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by

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In the late 1960s and early 1970s, abortion was legalized in most of the Western World. Legalization culminated in more women than had been expected choosing termination[1,2] with young, socially deprived, and childless women making up the largest proportion.[3] Initially, research focused on early complications, immediate maternal mortality, and optimization of abortion technique.[4] Subsequent interest in the potential long-term health consequences entered scientific discussion later, not primarily driven by specific hypotheses, but rather by those with conflicting viewpoints, vis a vis, the moral statue of the embryo or fetus, and desire to either limit or expand access to abortion.[5]

As profound sociologic changes in reproductive behavior were documented in the form of rising abortion rates, political pressures motivated governments to appoint special study commissions charged with the task of reporting on the long-term health implications of induced abortion.[6,7] The resulting reports lament the lack of long-term follow-up and call for detailed study of the health effects of this common procedure. Despite strong recommendations for substantive research, and the clear need for women to have accurate information as they execute their autonomy, current data remain sparse, studies are small and methodologically flawed, and the conclusions are often intertwined with the political agendas of their authors and publishers.[8]

Abortion Epidemiology

Epidemiologic data exists on abortion from most countries in which it is legal. However, the completeness of these data is subject to local statutes and their enforcement.[3] Sources of information include legally mandated registers, hospital administrative data and clinic statistics, and voluntary reporting or surveys of abortion providers. With these limitations in mind, we nonetheless can calculate abortion incidence. Both abortion rates and ratios are important measures in understanding the epidemiology of legal abortion. Rates reflect abortions per 1,000 reproductive-age women, and ratios are the number of abortions per 100 live births or pregnancies. Readers should note that abortion ratios increase as the number of births diminish, and increases in abortion ratios can reflect not only the incidence of women deciding to terminate a pregnancy, but also the incidence of women deciding to conceive.

From the early 1970s the annual number of abortions performed in the United States peaked at 1.61 million in 1990. Abortions have declined over the last decade with 1.37 million in 1996; this drop is attributed in part to aging of the population[9,10] and a fall in unintended pregnancies amongst adolescent women.[11,12] In 1996, the US abortion rate per 1,000 women aged 15-44 was 23/1,000, the lowest reported rate since 1975. The abortion ratio in 1996 was 26 abortions per 100 live births and abortions. Thus, 26% of all recognized pregnancies were terminated.[6,7] Overall, the United States' abortion rate (23/1,000 in 1996) is high compared with similarly developed countries. In 1995 the abortion rates were 16/1,000 in Canada, 15/1,000 in England, 6/1,000 in the Netherlands, and 18/1,000 in Sweden.[13]

One can presume that abortion is most often chosen as a response to a crisis or unintended pregnancy. The high prevalence of a history of induced abortion means that even small positive or negative effects on long-term health could influence the lives of many women and their families.

Epidemiologic Problems in Studying The Long-Term Consequence of Abortion

Abortion is an exposure that cannot be assigned to women by chance as part of an experimental design. Thus, investigations are deprived of the powerful tool of randomization to minimize bias in their findings. Progress in research must depend on well-done observational studies.

Observational studies are more prone to bias than experimental trials and thus less likely to allow the drawing of conclusions regarding causality. Potential problems in observational research done on the health consequences of induced abortion include two important sources of error.

First, bias in assessment of true exposure status. This may occur through information bias, namely, differing accuracy of information about abortion history across comparison groups. This is the case if medical records or registries systematically overreport or underreport elective abortions, for instance missing events, or may occur as the result of reporting bias, that is if women's self-report selectively reveals or suppresses information about their abortion history.

Second, selection of an inappropriate comparison group of women without a history of abortion. Populations of women who choose abortion differ in many ways from those who do not. At the time of the abortion they are likely to be younger, poorer, and less able to reliably contracept than a sample of the general population of women.[14] Dissimilarities in socioeconomic status, stress, access to health care, and lifestyle may persist across time, and themselves be associated with adverse health events. This introduces risk of uncontrolled confounding of the estimates of association between abortion and long-term outcomes – in other words, observed associations may stem from other confounding differences between women who choose abortion and those who do not. For a careful comprehensive analysis of the limitations of observational research in this area and a useful scheme for categorizing study design, readers are referred to the work of Hogue.[15]

