied to the total number of VLBW newborns (58,717) results in an excess of 18,496 VLBW infants due to prior IAs. Approximately 14,426 of these VLBW neonates will survive to discharge. Escobar et al, in a meta-analysis, reported a 7.7% CP rate in VLBW newborns.11 We used this 7.7% CP/VLBW rate in our excess cases of CP calculation. We estimated the rate of a non-VLBW newborns having CP as approximately 0.1%. Thus, the excess CP/VLBW rate was 7.6% (7.7 – 0.1%). We multiplied the excess cases of VLBW/IA by 7.6% to obtain the excess cases of CP; those with CP/IA not in the VLBW group were ignored. The Escobar meta-analysis, which included both other countries and the U.S., found that a U.S.-born VLBW newborn had a 50% higher risk of handicap than a non-U.S.-born VLBW neonate. Therefore, this conservative calculation of 1,096 excess U.S. CP cases is probably an underestimation of the impact of induced abortion on excess CP cases (Table II).

Results

Utilizing the dollar costs per surviving infant from the 2000 March of Dimes database in the St. John study,5 the total amount spent on neonates delivered for each week of gestational age was calculated. By summing each gestational week’s costs, the total cost of care for those neonates who survived to discharge alive or died prior to discharge when born at < 32 weeks’ gestation was possible (Table III). The 2002 costs of inflation were adjusted by the average inflation rates for the intervening years, 2001 (2.83%) and 2002 (1.59%).12 After adjusting for inflation, the total hospital costs for surviving neonates for at < 32 weeks in 2002 topped $3.4 billion per year (Table III). Using the previously noted induced abortion contribution of 31.5% to EPB, the attributable, cost-consequence contribution to initial neonatal hospital costs by induced abortion is 31.5% of the $3.4 billion, or $1.1 billion (in 2002 dollars) per year in the U.S.

Table II  Excess EPB/VLBW Costs (Dollars and Human) Due to Prior Induced Abortions in the United States per Year in 2002 Dollars

<table>
<thead>
<tr>
<th>Cost</th>
<th>Type of cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>22,917</td>
<td>Excess EPB</td>
</tr>
<tr>
<td>4,094</td>
<td>Excess deaths of EPB newborns</td>
</tr>
<tr>
<td>18,495</td>
<td>Excess VLBW cases</td>
</tr>
<tr>
<td>14,427</td>
<td>Excess surviving VLBW cases</td>
</tr>
<tr>
<td>1,096</td>
<td>Excess VLBWs with CP</td>
</tr>
</tbody>
</table>

$1.2 Billion excess initial neonatal EPB hospital costs per year in United States.
Table III  Summary of Costs of Induced Abortion from 24–28 and 29–32 Weeks' Gestation

<table>
<thead>
<tr>
<th>Gestational age (wk)*</th>
<th>Live birth (%)</th>
<th>Survival (%)</th>
<th>Cost per infant ($ millions)</th>
<th>Population cost ($ millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Survivors</td>
<td>Surivors</td>
</tr>
<tr>
<td>24</td>
<td>0.087</td>
<td>43</td>
<td>145,892</td>
<td>219</td>
</tr>
<tr>
<td>25</td>
<td>0.137</td>
<td>53</td>
<td>121,181</td>
<td>354</td>
</tr>
<tr>
<td>26</td>
<td>0.152</td>
<td>67</td>
<td>99,362</td>
<td>407</td>
</tr>
<tr>
<td>27</td>
<td>0.221</td>
<td>73</td>
<td>80,264</td>
<td>521</td>
</tr>
<tr>
<td>28</td>
<td>0.209</td>
<td>81</td>
<td>63,714</td>
<td>434</td>
</tr>
<tr>
<td><strong>Total cost</strong></td>
<td></td>
<td></td>
<td>1.94 Billion</td>
<td>2.02 Billion</td>
</tr>
<tr>
<td><strong>Inflation adjusted</strong></td>
<td>(2001–2002)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abortion adjustment</td>
<td>(31.5% of total)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>0.245</td>
<td>91</td>
<td>49,546</td>
<td>636</td>
</tr>
<tr>
<td>30</td>
<td>0.364</td>
<td>94</td>
<td>37,569</td>
<td>444</td>
</tr>
<tr>
<td>31</td>
<td>0.394</td>
<td>96</td>
<td>27,629</td>
<td>517</td>
</tr>
<tr>
<td><strong>Total cost</strong></td>
<td></td>
<td></td>
<td>1.4 Billion</td>
<td>1.46 Billion</td>
</tr>
<tr>
<td><strong>Inflation adjusted</strong></td>
<td>(2001–2002)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abortion adjustment</td>
<td>(31.5% of total)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td></td>
<td>460</td>
<td>12,996</td>
<td>26</td>
</tr>
</tbody>
</table>

