Improving the Accuracy of Maternal Mortality and Pregnancy Related Death

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ABSTRACT: Comparing abortion-related death and pregnancy-related death remains difficult due to the limitations within the Abortion Mortality Surveillance System and the International Statistical Classification of Diseases and Related Health Problems (ICD). These methods lack a systematic and comprehensive method of collecting complete records regarding abortion outcomes in each state and fail to properly identify longitudinal cause of death related to induced abortion. This article seeks to analyze the current method of comparing abortion-related death with pregnancy-related death and provide solutions to improve data collection regarding these subjects.

Background

Nearly half of American women experience an unplanned pregnancy by age 45,[1] often eliciting the choice to either parent or obtain an induced abortion. With four of every ten unplanned pregnancies ending in abortion,[2] induced abortion exists as one of the most common procedures in medicine.[3] Women express various reasons for choosing induced abortion, with risk of maternal health serving as the primary motivation for 2.8% of American women and up to 37.9% of women internationally.[4] Given these data, understanding the current limitations associated with comparing the safety of induced abortion compared to live birth remains vital to providing informed consent to patients as well as accurate information to physicians.

While current statistics suggest pregnancy and induced abortion are associated with low mortality rates, the relative safety of each event remains heavily debated in the medical literature. In 2012, Raymond and Grimes authored a paper in *Obstetrics and Gynecology* comparing the live birth mortality rate (8.8 deaths per 100,000 live

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births) with the mortality rate of induced abortion (0.6 deaths per 100,000 abortions) concluding: "[the] risk of death associated with childbirth is approximately 14 times higher than that with abortion." [5] *Medscape* cites this paper to claim induced abortion poses less threat to the life of the women than childbirth.[3] The Royal College of Obstetricians and Gynecologist (RCOG) also state, "abortion is a safe procedure for which major complications and mortality are rare at all gestations." [6]

Aside from failing to consider the unique health status of the patient, (e.g. past medical history of the mother, gestational age of the fetus, availability and skill of birth attendants, access and transportation to adequate delivery facilities, availability of oxytocin and other medication, method of termination, skill of the abortion provider, number of abortions and health status of the patient prior to termination), comparing the death attributable to induced abortion with live birth remains an impossible task given the current limitations within the CDC *Abortion Mortality Surveillance System and International Statistical Classification of Diseases and Related Health Problems (ICD).* This article seeks to discuss these problems and provide possible solutions.

Limitations Within the CDC Abortion Mortality Surveillance System

The CDC utilizes the *Abortion Mortality Surveillance System* to collect data on abortion. However, the CDC explicitly mentions some of the limitations within this system:

1. Reporting abortion-related deaths is not federally mandated. States and reporting areas *voluntarily* provide the CDC with information regarding induced abortions. Recently California, Delaware, Maryland, and New Hampshire did not report. Since California constitutes nearly a quarter of all the induced abortions in the United States, much of the data regarding induced abortion is entirely immune to analysis.[7]
2. Some states encourage or mandate reporting the number or outcome of performed abortions, however, the enforcement of these laws varies by state. Therefore, the number of reported abortions does not reflect the actual number of abortions.
3. States lack a standardized reporting form, leaving the CDC with incomplete information about the characteristics of women obtaining abortions (e.g., not every form accounts for age, race, ethnicity, type of abortion, outcome of the procedure, ect.).
4. Abortions are reported by location performed rather than the residency of the patient, leading to underreporting of the number of abortions in states with less abortion providers.

These limitations hinder comparing abortion-related death with pregnancy-related death. Since the United States lacks a coherent system for tracking pregnancy outcomes, the best insight regarding maternal morality arises from countries with comprehensive databases and mandatory reporting of abortion and pregnancy related morbidity and mortality. Currently, Finland[8] and Denmark[9] offer some of the most complete data

regarding abortion and pregnancy outcomes. These countries show up to a four-fold increased risk of mortality following induced abortion compared to childbearing. Gissler et. al. notes that relying upon death certificates (as many systems do) misses three out of four pregnancy-associated deaths compared to comprehensive record systems.[10] This indicates that data suggesting childbirth remains less safe than induced abortion may be a result of the limitations of the *Abortion Mortality Surveillance System*.