The most consistently debated problem in the study of long-term health effects of induced abortion is ascertainment of true exposure status: it is thought that women with a significant medical problem such as breast cancer or a preterm delivery may be more likely to report an induced abortion than controls who do not have such a health problem.[16-19] Paradoxically, Tang et al, in a methodologic study to assess underreporting in breast cancer cases and controls, could find no evidence of a hesitancy to report.[20, 21] Udry et al found a similar prevalence of induced abortion underreporting in a study of women with and without health problems where self reports were compared to medical records.[22] Soderberg et al demonstrated high non-participation rates of women with prior induced abortion in long-term follow-up studies. Moreover, they showed that non-participation was linked with being young, unmarried, and of low socioeconomic status.[23]

Daling et al examined the possibility of differential reporting in a paper that examined breast cancer risk in relation to induced abortion. They did so by completing a sub-study case control analysis of cervical cancer and induced abortion in which they could find no evidence of differential underreporting of prior induced abortion.[24] Lindefors-Harris et al linked self reports of induced abortion to a national registry.[25] While these authors claimed to have found evidence of ascertainment bias, subsequent reanalysis done with the assumption that women who had not

undergone abortion would not falsely report such caused Dahling et al to question their findings.[24]

Beyond difficulties in ascertaining abortion status, there is not a clear consensus about how investigators should conceptualize abortion as a risk factor. One analytic approach views an interrupted pregnancy as a fraction of a complete pregnancy, for instance assuming that an abortion at eight weeks is the biologic equivalent of 20% of a pregnancy. Others treat abortion as a distinct biologic event focusing on the abruptness of termination and subsequent hormonal changes.[26] The latter approach is most commonly used, though more sophisticated approaches to capture additional detail about duration of pregnancy as well as history and mode of abortion are warranted.

For the purposes of summarizing current knowledge, critical reviewers and meta-analysts are limited by the narrow focus of electronic searches using abortion as a search heading when many other studies of an array of exposures include information about reproductive history. For instance, Ananth et al[27] in their review and meta-analysis of induced abortion and placenta previa located three of the five pertinent articles via hand searches. Each article's identifiers had been designed to address the effects of smoking on placentation. Their discovery and inclusion allowed for meta-analysis and the drawing of a conclusion that a review such as ours would have been unable to do. This obscurity of potential sources of information is both a challenge and an opportunity. It increases the logistical difficulty, and therefore effort and cost of systematic review, but suggests the literature contains a rich reserve of data for future analyses.

Methods and Sources

We performed our research for relevant publications using the MEDLINE database. We searched under "abortion" and "abortion complications" headings from 1966-2002, restricting the search to publications in English. Abstracts were then reviewed to see if they met the inclusion criteria for this article. The bibliographies of relevant articles were analyzed to identify additional reports. Appropriate articles were obtained for full review.

Inclusion criteria were: The study must have had over 100 subjects with follow-up of two months or longer after elective abortion. A study size criterion was applied based on the premise that long-term complications are rare and reported effect sizes small, thus studies with fewer than 100 subjects would most likely not have inadequate power to detect differences. Long-term was defined as ≥ two months, paralleling clinical advice that a return to optimal fertility after elective abortion would take at least that long.

Articles were abstracted by a single author (JMT). Information abstracted included time and location of the study, the number of subjects, the study design, the findings, and appropriate comments. Our review is limited to legal abortions performed using surgical techniques. Illegal abortions are often done without sterile technique. We did not identify studies of medical abortions with long-term follow-up. When exploring the possible association between induced abortion and breast cancer, we did not believe that another review of the up to 31 observational studies published heretofore would add much to the four reviews and/or meta-analyses already in the literature. Thus we have provided summaries of these reviews similar to Davidson in his "personal view" article on breast cancer and induced abortion done in the 2001 issue of the *Lancet*.[28]

Induced Abortion and Subsequent Spontaneous Abortion

Five studies[26,29,30,31,32] evaluated for associations between induced abortion and miscarriage (Appendix-Table 1). Two utilized cohort design and three were case-controlled studies. None found a significant association between induced abortion and early pregnancy loss. Those that analyzed their data by the number of previous elective abortions did not show a dose response effect.[26,29,31,32] Likewise, utilization of logistic regression to control for confounding variables failed to demonstrate any significant associations.[26,29,30,31,32]

Three studies[33,34,35] were found exploring induced abortion and placenta previa (Appendix-Table 2). Both the cohort[33] and the two case control studies[34,35] found a positive association. Taylor's paper generated an odds ratio of 1.3 with confidence intervals of 1.01 - 1.66. That estimate of risk was maintained in a logistic regression analysis.[35]

Ananth et al utilized meta-analysis to study abortion and placenta previa.[27] He combined five observational studies [33,36,37,38,39] (only one of which met our inclusion criteria and is presented in our table)[33] and found that women with prior induced abortion had a relative risk of placenta previa of 1.7 (1.0, 2.9). He also noted substantial heterogeneity in effect estimates across studies.