Assumes 4,021,726 births.1

Applying the 2000 dollar costs per nonsurviving infant from St. John, the total amount spent on neonates dying for each week of gestational age was calculated by summing the individual weeks' costs (Table III). The 2002 costs of inflation from 2000 were adjusted by the average inflation rates for the intervening years, 2001 (2.83%) and 2002 (1.59%).2 The total hospital costs for the EPB nonsurviving neonates in 2002 topped $353 million (Table III). Using the noted induced abortion contribution to the EPB numbers calculated above, the attributable, cost-consequence contribution to neonatal hospital costs by induced abortion to EPB for nonsurviving infants was 31.5% of the $349 million, or $112 million. Therefore, the total initial financial consequence of induced abortion attributable to premature deliveries (surviving and nonsurviving) <32 weeks is >$1.2 billion in the U.S. per year.

In our calculations, 72,751 total EPBs were derived from the 2002 U.S. delivery data,1 and 31.5%, or 22,917, of them were excess preterm deliveries due to prior IAs (Table I). Of U.S. EPBs in 2002, 31.5% were attributable to induced abortion (Appendix A).

In addition to financial costs, there were 4,094 (31.5%×12,996) excess deaths due to early preterm births caused by prior induced abortions. Excess deaths in those born after 32.0 weeks' gestation are ignored. There were 58,717 VLBW newborns in 2002.1 We estimated from Martin study data that 78% of such VLBW infants survived the neonatal period.1 VLBWs due to IAs totaled 18,496 (31.5%×58,717), and 14,427 (78%×18,496) of them survived the neonatal period. We estimated that there were 1,096 excess cases of CP in the VLBW group due to IAs (7.6%×14,427). Excess CP cases in those weighing >1,500 g were ignored.

In brief, a condensed list of estimates of yearly abortion short-term costs, dollar and human, due to early preterm births:

1. Hospital dollar cost: $1.2 billion (in 2002 dollars) per year
   a) $1.1 Billion surviving preterm infants and
   b) $0.1 Billion nonsurviving preterm infants
2. Excess deaths: 4,094 infants
3. Excess CP cases: 1,096 infants with or who will develop CP

Discussion

Until recently, little has been written about induced abortion as a public health issue.13,14 The recent publication of 2 summaries of salient articles raises concerns about induced abortion and preterm birth, adding a new dimension to the discussion.4,14 The summary in Table IV of 5 representative, recent, key studies linking induced abortion and preterm birth is compelling enough to warrant the estimation of the public health effect of induced abortion
on neonatal hospital costs and excess numbers of CP cases (Appendix B). That study, however, did not include all the excess obstetric costs, emotional costs to families and long-term costs of care for disabled, preterm infants.

Etiologies implicated in the preterm birth risk for induced abortion include incompetent cervix from trauma,15 uterine adhesions,16 infection,15,17,18 mental stress,15 increased maternal age9 and substance abuse.19 “Birth before 32 weeks is ten times more likely with a diagnosis of incompetent cervix,” according to Luke.20 Pediatrician Elliot Gersh included the following risk factor for CP: “Incompetent cervix (premature dilation) leading to premature delivery.”21 Women carrying twins or triplets and with ≥1 of the 6 risk factors listed above boost their risk of an EPB (<28 weeks) delivery.

When a 31.5% increase risk is presumed for EPB deliveries (<32 weeks) is attributable to induced abortion in the United States, the public health costs are enormous. Using a conservative model for the analysis of hospital expenses raises the national neonatal hospital expenditure by a total of >$1.2 billion (living [$1.1 billion] and nonliving [$112 million]), and theoretically this expense is avoidable. All women, especially those facing a crisis pregnancy, deserve to be informed of the substantial impact that an induced abortion in the current pregnancy has on the next pregnancy and the entire family.