In addition to studies from international records, data from the California Medicaid system (analogous to the databases in Finland and Denmark) illustrate that compared to women who gave birth, those with a history of abortion were more likely to die from suicide, accidents, homicide, mental disease (newly onset following an abortion) and cerebral vascular disease over an 8-year period.[11] This suggests that when considering the long-term outcomes, pregnancy (not induced abortion) best promotes the health of the patient.

Global trends in maternal mortality also challenge the claim that childbirth is more life threatening to the mother than induced abortion. Interestingly, countries with the most prohibitive abortion laws (e.g. Poland, Malta, and Ireland) display decreasing maternal mortality rates, while countries with some of the most liberal abortion laws (e.g. United States, Norway, and Canada) have increasing maternal mortality rates.[12] However, a recent article in *The Lancet* illustrates that the countries with the most liberal abortion laws also have the highest decline in abortion rate despite a rise in the number of "unsafe" abortions overall.[13] This implies that more "unsafe" abortions occur in areas with less strict abortion laws. However, Koch et. al. analyzes the data in countries with less liberal abortion laws, observing a gross overestimate in the number of abortions (10-fold) and abortion-related mortality (up to 35%) in Mexico.[14] This is concerning given the World Health Organization (WHO) categorizes Mexico as "List A" (having complete vital records on maternal mortality).[15] These discrepancies illustrate the problem with relying on the current data collecting methods offered by the WHO and CDC.

Limitations Within the ICD-10 Coding System

In addition to noting the limitations of the Abortion Mortality Surveillance System and the international data surrounding maternal mortality, definitions and parameters within the ICD-10 of section *O08.- Complications following abortion and ectopic and molar pregnancy* also hinder proper classification of death related to abortion.

The ICD-10 defines *pregnancy-related death* as "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death."[16] The ICD-10 does not offer a definition of *abortion-related death*; rather, the definition comes from the CDC's *Abortion Mortality Surveillance System*, defined as a "death resulting from a direct complication of an abortion (legal or illegal), an indirect complication caused by a chain of events initiated by an abortion, or an aggravation of a preexisting condition by the physiological or psychological effects of abortion."[17] However, in order to be considered as abortion-related, the complication must occur within 42 days following the procedure and is up to the subjective discretion of the physician.[18]

There are multiple problems within the ICD-10 coding system that prevents accurate data collecting on when abortion or live birth contributes to maternal morality:

1. As previously mentioned, the ICD-10 lacks a category or definition of abortion-related death. Currently abortion related complications are included under the heading: *Complications following abortion and ectopic and molar pregnancy*. This makes complications following induced abortion indiscernible from ectopic and molar pregnancy complications. Furthermore, these criterion are *subjective* and thoroughness of the physician identifying the cause of death. Esscher et. al. notes that despite mandatory reporting and electronic medical records, some "physicians fail to complete death certificates correctly, information about pregnancy is not always taken into account when certificates are coded, direct maternal deaths are not always coded with an underlying cause of death connected to pregnancy, and indirect maternal deaths are not captured."[20]
2. Pregnancy-related death is an *objective* criteria (i.e. any death when pregnant or 42 days following delivery) defined by time rather than by the cause of death. Therefore, a "pregnancy-related death" may be falsely categorized if the manner of death does not actually relate to the pregnancy itself (i.e. trauma, infection, uncontrolled pre-existing disease, ect.). For example, a death related to eclampsia clearly relates to pregnancy, while a death related to trauma from an automobile accident may not.
3. The 42 day allotment for pregnancy related death is an arbitrary definition selected to parallel the period defining infant mortality.[21] Moreover, this means the time allowed for pregnancy-related death is 7.5 times longer than that of an abortion-related death (i.e. 273 days gestation and 42 days following delivery equaling 315 days,[16] compared to only 42 days following the abortion procedure). Therefore, given the amount of time, deaths related to pregnancy will be higher simply based on the arbitrary timeline.
4. While the CDC states abortion-related deaths include "aggravation of a preexisting condition by the physiological or psychological effects of abortion," certain conditions remain unclassifiable by the ICD-10 coding system. For example, the rupture of an unidentified ectopic pregnancy during an induced abortion causing the death of the patient must be categorized as a pregnancy related death.[21] Complications due to an ectopic pregnancy do not appear within *complications following (induced) termination of pregnancy*.[22] Similar scenarios exist with pelvic inflammatory disease (PID),[23] and uterine rupture.[24] Pelvic inflammatory disease (PID) associated with previous abortions may also lead to ectopic pregnancy.[23] Therefore, complications occurring during an abortion procedure would more accurately be categorized under distinct subheadings (e.g. ectopic rupture, PID, or uterine rupture) within abortion-related death.[25]
5. The ICD-10 does not account for longitudinal causes related to abortion-related deaths. For example, physicians are instructed to routinely implant an intra-uter-

