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## ARTICLES

### DEATHS ASSOCIATED WITH ABORTION COMPARED TO CHILDBIRTH – A REVIEW OF NEW AND OLD DATA AND THE MEDICAL AND LEGAL IMPLICATIONS

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In the landmark ruling of *Roe v. Wade*, the Supreme Court identified three reasons why States might seek to proscribe or regulate induced abortion: (1) “to discourage illicit sexual conduct”; (2) to exercise “the State’s interest — some phrase it in terms of duty — in protecting prenatal life”; and (3) “to protect the pregnant woman, that is, to restrain her from submitting to a procedure that placed her life in serious jeopardy.”<sup>1</sup>

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1. *Roe v. Wade*, 410 U.S. 113, 148-50 (1973).

The first reason, to discourage illicit sexual conduct, was quickly rejected by the Court, because it was not argued by the State and was also inconsistent with a ban on abortion for married couples. The second reason, the State's interest in protecting prenatal life, was the subject of much discussion (and remains so today), but this interest was substantially limited by the Court's determination that no consensus exists as to when human life begins. The Court allowed that the State's interest in protecting a prenatal life became more compelling as the pregnancy moved into later trimesters, but this interest could not impose a burden on the woman's own health needs.<sup>2</sup>

The third reason, to protect the life and health of the woman, was upheld as a legitimate and compelling state interest. However, the Court also noted that, due to medical advances,

abortion in early pregnancy, that is, prior to the end of the first trimester, although not without its risk, is now relatively safe. Mortality rates for women undergoing early abortions, where the procedure is legal, appear to be as low as or lower than the rates for normal childbirth. Consequently, any interest of the State in protecting the woman from an inherently hazardous procedure, except when it would be equally dangerous for her to forgo it, has largely disappeared.<sup>3</sup>

Using comparative mortality rates (abortion versus childbirth) as its marker, the Court held that "in the light of present medical knowledge," the State could only proscribe or regulate abortion to protect women's health after

approximately the end of the first trimester. This is so because of the *now-established medical fact* . . . that until the end of the first trimester mortality in abortion may be less than mortality in normal childbirth. It follows that, from and after this point, a State may regulate the abortion procedure to the extent that the regulation reasonably relates to the preservation and protection of maternal health.<sup>4</sup>

It was probably in regard to this judicial assessment of abortion's safety relative to childbirth that Chief Justice Berger stated that he was "troubled that the Court has taken notice of various scientific and

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2. *Id.* at 164-65.

3. *Id.* at 149.

4. *Id.* at 163 (emphasis added). This use of comparative mortality rates as the dividing line determining when the State may regulate abortion to protect the health interests of women was also stated and reaffirmed in *Planned Parenthood v. Casey*, 505 U.S. 833, 929 (1992).

medical data in reaching its conclusion.”<sup>5</sup> In stating his concern, the Chief Justice may have been reflecting the insight that medical opinions are often reversed in light of new discoveries. If later research were to reveal that abortion is not safer than childbirth, and more particularly that the mortality rate associated with first trimester abortions is not lower than that for childbirth, the logic of *Roe* would require a reversal of the practical impact of the ruling.<sup>6</sup> By establishing comparative mortality rates as the standard that determines when a State’s interests become “compelling,” it follows that the constitutional restrictions on the State’s right to proscribe or regulate abortion would necessarily contract if and when it were found that the mortality rates of abortion were higher than mortality rates associated with childbirth.

Thirty years later, the best available evidence now contradicts the “established medical fact” relied upon in *Roe*. Recent analyses of large medical databases linked to death certificates have now shown that when mortality rates associated with abortion and childbirth are examined using a single uniform standard, significantly higher mortality rates are associated with abortion (see Table 1). These record linkage studies have demonstrated that pregnancy-associated deaths are actually two to four times higher for aborting women compared to delivering women.