The costs of EPB infants do not simply include the initial hospitalization expenses. In concert with the delivery of the VLBW infant, the risk of CP has been reported to increase by some 38 times.11 This translates into one-half the neurologic problems in children and includes severe and significant developmental delay.22

Even a modest effect attributable to induced abortion leads to significant cost consequences in initial neonatal hospitalizations. Women, the public and public health officials must be made aware of the huge costs (some $1.2 billion per year in the U.S.) of even an increase of 31.5% in the risk of EPB will have on initial neonatal care. A careful history of induced abortion needs be part of every new pregnant patient encounter in any setting. Enhanced surveillance and counseling on increased risk for preterm birth ought to be discussed with women with a history of induced abortion, in preconception visits and/or early prenatal visits. These precautions will (1) provide the prudent obstetric practitioner with an opportunity to alter a woman’s prenatal care, given her induced abortion history; (2) allow compilation of national guidelines to manage pregnant women who have had an induced abortion; and (3) allow the construction and execution of new studies to improve perinatal outcomes of preterm birth specifically attributable to induced abortion.

Addendum

There is an international precedent for governmental concern about the preterm birth risk from IA. The Hungarian government became alarmed about the evidence of an abortion–preterm birth link as early as 1973: “A recent article in Magyar Hirlek, a journal sponsored by the government, contained detailed explanations of the new legislation. The columnist referred extensively to the research of

### Table IV  Five Recent, Representative, Key Studies Linking Induced Abortion and Preterm Birth

<table>
<thead>
<tr>
<th>Year published</th>
<th>Year data collected</th>
<th>Author</th>
<th>Country</th>
<th>Details</th>
<th>OR, 1 Induced abortion</th>
<th>OR, ≥2 Induced abortions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>1994–1997</td>
<td>Ancel3</td>
<td>Europe (10 European countries)</td>
<td>Unmatched case control</td>
<td>1.34 (1.08, 1.68)</td>
<td>1.82 (1.34, 2.49)</td>
</tr>
<tr>
<td>2001</td>
<td>1995</td>
<td>Henrig9</td>
<td>France</td>
<td>Some early and medium-early births</td>
<td>1.3 (1.0, 1.6)</td>
<td>1.9 (1.3, 2.9)</td>
</tr>
<tr>
<td>2000</td>
<td>1980–1994</td>
<td>Zhou8</td>
<td>Denmark</td>
<td>Low birth weight &lt;2,500 g</td>
<td>1.9 (1.6, 2.3)</td>
<td>1.9 (1.3, 2.7)</td>
</tr>
<tr>
<td>1998</td>
<td>1994</td>
<td>Martius6</td>
<td>Bavaria</td>
<td>Did not restrict controls to primiparous, preterm patients</td>
<td>2.5 (1.95, 3.24)</td>
<td>5.2 (3.52, 8.96)</td>
</tr>
<tr>
<td>1998</td>
<td>1983–1992</td>
<td>Lumley7</td>
<td>Australia</td>
<td>Controlled for no prior delivery</td>
<td>EPB 1.7 (1.2, 1.9)</td>
<td>EPB 1.8 (1.2, 2.5)</td>
</tr>
</tbody>
</table>

*OR 1.3 (95% CI 1.0–1.7); all numbers are noted in this fashion.
 Numerical RR instead of ORs are estimates from graphs.
 XPB = extremely preterm birth (birth at <28 weeks' gestation).
 See Appendix B for a full list of statistically significant studies involving induced abortion and preterm birth.
Jeno Sarkany, who had presented evidence considered conclusive by the government, that, artificially induced abortions predisposed to premature births in subsequent pregnancies. His study of perinatal and infant morbidity statistics revealed a striking increase in physically and/or mentally handicapped babies among those born to mothers who had had a therapeutic abortion previously. Apparently, this unforeseen social burden outweighed the benefits on economic pressures of free abortion, and the government, while emphasizing the unchanged importance of population control, felt compelled to repeal its abortions laws.22 Barriers to access, required counseling, and other factors have reduced the abortion rate in Hungary from a high of 57% of pregnancies in 1969 to 38 percent in 2000.23 The long-term effect of a decreasing abortion rate on pregnancy outcome should be monitored.