ine device (IUD) following abortion (over other forms of contraception).[26, 27, 28, 29, 30] This may damage the uterus or decrease peristalsis within the fallopian tube, increasing the risk of ectopic pregnancy compared to women not using any form of birth control.[31, 32, 33] Medical abortive agents (e.g. misoprostol) may lead to uterine rupture hemorrhage and scar formation. Much like a history of a previous cesarean section, this predisposes subsequent pregnancies to complications that may lead to hemorrhage and death of the patient upon delivery in a subsequent pregnancy.[24] However, if deaths related to these conditions occur beyond 42 days following the procedure, they become unclassifiable under abortion-related death despite the connection to the induced abortion procedure. These deaths would be difficult to classify as either pregnancy-related or abortion-related giving the overlapping nature of the inciting event.

6. It is also important to consider circumstances where pregnancy and childbearing might contribute to abortion-related death. For instance, some data suggest the rupture of a uterine scar from a previous caesarean section (CS) may increase complications of second trimester abortion.[34] Deaths from these events would also be difficult to classify as completely pregnancy-related or abortion-related.
7. Women often do not report their reproductive history (e.g. gestation at the time of abortion, method of abortion, spontaneous abortion, etc.) obfuscating the correlation between reproductive events and morbidity or mortality.[19]

Examining the Potential Long-Term Complications Associated with Induced Abortion

In addition to limitations within the CDC surveillance system and the ICD-10, the long-term complications of induced abortion are currently unaccounted for in the statistics on abortion-related death. Among these complications that may lead to the patients death are: mental illness, social demographics and breast cancer.

The effect of induced abortion on the mental health of a patient remains debated. The American Psychiatric Association (APA) claims, "there is no credible evidence that a single elective abortion of an unwanted pregnancy in and of itself causes mental health problems for adult women."[35] Interestingly, peer reviewed research illustrates an increase in mental illness directly attributable to induced abortion, especially in adult women in their twenties,[36] compared to live birth or spontaneous miscarriage.[37, 38] A recent review of nineteen studies on abortion and mental health reported thirteen studies showing a clear risk for at least one mental problem directly attributable to induced abortion, five studies with no effect and only one paper with worse mental outcome for childbearing.[39] Fisher et. al. also note a significant increase in sexual abuse in women with history of repeat induced abortion.[40] Other studies indicate that the risk of alcohol misuse, illicit drug use, suicidal behavior and incidence intimate partner violence (IPV) dramatically increases with the number of abortions.[41, 42] Gissler et. al. illustrates that suicide post-abortion is greatest among females age 15 to 24.[10] This is concerning given that suicide is the third leading cause of death among women ages 15-19.

Some argue correlations between mental health and induced abortion fail to consider the mental health status of the patient prior to pregnancy.[43] Despite an increased incidence in overall psychiatric illness after induced abortion, Munk-Olsen et. al. argue that a "selection phenomena" exists where women with a history of induced abortion constitute a population predisposed to psychiatric illness.[44] However, while the "selection phenomenon" explains the lack of new onset mental illness, it does not explain the increase in incidence of preexisting mental illness acutely following an induced abortion. Yet, given the increased incidence in mental illness following induced abortion it remains clear that such an event contributes to the mental distress experienced by a patient. Seeking an induced abortion may even constitute an expression of a psychiatric illness.