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5. *Doe v. Bolton*, 410 U.S. 179, 208 (1973). It should be noted that the court has also made subsequent statements reflecting the belief that mortality rates for abortion are lower than for childbirth. In *Stenberg v. Carhart*, 530 U.S. 914, 923-24 (2000), there is this language: “Vacuum aspiration is considered particularly safe. The procedures for mortality rates are, for example, 5 to 10 times lower than those associated with carrying the fetus to term.” *Id.* (citing *OBSTETRICS: NORMAL & PROBLEM PREGNANCIES* 1251 (Steven G. Gabbe et al. eds., 3<sup>rd</sup> ed. 1996); Herschel W. Lawson et al., *Abortion Mortality, United States, 1972 through 1987*, 171 *AM. J. OBSTETRICS & GYNECOLOGY* 1365, 1368 (1994); MAUREEN PAUL ET AL., *A CLINICIAN’S GUIDE TO MEDICAL AND SURGICAL ABORTION* 108-09 (1999)). None of these cited sources, however, take into account the recent record-based studies discussed herein. Moreover, the mortality statistics they do rely upon are subject to all of the same criticisms described in this article.

6. *Casey*, 505 U.S. at 861-64.

*Table 1: Record linkage studies comparing deaths associated with abortion and childbirth*

Location	Time Period	Primary Source Record	Secondary Source Linked to Primary Source	Age-adjusted relative risk of death from all causes for aborting women compared to delivering women over the period of time examined
Finland <sup>7</sup>	1987-94	9,192 death certificates	Birth and abortion registries for the one year prior to death	3.5 over 1 year
California <sup>8</sup>	1987-98	173,279 women with a pregnancy outcome in 1987 paid by Medicaid insurance	Death certificates for subsequent eight years	2.0 over 2 years 1.6 over 8 years

While no state has yet attempted to regulate or proscribe abortion based on these findings, it is likely that the key “medical fact” relied upon in *Roe* will come under much closer judicial scrutiny in the near

7. Mika Gissler et al., *Pregnancy-Associated Deaths in Finland 1987-1994—Definition Problems and Benefits of Record Linkage*, 76 ACTA OBSTETRICIA ET GYNECOLOGICA SCANDINAVICA 651 (1997).

8. David C. Reardon et al., *Deaths Associated with Pregnancy Outcome: A Record Linkage Study of Low Income Women*, 95 S. MED. J. 834 (2002).

future. Presented with evidence that abortion, even in the first trimester, is associated with higher rates of death among women, the Supreme Court could determine that the new demonstration of facts is sufficient to establish that the State has a compelling interest in regulating or even prohibiting abortion in the first trimester.<sup>9</sup> While such a ruling might open the way for states to enact and enforce the type of restrictions that existed prior to 1973, it would not require any change in constitutional law. Instead, such a ruling would simply apply the existing standard in *Roe* to the best current understanding of facts. In that event, the principle of *stare decisis* would be preserved and the Court could not be accused of “compromises with social and political pressures.”<sup>10</sup> In short, the Court may allow new restrictions on abortion due to a change in facts without engaging in any reinterpretation of constitutional law.

Alternatively, as signaled in *Planned Parenthood v. Casey*, a demonstration that key factual assumptions in *Roe* were actually false might justify a complete repudiation of *Roe*.<sup>11</sup> However, since such a

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9. Such an interpretation would be consistent with reasoning employed in *Casey* which noted that advances in medical knowledge required a rejection of the strict trimester system established in *Roe*. *Casey*, 505 U.S. at 873. Regarding the interest of the State in protecting viable unborn humans, the Court recognized that advances in fetal care had resulted in a shift in viability into the second trimester, which meant that the State therefore had a compelling interest in protecting viable human lives prior to the third trimester. *Id.* at 859-60. Using similar reasoning, the Court might rule that *Roe*'s other central holding — “the State may enact regulations to further the health or safety of a woman seeking an abortion,” *id.* at 878, and the State's interest in regulating abortion for this purpose is compelling “at that point that the mortality rate in abortion approaches that in childbirth,” *id.* at 878, 929, — provides a basis for allowing State regulation of abortion in the first trimester in light of the new evidence that the mortality rate associated with abortion, even in the first trimester, exceeds that associated with childbirth.

10. *Casey*, 505 U.S. at 865.