Induced Abortion and Subsequent Ectopic Pregnancy

Nine articles examined associations between induced abortion and ectopic pregnancy (Appendix-Table 3)[40-48] All but two of these utilized case control design.[41,47] An Italian case control study (n=559) showed a strong association between induced abortion and ectopic pregnancy (OR=2.9, CI=1.6, 5.3)[44]

A French case control study showed significant effect with a dose-response with two or more abortions: one abortion, OR=1.4 (CI=1.0 - 2.0) and two or more abortions OR=1.9 (CI =1.0-3.7)[48] The other seven studies did not demonstrate an association between abortion and subsequent ectopic pregnancy.[40-47]

Induced Abortion and Subsequent Preterm Birth (PTB)

We found 24 studies that explored associations between abortion and PTB (or a surrogate marker for PTB - low birthweight [LBW]) (Appendix-Table 4).[49-72] Twelve studies found an association between these two phenomena with consistent results in risk ratio elevation of 1.3-2.0. Moreover, seven of the twelve identified a "dose response effect" with risk estimates rising as a woman had more induced abortions. Also notable is the increased risk of very early deliveries at 20-30 weeks after induced abortion, first noted by Wright, Campbell, and Beazley in 1972.[49] Seven subsequent papers displayed this phenomena of mid-term pregnancy PTB associated with induced abortion,[57,59,60,63,64,70,72] which is especially relevant as these are the infants with the most dire risk of morbidity and mortality, upon which society expends so many resources.[73] Of particular note are the three large cohort studies done in the 1990s, 20 – 30 years after legalization.[70,71,72] Each shows elevated risk and a dose response effect. One would assume that these studies were done so long after legalization that the stigma of abortion that might contribute to underreporting would have waned. Henriet and Kaminski[72] did sensitivity analyses of non-differential underreporting of previous induced abortion in women experiencing a preterm birth and found that their risk estimates were stable even with underreporting rates of 50%.

Induced Abortion and Subsequent Subfertility

Seven articles have studied links between abortion and the subsequent inability to conceive (Appendix-Table 5).[74-80] Only two studies from Greece[74,79] have seen any association. Each was done in different decades. Other studies found no association. Finding an appropriate control group for fecundity studies limits all such papers. Women undergoing abortion are by definition fertile and neither women who have never conceived nor those who have born children constitute an ideal comparison group.

Induced Abortion and Subsequent Breast Cancer

As described earlier, we have addressed the linkages between

induced abortion and breast neoplasia differently from the other topics. Rather than replicate the tables and works of numerous other authors we have summarized four review articles,[81-84] one of which conducted a meta-analysis (Appendix-Table 6).[83] Two of the four reviewers[81,82] found no association between induced abortion and breast cancer, while one found a "small to non-significant effect."[84] The sole meta-analysis by Brind et al reported a summary odds ratio for breast cancer of 1.3 (95% C1 1.2, 1.4) in patients with a previous induced abortion.[83] They concluded that induced abortion is an independent risk factor for breast carcinoma.[83]

All the reviews comment on the potential for bias in data collection, presentation, and analysis emphasizing in particular the sensitive nature of abortion with its potential for underreporting. All the reviewers acknowledge that these potential biases could obscure real relations or create spurious associations. In addition, reviewers comment on the high likelihood of a "file drawer" effect with pertinent studies being withheld from publication due to the highly politicized atmosphere in which their findings would be reported. None of the reviewers seems to be comfortable with the scope and content of the current literature. Each advocates for the analysis of prospectively gathered data that link known pregnancy outcomes to subsequent neoplastic events.[28,85] Brind et al have clearly demonstrated the need for such studies by showing that, despite the relatively low increase in risk they discovered, the high incidence of both breast cancer and induced abortion would ensure a substantial impact on women's health if their conclusions are correct.[83] Weed and Kramer have thoughtfully considered the ways in which the conclusions one draws on this "thorny" issue are influenced by the moral values each reviewer brings to these complex data.[85] Nonetheless, a statistically significant positive association between induced abortion and breast cancer cannot be easily dismissed, as Brind's is the only quantitative review.