While mental illness associated with induced abortion remains debated, Furgusson et. al. illustrates that induced abortion does not abate the overall risk of mental illness compared to women without a history of abortion.[45] Given this data, the medical community would be more accurate by avoiding the use of the term "therapeutic abortion" when referring to an elective or induced abortion. It is worth noting that certain pregnancies (e.g. molar pregnancy or ectopic pregnancy) may require "abortive" procedures (i.e. D&C) to protect the life of the mother. However, in these circumstances there are clear benefits to aborting the pregnancy. These conditions would most accurately define a "therapeutic abortion."

While women obtaining an induced abortion show an increased incidence of mental illness, pregnancy is not void of mental health complications. Postpartum depression occurs in 10 to 20 percent of pregnancies and increases with maternal age, unmarried status, smoking or drinking, substance abuse, hyperemesis gravidarum, preterm birth, and high utilization of sick leave during pregnancy.[46] However, the incidence of postpartum depression is only slightly higher than depression among nonpregnant women[47] and symptoms typically improve without medication six months following delivery.[47]

In addition to mental health complications, the potential link between induced abortion and breast cancer exists as a long-term health consequence of induced abortion. Breast cancer is the most common women-specific cancer, consisting of nearly one third of all cancers.[48] Second to heart disease and lung cancer, breast cancer is the leading cause of death in American women. In the past decade, breast cancer decreased in white women, increased in black women and remained level in other ethnicities.[49] While these trends may be due to disparage within health care access, black women show the highest incidence of abortion by population with an increasing incidence of breast cancer (compared to other ethnicities).

Abortion may be linked to breast cancer due to the carcinogenic effects of estrogen (during pregnancy) without the protective effects of breast maturation (after an abortion).[50] *Harrison's Principles of Internal Medicine* notes, "Breast cancer is a hormone-dependent disease. Women without functioning ovaries who never receive estrogen-replacement therapy do not develop breast cancer."[51] Unlike other organs in the body, the breast does not fully mature until a women's first live birth. During pregnancy, immature

breast epithelial cells proliferate; this cell type lacks the protective effects of postlactional epithelium, making it more susceptible to carcinogens.[52, 53] Therefore, early menarche, late first full-term pregnancy and later onset of menopause all increase the exposure of estrogen to the body, which contribute to the risk of breast cancer.[51]

Despite the currently accepted physiological model of breast cancer as a hormone-based disease, the National Cancer Institute (NCI) issues the highest level of evidence against any relation between abortion and breast cancer.[54] The NCI considers any data indicating a possible cause between abortion and breast cancer a result retrospective data collecting and recall bias in the studies conduced in the 1990s.[55] Currently, the NCI rejects the abortion-breast cancer link based on a 2003 NCI workshop of "100 experts," a 2004 *Lancet* meta-analysis[56] and the 2009 American College of Obstetrics and Gynecologists (ACOG) report on abortion and breast cancer.[57] Interestingly, the NCI still accepts the well established fact that breastfeeding reduces the risk of breast cancer- yet induced abortion prevents women from this protective effect.[58]

While the link between abortion and breast cancer remains debated, many studies continue to indicate that induced abortion increases the risk of breast cancer in women.[59] In 2009, a prospective study by Ozmen et. al. found induced abortion to be a statistically significant independent risk factor for breast cancer (OR=1.66).[60] Lecarpentier et al. observed examined the medical history of French women with homogeneous risk regions for BRCA1 and BRCA2, finding an increase in breast cancer in patients with a history of induced abortion (OR = 1.28-3.84), with the highest risk in those with multiple abortions or a first abortion before age twenty.[61] A case control study by Jabeen et. al. in 2013 illustrated a 20-fold (OR= 20.62) increase in breast cancer in patients with a history of induced abortion.[62] Khachatryan et. al. conducted a case control study in Armenian women with diabetes mellitus type 2, finding an increase risk associated with a history of induced abortion (OR=2.86).[63] Given the rise in breast cancer in China with the one-child-policy, much research has been done on examining the effect of induced abortion on breast cancer in China. While two Chinese studies do not show an increase risk of breast cancer in women with a history of induced abortion,[64, 65] another study[66] and one recent meta-analysis[67] clearly illustrate a correlation between induced abortion and breast cancer. If a causal link exists between abortion and breast cancer, deaths due to abortion-related cases of breast cancer ought to be included in the criterion of abortion-related death. While this currently remains indiscernible, future research may elucidate the percentage of breast cancer attributable to induced abortion.