11. In *Casey*, the Court acknowledged that changes in factual understanding have necessitated the reversal of basic judicial interpretations of the Constitution in the past, but that the claim of such a change in facts had not been presented to the Court in *Casey*. *Id.* at 861-64. In a discussion of cases when the Court had appropriately overruled prior interpretations of constitutional law, the Court noted, as an example, that *West Coast Hotel Co. v. Parrish*, 300 U.S. 379 (1937), “signaled the demise of *Lochner*” because the Depression had exposed the false factual assumptions about the capacity of a relatively unregulated market to satisfy minimal levels of human welfare . . . The facts upon which the earlier case [*Lochner*] had premised a constitutional resolution of social controversy had proven to be untrue, and history's demonstration of their untruth not only justified but required the new

departure from *stare decisis* might undermine the Court's credibility,<sup>12</sup> it is likely that the Court would overrule *Roe* only if its failure to do so would cost women, their families, and the nation a "terrible price."<sup>13</sup> For abortion opponents, that "terrible price" would be the physical and psychological damage women suffer from abortion, plus the loss of pre-viable human lives, that would continue in states that might fail to adequately restrict abortion. For abortion supporters, that "terrible price" would be the loss of easy access to abortion, as either a tool for self-determination or as a tool for population control, eugenics, or social engineering. Faced with these two opposing viewpoints, but confronted with a change in facts sufficient to reject *Roe*'s standard as useful for determining when the State has a compelling interest in protecting maternal health, the Court could either (a) return the task of judging the medical evidence for when abortion is contraindicated or medically justified to state legislators and state regulators, thus opening the way to a hodgepodge of different regulations in different states; (b) require the States to prohibit abortion on the grounds of an affirmative duty to protect women's health and the lives of their pre-viable children, and thereby establish a single national standard; (c) define a new, more lax medical standard for determining when the State's interest in protecting women's health is compelling; or (d) define the right to seek and perform abortions as an absolute right that is not subject to any State regulation, an option that the Court has, in the past, firmly dismissed.<sup>14</sup> While none of these options will satisfy all

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choice of constitutional principle that *West Coast Hotel* announced. . . . [T]he clear demonstration that the facts of economic life were different from those previously assumed warranted the repudiation of the old law.

*Casey*, 505 U.S. at 861-62.

Similarly, in the face of growing evidence about the higher mortality rates associated with abortion, in addition to new evidence linking abortion with higher rates of physical and psychological morbidity, it has become clear (to paraphrase the Court's above-stated analysis of *Lochner*) that *Roe* rests on false factual assumptions about the capacity of a relatively unregulated abortion industry to satisfy minimal levels of women's welfare.

12. *Casey*, 505 U.S. at 864-69.

13. *Id.* at 864.

14. "Some *amici* argue that the woman's right is absolute and that she is entitled to terminate her pregnancy at whatever time, in whatever way, and for whatever reason she alone chooses. With this we do not agree." *Roe*, 410 U.S. at 153. "The privacy right involved, therefore, cannot be said to be absolute. . . . The Court has refused to recognize an unlimited right of this kind in the past." *Id.* at 154. "Even an adult woman's right to an abortion is not unqualified." H.L. v.

parties, the latter two seem especially unlikely as these would require the Court to determine that a higher priority must be placed on protecting the abortion “liberty”<sup>15</sup> than on protecting women’s health.

Even if new information on abortion-associated mortality were not to have any effect on the constitutional law governing abortion regulations, however, it should have an impact on the medical judgment of physicians recommending abortion. This is especially true in countries such as Great Britain, which only allow abortion when it is medically deemed to be safer than carrying a child to term.<sup>16</sup>

Clearly, the question of the comparative mortality rates of abortion and childbirth is an important legal and medical issue. Therefore, the purpose of this paper is to examine the evidence accumulated regarding these comparative mortality rates in greater detail than has previously been done. To that end, the remaining portion of this paper will review the basis for and the difficulties involved in prior efforts to compare the mortality rates of abortion and childbirth, examine the

Matheson, 450 U.S. 398, 419 (1981) (Powell and Stewart, concurring); *see also* Planned Parenthood v. Danforth, 428 U.S. 52, 60 (1976); *Casey*, 505 U.S. at 875-76.

15. *Casey*, 505 U.S. at 869.