Induced Abortion and Subsequent Mental Health

The literature on psychosocial sequelae of induced abortion is confusing and results are confounded by not only the research problems described above but the cultural, religious, and legal milieu of reproductive decision-making within the society studied.[86] Given the psychological distress faced by a woman with an "unwanted or unintended" pregnancy, separating the sequelae of such a pregnancy from its ultimate disposition can be quite difficult.[87] Given the breadth of mental health outcomes postulated to be associated with induced abortion, we present tables that reflect the range of outcomes in published reports. Because mental health status may change over time, we have also annotated the duration of follow-up for each particular study.

Table 7 (Appendix) presents our tabulation of these studies; of particular note is the association between induced abortion and either suicide or suicide attempt.[90,93,96,97] This is an objective rather than a subjective outcome, and the fact that the effects are seen after induced abortion rather than before[90,93] indicates either common risk factors for both choosing abortion and attempting suicide, such as depression, or harmful effects of induced abortion on mental health. This phenomena is not seen after spontaneous abortion.[91] Other studies tabulated that demonstrated increased risk of depression or emotional problems after induced abortion in certain subgroups may explain the psychopathology that culminates in deliberate self-harm.[88,91,94]

Conclusions

The long-term health effects of elective abortion are difficult to study and thus poorly understood. This lack of knowledge stems from a variety of causes. First and foremost, exposure to abortion cannot be assigned on an experimental basis, restricting researchers to rely on observational studies and precluding randomized trials. Thus, all research in this realm is prone to an array of different sources of bias that complicate the process of drawing conclusions. Second, it is not clear what group of women constitutes an appropriate comparison group for these observational studies. Third, the decision to terminate a pregnancy is emotionally difficult for many women. Hence, regret, remorse, or shame may cause them not to disclose having made such a decision when queried about their reproductive histories. Fourth, the long-term health consequences of elective abortion have been highly politicized. Those who would grant a moral status to an embryo or fetus, and thus limit elective abortion, often use adverse health consequence claims as a tool to further their moral agenda, while those who support no restrictions on abortion access are at times unwilling to consider that pregnancy interruption could affect future mental and physical health. Finally, the effect sizes are small with risk ratios, when present, falling in the range of a doubling or less of risk for comparatively rare outcomes. The potential for modest influence on events that are unlikely and distant for an individual woman hinders the ability of clinicians or patients to use their experience and judgment to employ such information in decision-making.

One might then reasonably ask why study such a complicated, politically treacherous, and difficult to understand phenomena? Studies would have to be large and thus expensive to have adequate power to detect small effects and control for the biases described and might not directly influence clinical care. We would point to cigarette smoking and its health consequences as an answer. In the 1950s and 60s each point delineated in the preceding paragraph could have been and were applied to the dilemma

of studying whether tobacco consumption has adverse health consequences. While no individual clinician or patient could discern the harms of cigarette smoking and all studies had to be observational with their inherent biases, well-done epidemiologic research was able to document adverse consequences and ultimately inform public opinion and policy. Elective abortion must be studied in the same fashion with similar vigor, given the frequency with which women choose to terminate a pregnancy and the important and prevalent health conditions that some of the data gathered heretofore have linked to elective abortion, e.g., preterm birth and breast cancer. Women deserve to be fully and accurately informed about potential health effects of elective abortion, preferably in a health education context separate and distinct from the timeframe of actually being faced with making difficult decisions about whether to continue or end a pregnancy.

Until further research and meta-analyses are forthcoming, we are faced with the uncertainties outlined in this review. We find little evidence to support the claims that elective abortions increase the risk of subsequent subfertility, ectopic pregnancy, and spontaneous abortion. Of more concern are the possibility of links to preterm birth, placenta previa, breast carcinoma, and serious mental health problems.

Abortion is a procedure most used by women at the outset of their reproductive life. The majority of women having an induced abortion are under 30 years old.[72] Preterm birth is common, affecting around 10% of deliveries in the Western World, and is the leading cause of infant morbidity and mortality.[73] Despite substantial investigative effort, primary preventive measures to lower the rate of preterm births have proven futile and rates have been steady or increased over the past two decades.[73] The population-based studies we reviewed suggest that induced abortion increases the risk of preterm birth in subsequent pregnancies. Moreover, these reports suggest that a dose response effect is present with increasing numbers of abortions associated with increasing risk, and that the linkage is most strong with extremely premature deliveries (<32 weeks), which is the population of newborns that experiences the bulk of the morbidity and mortality that occur from being born prematurely. **Readers should note that the increased risk of early childbirth associated with induced abortion occurs over and above the background risk of preterm birth (estimated to be 10%) inherent with any pregnancy.** The respective roles of various surgical and medical techniques used for induced abortion and their impact on preterm birth remain unexplored and may mitigate these consequences. In light of these data, we believe that women in general, including those considering abortion, need to be informed that surgical abortion procedures may increase the likelihood of subsequent preterm births, and that the risk associated with the other methods is unknown. For those women who choose abortion, techniques that in