Appendix A Excess EPBs Due to Prior IAs

The Martius data best represent the abortion and pregnancy patterns of U.S. women, with the best control group (both multiparous and primiparous women delivering preterm). Further, there was the largest number of EPBs (1,164 neonates) in the Martius study, adding to its statistical robustness.6

Since the United States has no national database on number of elective abortions or abortion complication rates, the percent of U.S. delivering women with prior IAs is not directly known. Each year approximately 1.3 million abortions are performed and 4 million infants are born.1,24 Therefore, approximately 25% of pregnancies end in abortion per year. However, this number does not inform as to the timing of IAs in relation to term pregnancies. The most likely group of women who have never had an IA before term pregnancy is teenagers. Therefore, the general calculation of women who have had an IA before term pregnancy is most likely greater than teenagers. To keep our estimates conservative, we used teen numbers and adjusted the numbers downward by about 10% to include those teens who had had an elective abortion prior to term birth. In 1996 in the U.S. the ratio of pregnant teens having IAs as compared to those giving birth (IAs + births) may be described by the equation (29/1,000) + [(29/1,000) + (54/1,000)] = 35% according to the Alan Guttmacher Institute.25 This suggests that a reasonable estimate of delivering women with at least 1 prior IA is estimated at 20%. So, very young pregnant U.S. women have a substantial risk (35%) of an IA. Since one third of all U.S. women have at least 1 IA in their lifetime and 35% of pregnant teenagers have IAs, we think it reasonable to conclude that at least 20% of delivering women have had > 1 prior IAs; we will use 20% in our estimates. It has been estimated that 40-50% of U.S. women with IAs have had ≥1.26 To remain “conservative,” we will use a figure of 30% of delivering women with prior repeat IAs. Thus, we estimate that 6% (30% × 20%) of delivering women have had repeat IAs. Martius provided EPB ORs for 1, 2, and >2 prior IAs.

The model we used to compute the excess percent of EPBs due to prior IAs is very close to the Martius model that used multivariate analysis to control for maternal age > 35 years, infertility therapy, premature cervical dilation, history of stillbirth, history of preterm birth, maternal age < 18 years, preeclampsia, uterine bleeding, chorioamnionitis, premature rupture of membranes, malpresentation and preterm labor in presenting pregnancy:

<table>
<thead>
<tr>
<th>1 prior IA</th>
<th>2 prior IAs</th>
<th>&gt; 2 prior IAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPB EPB</td>
<td>EPB EPB</td>
<td>EPB EPB Model</td>
</tr>
<tr>
<td>Martius</td>
<td>2.5 OR</td>
<td>5.2 OR</td>
</tr>
<tr>
<td>CSR</td>
<td>2.5 RR</td>
<td>5.2 RR</td>
</tr>
</tbody>
</table>

The largest difference between the Martius model and the CSR model is the EPB risk of > 2 IAs. We were forced to use a lower number than Martius since the U.S. prevalence of > 2 prior IAs for delivering women is pure conjecture. The Martius sample had an overall EPB prevalence of 1.08% (1,146 of 106,345). At such a low prevalence, ORs and RRs are virtually identical. To compute the excess U.S. EPB percent, one should employ RRs. The inputs to this computation are:

80% Of delivering U.S. women have zero prior IAs
14% Of delivering U.S. women have exactly 1 prior IA
6% Of delivering U.S. women have > 1 prior IAs

RR (EPB/1 prior IA) = 2.5
RR (EPB/ > 1 prior IA) = 5.2

Computation:
1. Overall excess U.S. RR (EPB/prior IAs) = 
   

\[
(0.80 \times 1.00) + (0.14 \times 2.5) + (0.06 \times 5.2) - 1.00 = 0.46
\]

2. Excess percent of U.S. EPBs due to prior IAs =

\[
100\% \times \left(0.46 - 1.00\right)/1.46 \right) = 31.5%
\]

The CSR model implies that 31.5% of U.S. EPBs are due to prior IAs; 31.5% is an estimate, which is as accurate as the inputs (RRs and IA prevalence prior to delivery for U.S. women).