16. In the United Kingdom, the 1967 abortion act provides that an abortion is legal

if two registered medical practitioners are of the opinion, formed in good faith — a) that the continuance of the pregnancy would involve risk to the life of the pregnant woman, or of injury to the physical or mental health of the pregnant woman or any existing children or of her family, *greater than if the pregnancy were terminated*; or b) that there is a substantial risk that if the child were born it would suffer from such physical or mental abnormalities as to be seriously handicapped.

The Public General Acts, 1967, p. 2033 (Eng.) (emphasis added); *see also* The Public General Acts, Human Fertilization and Embryology Act, 1990, p. 1493, c.37 (Eng.) The Act states that the time limit is defined in terms of

(a) that the pregnancy has not exceeded its twenty-fourth week and that the continuance of the pregnancy would involve risk, greater than if the pregnancy were terminated, of injury to the physical or mental health of the pregnant woman or any existing children of her family; or (b) that the termination is necessary to prevent grave permanent injury to the physical or mental health of the pregnant woman; or (c) that the continuance of the pregnancy would involve risk to the life of the pregnant woman, greater than if the pregnancy were terminated; or (d) that there is a substantial risk that if the child were born it would suffer from such physical or mental abnormalities as to be seriously handicapped.

*Id.*, available at <http://www.legislation.hmso.gov.uk/cgi-bin/search.pl?DB=hmso-new> (last visited Apr. 17, 2004).

strengths and weaknesses of the new record-based studies, and examine these findings in the light of related research that provides an additional context in which to interpret these results.

### OBSTACLES IN ASSESSING PREGNANCY ASSOCIATED DEATHS

On March 1, 1989, Erica Richardson, a sixteen-year-old Maryland resident, bled to death from a uterine perforation only hours after undergoing an abortion. During the next five months, two other residents of Maryland, Gladys Estanislao and Debra Gray, also died from abortion complications.<sup>17</sup> Surprisingly, none of these women was ever granted the smallest of recognitions—becoming a statistic. The official statistics issued by Maryland public health officials showed that *there were no deaths* from abortion in 1989. Indeed, Maryland only reported a single abortion-related death for the entire decade of 1980 to 1989.<sup>18</sup>

Actually, there was a fourth woman who died as a result of a 1989 abortion in Maryland. In this case, Susanne Logan fell into a coma during her abortion and awoke four months later as a quadriplegic, unable to talk. She survived for three years, dying in 1992 at the age of twenty-four.<sup>19</sup> Since Susanne's death did not occur within forty-five days of her abortion, it has not been counted in any of the official abortion mortality statistics.

These four deaths occurred in one small state. For that same year, 1989, the Abortion Surveillance Unit of the Centers for Disease Control and Prevention (CDC) reported only twelve abortion-related deaths for the entire country.<sup>20</sup> But, as we will see, the CDC lacks any regular and systematic means of identifying abortion-related deaths.

There are numerous inherent difficulties involved in efforts to identify deaths related to pregnancy, childbirth, and abortion. First, it is obvious that the quality of analyses and conclusions can never

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17. KEVIN SHERLOCK, VICTIMS OF CHOICE, 134-35 (1996).

18. *Id.*

19. SHERLOCK, *supra* note 17, at 33; James A. Miller, 'Safe and Legal'—Back in New York and Maryland, HLI REPORTS, Feb. 1993, at 8-9; Retha Hill, 2 Tragedies Raise Doubts About Suitland Clinic: Abortion Patient, Left Paralyzed, Files Suit, WASH. POST, Aug. 13, 1990, at A1; Botched-abortion Victim Dies in Baltimore, WASH. TIMES, Dec. 2, 1992, at B2.

20. Lisa M. Koonin et al., Abortion Surveillance—United States, 1992, 45 MORBIDITY & MORTALITY WEEKLY REPORT 1, 17 (1996).

surpass the quality of data sources. Inaccurate data will produce inaccurate conclusions.

Claims that abortion mortality rates are lower than maternal mortality rates related to childbirth are based on comparing two sets of statistics: maternal mortality rates compiled by the National Center for Health Statistics (NCHS) through its National Vital Statistics System, and the number of deaths reported to be abortion-related by the CDC.<sup>21</sup> This comparison is problematic for two general reasons. First, NCHS and CDC employ different standards and means of data collection. Second, both systems are prone to missing a large percentage of deaths associated with childbirth and abortion.