theory protect the cervix from trauma, such as laminaria or pre-abortion cervical ripening, should be utilized.

Placenta previa affects 0.3 - 0.8% of pregnancies and is the leading cause of uterine bleeding in the third trimester and of medically indicated preterm birth. Pregnancies complicated by placenta previa result in high rates of preterm birth, low birthweight, and perinatal death.[27] Both the observational studies included in our review and Ananth et als' meta-analysis show a link between placenta previa and previous induced abortion. The meta-analysis[27] incorporated articles outside the scope of our search and exemplifies how review of other papers on topics such as smoking and placenta previa can inform the search for linkages between abortions and reproductive health. Ananth et al speculate that a 50% reduction in induced abortion would be required to avert 1.5% of placenta previa cases. Placenta previa is rare enough and the impact of this change is so small that we would not feel obliged to mention this to women contemplating their first abortion. Our advice might change if a woman had had a previous cesarean section, an independent risk factor for placenta previa; or if she were contemplating undergoing a second elective pregnancy termination.[27] In other venues, information about the existence and magnitude of risk may be appropriate for health education summaries of the reproductive correlates of elective abortion.

Potential links between breast cancer and abortion are the most controversial long-term health consequence explored in our review. Findings are mixed with reviewers and authors of original manuscripts drawing different conclusions. The one meta-analysis done to date points to a small but significant link between abortion and breast carcinoma. The current literature is insufficient to be informative for counseling. Nonetheless, the topic is worthy of well-designed and conducted research and of careful meta-analyses using the hand search techniques employed by Ananth et al[27] to explore sources of published data not focused on the direct link between abortion and breast cancer. In the interim should we, and how do we, inform the patients? We would argue that given the undisputed protective effect of a full-term delivery early in one's reproductive life on subsequent breast cancer development that a young woman facing an unwanted or crisis pregnancy can and should be informed of the loss of that protection which would derive from a decision to terminate her pregnancy and delay having a baby.[98,101]

To illustrate, Figure 1 (Appendix) utilizes the Gail Equation to predict the five-year and lifetime risk of breast carcinoma for an 18-year-old woman with an unintended or crisis pregnancy. The Gail model[99] is considered the best available measure for estimating an individual woman's risk of developing breast cancer. It was used to calculate risk estimates for the National Cancer Institute's breast cancer chemo-

prevention trial and is specifically designed to be useful in decision-making by women.[100] In the first scenario, she decides to terminate and then has her first term delivery at age 32, where in the second she has a live-born infant. We then assess her individual risk at age 50, when the risk of breast cancer begins to peak. For both black and white women her decision at age 18 and subsequent reproductive choices can almost double her five-year and lifetime risk of breast neoplasia at age 50.

Tables 5, 8, and 9 (Appendix) demonstrate that the "loss of protection" effect is most pronounced in women under twenty years of age who elect to undergo abortion rather than continue their pregnancy. We believe at the present time that clinicians are obliged to inform a pregnant woman that a decision to abort her first pregnancy may almost double her lifetime risk of breast cancer through loss of the protective effect of a completed first full-term pregnancy earlier in life. Additionally, we believe that women should be aware of the studies that support induced abortion as an independent risk factor for breast cancer, with the only quantitative analysis showing a small but statistically significant odds ratio of 1.3, while the other three reviewers (which are non-quantitative) refute this.

The effects of elective abortion on mental health are challenging to interpret for the reasons outlined. While earlier studies focusing on secondary outcomes were reassuring, more recent, large cohort studies linking abortion to the "hard" outcomes of either suicide, psychiatric admission, or deliberate self-harm are concerning.[90,93,97] A major question remains unanswered because of the lack of a proper control group. Is the observed phenomena a correlate of the circumstance that may lead to a crisis or unintended pregnancy regardless of a woman's decision to choose abortion, or is this a function of both? Until that question can be answered it will be hard to inform women as to what, if any, additional risk a decision to terminate will produce. Likewise, the uncertainty limits a clinician's ability to reassure such a woman that her decision will not have long-term mental health effects. The observation of the association, regardless of the lack of causal linkage, suggests careful screening and follow-up for depression and anticipatory guidance/precautions for women who choose elective abortion.