Practical Implications and Future Recommendations To Improve the Accuracy of Assessing the Risk of Maternal Death

Many factors contribute to the general impression that induced abortion remains markedly safer than childbirth. Calhoun accurately summarizes the problems with attaining valid scientific assessment of abortion mortality: "incomplete reporting, definitional incompatibilities, voluntary data collection, research bias, reliance upon estimations, political correctness, inaccurate and/or incomplete death certificate completion,

incomparability with maternal mortality statistics, and failing to include other causes of death such as suicides."[68] Therefore, the problem for providing accurate information to patients and physicians remains an issue of working within a faulty system, not a lack of data or analysis.

The following changes would dramatically improve the accuracy of discerning the etiology of maternal health:

1. Require mandatory reporting of all abortions and maternal deaths in all states as part of the use of electronic medical records (EMRs).
2. Separately and clearly track induced abortion-related deaths from deaths due to spontaneous abortions or stillbirths or live-birth related deaths by using a uniform tracking and coding system which clearly identifies which type of parturition event took place, and the relationship of the death to the parturition event.
    a. Include an objective definition of abortion-related death within the ICD-10 manual. Add an additional category and ICD code for long-term abortion-related death, allowing for complications that contribute to the death of the mother over time (especially from repeated abortions, breast cancer, ect.).
    b. Replace the arbitrary time frame for maternal deaths with a time frame that supports any complication directly attributable to pregnancy.
    c. Add a causality requirement to pregnancy-related deaths (matching causal association included in abortion-related deaths). For instance, if a mother has uncontrolled hyperthyroidism and dies while pregnant due to a thyroid storm that was not exacerbated by pregnancy, causality could not be attributable to the pregnancy and therefore could not be categorized as a pregnancy-related death.
    d. Separate abortion from ectopic pregnancy and molar pregnancy in the ICD-10 section labeled *Complications following abortion and ectopic and molar pregnancy.* The new section under abortion complications should include subheads such as ectopic pregnancy rupture, uterine rupture, and other preexisting gynecologic conditions exacerbated by the induced abortion.
3. Update the analysis from NCI and CDC regarding newly published papers in support of the abortion and breast cancer link. Given the fact that data continues to arise on either supporting or negating the link, the NCI ought to justify why such a high strength of evidence rating exists.

In the meantime, health care professions ought to be aware of the limitations within the current system, especially when discussing pregnancy options for patients.

Conclusion

Comparing abortion-related death and pregnancy-related death remains difficult due to the inadequacy of the *Abortion Mortality Surveillance System* and the ICD-10 categories within *Complications following abortion and ectopic and molar pregnancy.* These systems lack a systematic and comprehensive method of collecting complete records

regarding abortion outcomes in each state. Furthermore, the ICD-10 classification does not identify the most proximal causes of death related to induced abortion. Lastly, mental and physical sequelae associated with induced abortion are currently denied by medical authorities despite primary literature that illustrates induced abortion is an independent risk factor for mental illness and breast cancer in certain populations. Until progress is made in collecting more accurate data, comparing abortion-related death and pregnancy-related would best be done within systems that include a complete and accurate medical record.

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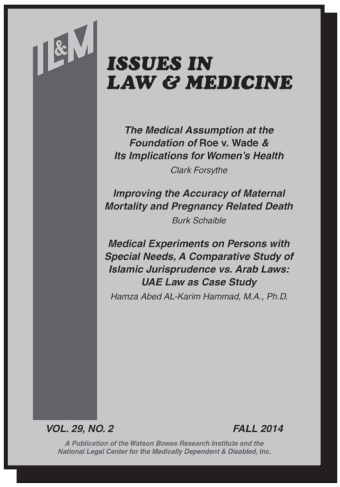

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