Death certificates are the primary source of data used by NCHS to compile mortality statistics through its National Vital Statistics System. In the United States, cause of death on death certificates is normally reported by the attending physician. In some cases, particularly when the cause of death is due to violent or unknown causes, medical examiners or coroners will make the final classification of causes. In either case, a recent pregnancy may not be recorded due to error or lack of knowledge on the part of the attending physician or coroner. More careful analyses in individual states reveal that fifty percent or more of death certificates for pregnant or recently pregnant women failed to note the pregnancy.<sup>22</sup>

In many cases, the physician filing the death certificate may not know about a recent birth unless told by relatives. The physician is even less likely to know about a recent abortion, since most American women obtain abortions from specialists, not their own personal physicians. Similarly, interviews with relatives are less likely to be revealing in regard to abortion than they are in regard to childbirth, or even miscarriage. The deceased may not have told relatives about her abortion. Even if they are aware of it, relatives might refrain from telling the physician completing the death certificate about the abortion simply because they would not want it noted on this public record. There is also the risk that persons involved in reporting the

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21. William Cates, Jr., et al., *Mortality From Abortion and Childbirth: Are the Statistics Biased?*, 248 JAMA 192-96 (1982).

22. Timothy D. Dye et al., *Retrospective Maternal Mortality Case Ascertainment in West Virginia, 1985 to 1989*, 167 AM. J. OBSTETRICS & GYNECOLOGY 72, 76 (1992); Centers for Disease Control and Prevention, *Pregnancy-Related Mortality—Georgia, 1990-1992*, 44 MORBIDITY & MORTALITY WEEKLY REPORT 81, 93 (1995); Isabelle L. Horan et al., *Enhanced Surveillance for Pregnancy-Associated Mortality—Maryland, 1993-1998*, 285 JAMA 1455, 1455 (2001).

death may deliberately obscure the underlying cause in cases of abortion-related death. This may be done either to protect families from potential embarrassment or to avoid the implication of malpractice against the abortion providers, who in some cases may also be the attending physician who is completing the death certificate.

Additional ambiguities arise in regard to efforts to accurately identify deaths that are related to pregnancy. The International Classification of Diseases ninth revision (ICD-9) defined "maternal death" as one which occurs while a woman is pregnant or within forty-two days of the termination of the pregnancy, regardless of the outcome (abortion, miscarriage, or delivery) and anatomical site of the pregnancy, where the death is judged to be caused by a disease related to or aggravated by the pregnancy or its management, excluding incidental deaths.<sup>23</sup> The provision to exclude deaths deemed to be "incidental" introduces subjective judgments that are often reversed upon closer review.<sup>24</sup> For example, it is frequently unclear what role, if any, a current or recent pregnancy may have in deaths resulting from "some cancers, stroke, asthma, liver cirrhosis, pneumonia with influenza, anorexia nervosa, and many violent deaths such as suicide, homicide, and accidents."<sup>25</sup>

Moreover, the limitation to forty-two days after the pregnancy outcome is an arbitrary one, chosen to parallel the time period used in defining infant mortality. While it is known that some deaths related to pregnancy complications may occur outside this forty-two day period, as in the case of Susanne Logan, a specific time restriction is a practical coding convenience. A forty-two day time limit would also distort comparisons if delayed deaths are more commonly associated with abortion than childbirth. More certainly, this definition of maternal death associates a far larger period of time to maternal deaths than abortion deaths. In the case of abortion, the maximum period of time covered is forty-two days. In all other cases, every death occurring at any time during the pregnancy, plus an additional forty-two days, must be considered as possible maternal deaths. In other words, abortion related deaths cover forty-two days of a woman's life compared to 312 days (on average) for women who carry to term. This sevenfold longer time period automatically encompasses a larger number of deaths and greater exposure to errors in judgment regarding whether or not the pregnancy was a contributing cause of

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23. WORLD HEALTH ORGANIZATION, THE INTERNATIONAL STATISTICAL CLASSIFICATION OF DISEASES AND RELATED HEALTH PROBLEMS (9<sup>th</sup> rev. 1978).

24. Horan et al., *supra* note 22, at 1459.

25. Gissler et al., *supra* note 7, at 652.

death, especially in cases of death due to natural causes, such as heart failure.