Informed Consent Implications

Informed consent is a bioethical tool used in medical practice to protect an individual's autonomy as he or she makes a health care decision. Clinicians are obliged by law to inform patients prior to a medical decision of the benefits and risks of the treatment being pondered. The goal is not to confuse a patient nor direct her decision-making but to provide patients

with the information that a reasonable person would want to know. Thus, not every possible good or bad consequence or consequences that are uncertain are obliged to be shared. In light of our review we believe that any woman contemplating an induced abortion should be cautioned about the mental health correlates of an increased risk of suicide or self-harm attempts as well as depression and a possible increased risk of death from all causes. Analogous to the clinical practice with puerperal depression, women undergoing abortion should be screened for depression at follow-up visits, warned of the signs and symptoms of depression and suicidal ideation, and provided easy access to mental health evaluation and treatment.

The reader should keep in mind that the informed consent process is an interaction between two individuals, clinician and patient, with the intent to respect the patient's autonomy. Individual patients will weigh the importance of these potential risks differently, based on their life experiences and values. Furthermore, we anticipate the outcry arising from this approach from both sides of the abortion debate. Those who would ascribe a moral status to an embryo or fetus will view calculation of risk as a cruel calculus compared to the loss of an individual life. Their opponents who view maternal autonomy as paramount and fear that an unwanted pregnancy limits a woman's capacity for fulfillment will view information about remote risk from abortion as an attempt to limit access to the procedure. Nevertheless, we think abortion decision-making should include the protection of informed consent and women who wish to know the long-term physical and mental consequences of their decision should be informed.

Furthermore, women contemplating their first induced abortion early in their reproductive life should be informed of two major long-term health consequences. First, their risk of subsequent preterm birth, particularly of a very low birthweight infant, will be elevated above their baseline risk in the current pregnancy. Second, they will lose the protective effect of a full-term delivery on their lifetime risk of breast carcinoma. This loss of protection will be in proportion to the length of time that elapses before they experience their first delivery. Increased rates of placenta previa and the disputed independent risk of induced abortion on breast cancer risk warrant mention as well. Failure to provide this information is a direct threat to maternal autonomy, diminishing a woman's ability to give informed consent. We believe a reasonable person is entitled to know these conclusions and their limitations, and having been informed will find herself in a better place to personally evaluate the long-term health consequences of an induced abortion.

We acknowledge that the setting of informed consent at the time of counseling about an undesired or crisis pregnancy is suboptimal as an

opportunity to be first introducing the potential risks of elective abortion. Women would be better served by having pre-existing knowledge about the scope and nature of potential risks. That being the case suggests that reproductive health education opportunities in clinical settings, schools, and the media, would serve the interests of women best by featuring currently available information about potentially associated risks. Such knowledge could hypothetically reduced behaviors that place individuals at risk of an undesired pregnancy, and certainly would protect against the undesirable but necessary circumstance of being provided with such information for the first time in the setting of a crisis pregnancy.

Given the central role that abortion has played in the lives of women over the past thirty years, we are distressed by the lack of term-term, well-done research designed to understand the sequelae. A clear and overwhelming need exists for a large epidemiologic, cohort study of women with an unintended or crisis pregnancy. Follow-up across participants' lifetimes with careful measurement of other pertinent exposures would dramatically advance knowledge. Until such an investigation is invested in, women are making important health decisions with incomplete information. A commitment to such research would seem to us to be morally neutral common ground upon which both sides of the abortion/choice debate would agree is critical.