Two alternative estimates of excess percent of EPBs:

<table>
<thead>
<tr>
<th>PIA%</th>
<th>% 1 IA</th>
<th>% &gt; 1 IA</th>
<th>Excess % EPBs</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>15%</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>C</td>
<td>25%</td>
<td>17%</td>
<td>8%</td>
</tr>
</tbody>
</table>

PIA% = prior induced abortion (%).

Clearly, B (PIA% = 15%) is a conservative estimate, but it still results in about 19,279 (26.5% x 72,751) excess early preterm births yearly in the U.S. Estimate C (25% prior IA rate) is possible, but reliable data on prior IA rates of U.S.
delivering women are required to justify this estimate.

Thus, we think that the true excess EPB percent lies between 26.5% and 36.9%; 31.5% (A, associated with a 20% prior IA rate) has been selected in our computations. The U.S. preterm birth rate of 12.1% is very high by world standards. Using a plausible estimate of a 20% prior IA rate (14% per 1 IA, 6% per >1 IA) we think is justified. We are relatively confident that the true PIA% for U.S. women delivering newborns lies between 15% and 25%.

The 95% CIs for the 20% PIA% model are those of CSR:

<table>
<thead>
<tr>
<th>1 IA</th>
<th>2 IAs</th>
<th>&gt;2 IAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5  (1.96–3.27)</td>
<td>5.2  (3.28–8.34)</td>
<td>5.2  (3.28–8.34)</td>
</tr>
</tbody>
</table>

In a model in which exactly 20% of delivering women have had prior IAs (exactly 6% have had >1 prior IA) and the CSR EPB RR applies, the point estimate (with 95% CI) of excess EPBs due to prior IAs is:

31.5% (21.43.2%) (The CSR model uses an EPB RR of 5.2 [3.28–8.34] for >1 prior IA).

The lower CI limit, 21.2% excess EPBs due to prior IAs, is still a sobering number since it would represent >15,000 excess early preterm U.S. births yearly due to prior elective abortions.

Appendix B Statistically Significant IA–Preterm Birth Study List

Fifty-nine studies that showed a statistically significant increase in preterm birth or low birth weight after IA; the list starts below at “List of 59 Significant APB Studies.”

A. The 59 studies are at least 95% confident of increased risk of preterm birth or “surrogates” for PTB (such as low birth weight or second-trimester spontaneous abortion) from previous surgically induced abortions (IAs); this list, in all probability, is NOT a complete list of all such studies; studies preceded by “+” found that the greater the number of prior abortions, the higher the preterm birth risk (studies 8, 9, 11, 25, 29, 32, 34, 35, 38, 39, 41, 43, 47, 48, 49, 50, 51, 54, 57, 58).

B. All 3 studies that examined whether prior IAs boosted the risk of subsequent extremely preterm births (XPBs) (birth at <28 weeks’ gestation) found that they did:

1. Lumley J (Australia, 1993, study number 43)
2. Lumley J (Australia, 1998, study number 48)
3. Moreau C et al. (France, 2005, study number 58)
(The 2005 Moreau study was the first European confirmation of the Australian XPB results of Judith Lumley.)

C. These 59 studies involved 23 countries.

List of 59 Significant APB Studies

1960s


1970s

18. Lean TH, Hogue CJR, Wood J: Low birth weight after in-


1980s


32. Puyenbroek J, Stolte L: The relationship between spontaneous and induced abortions and the occurrence of second-trimester abortion in subsequent pregnancies. Eur J Obstet Gynecol Reprod Biol 1983;14:299–309.[This is the only study in this list that uses second-trimester miscarriage as a surrogate for PTB.]


1990s


52. Ancel PY, Saurel-Cubizolles, Di Renzo GC, et al: Social differences of very preterm birth in Europe: Interaction with
obstetric history. Am J Epidemiol 1999;149:908–915

2000–2005


*Studies that included spontaneous and induced abortions but did not report P1B/LBW risk separately for each.
+Studies that found dose/response (the more SSIAs, the higher the risk).

References


10. www.agi-usa.org/pubs/or_teen_preg_decline.html (Alan Guttmacher Institute)


18. Daling JR, Krohn MA: Miscarriage or termination in the immediately preceding pregnancy increases the risk of intranomial infection in the following pregnancy. Am J Epidemiol (abstr) 1992;136:1036