To further complicate matters, if a woman undergoing an abortion has an unidentified ectopic pregnancy that subsequently ruptures and causes her death, should that be counted as an abortion-related death or a maternal death? The CDC researchers who compile statistics on abortion deaths have chosen to exclude deaths from ectopic pregnancy following an abortion<sup>26</sup> even though the deaths are at least partially due to the failure of the abortion provider to verify the site of the pregnancy and the completion of the abortion.<sup>27</sup> An additional confounding factor is that scar tissue resulting from a prior induced abortion may be associated with increased risk of subsequent ectopic pregnancies.<sup>28</sup> All of these considerations regarding abortion and ectopic pregnancies are especially problematic since ectopic pregnancies are the leading cause of maternal death in the United States.<sup>29</sup>

Another disparity in tracking deaths associated with childbirth and abortion is related to different coding standards. Coding rule 12 of the ICD-9 requires that deaths due to medical and surgical treatment must be reported under the complication of the procedure (embolism, for example) and not under the condition for treatment (elective abortion). According to researcher Isabelle Bégin,

In effect, this makes abortion a “ghost” category under which it is impossible to code a death. Medical coders have, in fact, relayed that any attempt to code a death due to abortion under an abortion category yields a “reject message” from the computer programs provided by the National Center for Health Statistics of Washington D.C., a division of the U.S. Centers for Disease Control in Atlanta, Georgia. . . . These computer programs simply incorporate the same problematic coding rules already used throughout the world. Only a minute number of

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26. CENTERS FOR DISEASE CONTROL, ABORTION SURVEILLANCE (1979).

27. Hani K. Atrash et al., *Ectopic Pregnancy Concurrent with Induced Abortion: Incidence and Mortality*, 162 AM. J. OBSTETRICS & GYNECOLOGY 726, 729 (1990); J. M. Hardman et al., *Ectopic pregnancy association with induced abortion: message for the pathologist*, ARCHIVES PATHOLOGY & LABORATORY MED. 117, 698-700 (1993).

28. Catherine Tharaux-Deneux et al., *Risk of Ectopic Pregnancy and Previous Induced Abortion*, 88 AM. J. PUB. HEALTH 401 (1998). See generally Ann Aschengrau Levin et al., *Ectopic Pregnancy and Prior Induced Abortion*, 72 AM. J. PUB. HEALTH 253 (1982).

29. Kees P. Nederof et al., *Ectopic Pregnancy Surveillance, United States, 1970 - 1987*, 39 MORBIDITY & MORTALITY WEEKLY REPORT 9 (1990).

abortion-related deaths actually qualify to be declared under abortion, i.e. those for which the medical certificate of death categorically and unequivocally gives abortion as the underlying cause of death. If abortion is mentioned anywhere else on the death certificate, on the underlying cause line, the death gets coded as an accident of some kind, a sudden or unexpected death, an illness (like septicaemia—blood poisoning) or an injury, etc.<sup>30</sup>

While there are numerous three-digit ICD codes for identifying specific causes of death related to pregnancy and delivery (such as 633 for ectopic pregnancy, 640 for hemorrhage in early pregnancy, 666 for postpartum hemorrhage, et cetera), there is only one code for legally induced abortion (635), and it is chiefly intended to identify when an abortion was provided in medical and billing records. As described above, the code for a legally induced abortion is not intended for use when identifying cause of death. Examination of death certificates where abortion is known to be the underlying cause of death reveals that code 635 (legal abortion) is rarely identified as the cause of death.<sup>31</sup>

In short, death certificates are not a reliable source for identifying deaths related to childbirth and are an even weaker means of identifying deaths related to abortion. In 1972, Family Planning Evaluations Division of the CDC implemented a patchwork method for identifying abortion-related deaths to “complement the vital statistics activities of NCHS by identifying causes of preventable abortion deaths.”<sup>32</sup> We describe this surveillance system as a “patchwork system” because it does not rely on any regular source of data. Since no state has laws or regulations requiring doctors, emergency room personnel, or coroners to report possible abortion-related deaths for investigation, the CDC system simply investigates such deaths if they happen to come to their attention through “reports

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30. Isabelle Bégin, *False Abortion Statistics Exposed*, REALITY (REAL Women of Canada, Ottawa, Ontario), Sept.-Oct. 1999, at [http://www.realwomenca.com/newsletter/1999\\_Sept\\_Oct/article\\_10.html](http://www.realwomenca.com/newsletter/1999_Sept_Oct/article_10.html) (last visited Apr. 17, 2004).