Appendix

Table 1: Induced Abortion and Subsequent Spontaneous Abortion

Ref	Epoch	Location	Number	Abortion Ascertainment	Design	Findings
#26	1987-1989	Canada	1,324	Self report	Case Control	No association
#29	1990-1995	Italy	2,325	Self report	Case Control	No association
#30	1975-1977	Germany	3,042	Medical records	Cohort	No association
#31	1980-1982	USA	3,110	Self report	Cohort	No association
#32	1974-1982	USA	989	Self report	Case Control	No association

Table 2: Induced Abortion and Subsequent Placenta Previa

Ref	Epoch	Location	Number	Abortion Ascertainment	Design	Findings
#33	1979-80	USA	3184	Self report	Cohort	Induced abortion is associated with placenta previa
#34	1984-87	USA	2084	Self report	Case control	Induced abortion is associated with placenta previa (OR- 1.30)
#35	1993-97	Thailand	16,169	Self report	Cohort	Two induced abortions associated with placenta previa (OR- 2.1)

Table 3: Induced Abortion and Subsequent Ectopic Pregnancy

Ref	Epoch	Location	Number	Abortion Ascertainment	Design	Findings
#40	1976-78	USA	583	Self report	Case Control	No association
#41	1975-80	USA	102, 320	Medical records	Cohort	No association
#42	1976-78	USA	2,788	Self report	Case Control	No association
#43	1986-87	Greece	140	Self report	Case Control	No association
#44	1992-94	Italy	559	Self report	Case Control	Relative risk of ectopic pregnancy increased 2.9 (1.6-5.3)
#45	1987-90	Finland	289	Self report	Case Control	No association
#46	1988-90	USA	1,238	Self report	Case Control	No association
#47	1987-92	Norway	3,754	Medical records	Cohort	No association
#48	1989-91	France	1,955	Self report	Case Control	Relative risk of ectopic pregnancy increased 1.4 (1.0 – 2.0) Also dose response effect.

Table 4: Induced Abortion and Subsequent Preterm Birth or Low Birth-Weight (LBW) Infant

Ref	Epoch	Location	Number	Abortion Ascertainment	Design	Findings
#49	1971	England	3,314	Self report	Case control	Increase in PTB
#50	1971	Japan	3,877	Self report	Case control	No association
#51	1966-68	Greece	13,242	Self report	Cohort	Increased risk PTB
#52	1966-68	Israel	11,057	Self report	Cohort	Increased risk LBW
#53	1972-76	USA	1,042	Self report	Cohort	No association
#54	1974-75	Denmark	7,327	Self report	Cohort	No association
#55	1972-76	Norway	3,780	Self report	Cohort	No association
#56	1970-72	Norway	1,238	Self report	Case control	No association
#57	1974-76	USA	31,917	Self report	Cohort	Increased risk PTB RR: 1.99 (1.09-3.62)
#58	Pre-1979	Finland	1,046	Self report	Case control	No association
#59	1973-74	Denmark	7,270	Self report	Cohort	No association
#60	1976-78	USA	1,312	Self report	Case control	Association with PTB <29 wks., proportional to the number abortions, increased with increasing numbers
#61	1976-78	USA	6,179	Self report	Case control	Association with pregnancy failure*
#62	1974	USA	6,832	Self report	Case control	No association
#63	1973-77	Netherlands	133	Self report	Case control	Association with PTB
#64	1977-80	USA	9,823	Self report	Cohort	Increased abortion association with PTB via ROM OR: 1.9 (1.3, 2.9)**
#65	1976-79	England	1,339	Med. Records	Cohort	No association
#66	1976-79	England	2,483	Med. Records	Cohort	No association
#67	1985-89	China	560	Self report	Case control	No association
#68	1988-89	USA	420	Med. Records	Case control	Association with spontaneous PTB 1.6 (.9, 2.7); increased risk with increasing numbers.
#69	1984-87	USA	6,451	Med. Records	Cohort	No association, no >risk with multiple abortions
#70	1994	Germany	106,345	Med. Records	Cohort	Association with PTB 1.8 (1.6 – 2.1) increased with increasing numbers
#71	1996	Denmark	61,753	Med. records	Cohort	Association d with increased risk LBW 1.9 (1.6, 2.3); increased with increasing numbers
#72	1995	France	12,432	Self report, Med. Records	Cohort	Association with increased risk PTB 1.4 (1.1, 1.8), with dose response effect; increased with increasing numbers

* SAB, ectopic, perinatal death ** Rupture of membranes

Table 5: Induced Abortion and Subsequent Subfertility

Ref	Epoch	Location	Number	Abortion Ascertainment	Design	Results
#74	1973-74	Greece	249	Self report	Case Control	Associated with
				increased risk of subfertility 3.4 (1.4, 8.4)		
#75	1974-75	Demark	7,720	Self report	Cohort	No association
#76	Pre-1984	Hungary, Korea	448	Self report	Case Control	No association
#77	1979-81	USA	395	Self report	Cohort	No association
#78	1973-83	England	140	Med Records	Cohort	No association
#79	1987-88	Greece	252	Self report	Case Control	Associated with
				increased risk of subfertility 2.1 (1.1, 4.0)		
#80	1976-87	England	1,468	Med records	Cohort	No association