31. See generally SHERLOCK, *supra* note 17. According to one assessment by the Centers for Disease Control, NCHS data identified only thirty percent of the abortion-related deaths that CDC identified through its follow-up system, which also has many weaknesses as described elsewhere in this paper. See William Cates, Jr., et al., *Assessment of Surveillance and Vital Statistics Data for Monitoring Abortion Mortality, United States, 1972-1975*, 108 AM. J. EPIDEMIOLOGY 200, 201 (1978). See also Cates, Jr., et al., *supra* note 21, at 192-6.

32. Cates, Jr., et al., *supra* note 31, at 201.

from state health departments, case histories published in medical journals, anecdotal reports from state medical or hospital associations, CDC special surveys of deaths from other fertility control measures, reports to national abortion organizations, registries from the Food and Drug Administration, and reports from state maternal mortality review committees.”<sup>33</sup>

The inadequacy of this system of reliance on ad hoc tips is illustrated by the fact that for the period immediately after it was implemented, the CDC identified twice the number of abortion-related deaths as those reported by NCHS,<sup>34</sup> while in the 1980s it discovered only three percent more abortion-related deaths than NCHS. By contrast, a single investigative journalist examining public records, including autopsies and malpractice suits, documented thirty to thirty-nine percent more abortion-related deaths than were reported by either NCHS or the CDC.<sup>35</sup>

#### HOW ACCURATE IS THE CDC SURVEILLANCE SYSTEM?

In the years following legalization of abortion, the CDC’s efforts to investigate abortion-related deaths and complications were led by vocal proponents of abortion, some of whom also performed abortions in their private practices.<sup>36</sup> As a result, opponents of abortion questioned the CDC’s commitment to fully identify and document abortion-related injuries. More specifically, it was charged that the CDC reports regarding abortion-related deaths were misleading.<sup>37</sup>

In response to concerns raised about the completeness of their statistics on abortion-related deaths, CDC investigators responded with a paper published in one of the country’s premier medical journals, *JAMA*, in which they state, “Although it is likely that the CDC has not identified all abortion deaths in the United States since 1972, *every reported death* has been counted in CDC statistics.”<sup>38</sup> The real question, however, is how many abortion-related deaths are not

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33. *Id.*

34. *Id.*

35. SHERLOCK, *supra* note 17, at 117.

36. MARK CRUTCHER, *LIME* 5 146 (1996).

37. Thomas W. Hilgers, M.D., & Dennis O’Hare, *Abortion Related Maternal Mortality: An In-Depth Analysis*, in *NEW PERSPECTIVES ON HUMAN ABORTION* 69, 70 (Thomas W. Hilgers et al. eds., 1981).

38. Cates, Jr., et al., *supra* note 21, at 193 (emphasis added).

reported? In response to this question, the CDC team offered a statistical analysis based on “the Chandrasekaran-Deming theory” [sic] as evidence that they were successfully tracking “90% of all abortion deaths.”<sup>39</sup>

This claim, and the statistical analysis on which it was based, deserves detailed examination. While the research articles published by investigators within CDC’s Family Planning Evaluation Division consistently reflected a favorable opinion of abortion, the egregious misapplication of statistical methods in this particular study strongly suggests that their analyses were being used to deliberately promote an unjustified confidence in abortion safety.

Specifically, the CDC researchers used “the Chandrasekaran-Deming theory” [sic] that “compares the results of two independent systems of ascertaining the same event and provides an estimate of the completeness of ascertainment in both systems,” to compare the abortion death tallies generated by NCHS and the data collected by CDC.<sup>40</sup> The wrongly cited statistical theory used was actually that of C. Chandra Sekar and W. Edwards Deming and reference to the original paper reveals strict limitations upon its application.<sup>41</sup> All of these restrictions were violated by the CDC analysts.