Table 6: Induced Abortion and Subsequent Breast Cancer

Relevant review Articles & Meta-Analyses

Ref.	Epoch	No. of Studies	Meta-analysis	Findings
#81	966-96	32	No	Breast cancer risk did not appear to be associated with induced abortion.
#82	1966-98	Cannot ascertain	No	Breast cancer risk did not appear to be associated with induced abortion.
#83	1966-96	21*	Yes	Abortion is an independent risk factor for breast cancer [Odds ratio 1.3 (1.2-1.4)]
#84	1966-96	18	No	Any relation is likely to be small or non-significant

* 21 independent studies with representative data from 26 published reports.

Table 7: Induced Abortion and Subsequent Mental Health

Ref.	Epoch	Location	Number	Abortion Ascertainment	Design	Follow-up Length	Outcome Studied	Findings
#88	1984-91	USA	4,403	Self report	Cohort	5-10 yrs	Depression	Married (not
				unmarried women) with previous abortions were more				
				likely to be at increased risk of depression or 2.4 (1.11, 5.2)				
#89	1974	New Zealand	309	Telephone survey	Cohort	3-9 mos	Emotional effects	No emotional repercussions
#90	1987-94	Finland	9,192	Death certificates	Cohort	>30 days	Suicide	Increased risk of suicide
						after induced abortion; OR-3.1 (1.6, 6.0)		
#91	1993	USA	882	Self report	Cohort	2 yrs	Depression, self esteem	Regret associated
							with preexisting depression	
#92	1996	USA	700	Self report	Cohort	Up to 15 yrs	Substance abuse	Women who aborted first
					pregnancy more likely to report substance abuse			
#93	1991-95	England	408,000	Med records	Cohort	30 days post abortion	Suicide admission	Induced abortion associated
			with increased risk of admission after but note before RR-3.2 (118, 5.9)					
#94	1989	Sweden	854	Self report	Cohort	1 yr after abortion	Emotional distress	50-60% of women
					experienced emotional distress, severe in 30%			
#95	1996-2000	USA	54,419	Insurance claims	Cohort	4 years	Claim for mental health care	More claims after abortion
#96	1989-97	USA	173,279	Med records	Cohort	1-8 years	Death, suicide	Death (all causes)
		RR-1.6 (1.3, 7.0); suicide %%-2.5 (1.1, 5.7) more common after elective abortion						
#97	1976-79	Great Britain	13,261	Med records	Cohort	6 mos	Deliberate self harm	Self harm more common
				in women with induced abortion RR-1.7 (1.1, 2.6)				

Table 8: White Women with Unintended or Crisis Pregnancy at 18, 28, 38 Years of Age – Effects of Delaying First Live Birth by 5, 10, 20 Years Compared to Delivery Now*

Age at pregnancy	5-year risk at 50 w/delivery now	5-year risk at 50 w/5-year delay	5-year risk at 50 w/10-year delay	5-year risk at 50 w/20-year delay
18	0.7	0.9	1.1	1.3
28	1.1	1.3	1.3	—
38	1.3	1.3	—	—

*Assume term delivery, menarche at 12 years of age, no family history of breast cancer, no breast biopsies

Table 9: Black Women with Unintended or Crisis Pregnancy at 18, 28, 38 Years of Age – Effects of Delaying First Live Birth by 5, 10, 20 Years Compared to Delivery Now*

Age at pregnancy	5-year risk at 50 w/delivery now	5-year risk at 50 w/5-year delay	5-year risk at 50 w/10-year delay	5-year risk at 50 w/20-year delay
18	0.4	0.9	1.1	1.3
28	1.1	1.3	1.3	—
38	1.3	1.3	—	—

*Assume term delivery, menarche at 12 years of age, no family history of breast cancer, no breast biopsies

Figure 1.

Scenario

Gail Variable	#1	#2	#3	#4
Race	Caucasian, Non-Black	Black	Caucasian, Non-Black	Black
Age	50	50	50	50
Menarche	12	12	12	12
Age 1st live birth	32	18	32	18
#of first-degree relatives w/breast cancer	0	0	0	0
#of previous breast biopsies	0	0	0	0
5-year risk	1.3%	0.7%	0.8%	0.4%
Lifetime risk	12.1%	6.5%	6.7%	3.6%

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