First, the Sekar-Deming theory applies only to a comparison of *independent* surveys.<sup>42</sup> NCHS and CDC data, however, are heavily interdependent since the CDC uses state health agency reports in the same way as the NCHS. At best, NCHS statistics are merely a subset of CDC data, not an “independent” study.

Second, the theory is valid only “over an area large enough to contain a *large number* of N events.”<sup>43</sup> But even the severest critics of abortion do not believe that abortion-related deaths are statistically “a large number” of events compared to the total number of abortions performed. The most deaths reported to the CDC in any one year were only twenty-seven.<sup>44</sup>

Third, the Sekar-Deming theory makes no allowances for deliberate deception, which critics insist is the primary cause for the underreporting of abortion-related deaths. The Sekar-Deming method

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39. *Id.*

40. Cates, Jr., et al., *supra* note 31, at 201.

41. C. Chandra Sekar & W. Edwards Deming, *On a Method of Estimating Birth and Death Rates and the Extent of Registration*, 44 J. AM. STAT. ASS’N 101, 102 (1949). Note: The authors’ names were cited incorrectly by the CDC authors.

42. *Id.* at 102; Cates, Jr., et al., *supra* note 31, at 201.

43. Sekar & Deming, *supra* note 41, at 103 (emphasis added).

44. Cates, Jr., et al., *supra* note 21, at 193.

is applicable only for relatively neutral data which might be missed by one surveillance system or another merely because of clerical errors, lost forms, changes of address, et cetera.<sup>45</sup>

Perhaps the best way to demonstrate why the Sekar-Deming formula cannot be appropriately applied to surveys of abortion deaths is to examine the type of analysis it was developed to do. The statistical method developed by Sekar-Deming was originally designed to provide a method of checking the accuracy of birth and death registration in underdeveloped provinces of India. They specifically wanted to know what percent of deaths and births were not being recorded in the official birth and death registries. Their statistical method compared the “official” records to a list obtained from house-to-house canvass surveys in small test areas. Note that this was a literal house-to-house survey looking for common events, births and deaths, during the past year.<sup>46</sup> Neither the NCHS nor the CDC surveillance system is nearly as thorough as this. If the CDC had a list of all women who had aborted in the U.S. and called on each home to find out if the woman had died from her abortion, only then would it approach the independent survey status envisioned by Sekar and Deming. Instead, the CDC begins its tally by using the NCHS report and supplements this with reports from physicians and other authorities — the same people who should have been responsible for correctly reporting abortion-related deaths to the NCHS through death certificates.<sup>47</sup> In other words, the CDC simply draws on the same group of information suppliers who should have correctly reported the abortion deaths the first time. This lack of independently derived data is in very sharp contrast to the Sekar-Deming population study that compared the statistical reports of village officials (data gathering officials analogous to physicians and health agencies) with a survey of the general populace who would be more intimately aware of the events in question (a group analogous to aborted women and their families).

Perhaps even more importantly, the Sekar-Deming method was only intended to estimate the rate of “missed events” which are extremely common, i.e., births and deaths in India, involving hundreds of thousands of cases or more. As Sekar’s and Deming’s conditions for use of the theory underscore, it is simply not appropriate to load small numbers into statistical equations designed for “meganumbers.” Since both abortion and pregnancy-related deaths are uncommon in the

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45. Sekar & Deming, *supra* note 41, at 102.

46. *Id.*

47. Cates, Jr., et al., *supra* note 31, at 201.

general population, the Sekar-Deming theory cannot be appropriately applied to an analysis of pregnancy-related death. The CDC's use of this analytic technique with such small numbers is analogous to loading a marble into a cannon. While a cannon may be relatively accurate when launching a properly sized cannon ball, its accuracy is reduced to nil when it is loaded with a single marble.

Clearly, the CDC authors violated all the conditions required to properly use the Sekar-Deming formula. Yet they barely give any notice to the possibility that their estimate may be low to the extent that the "independent assessment" is imperfect.<sup>48</sup> Instead, they argue that if there is any error in their estimate, it is most likely that their "strict matching criteria" and tolerance of "false positives" would lead to an overestimation of the number of abortion deaths.<sup>49</sup> In other words, they assert that "the Chandrasekaran-Deming theory" indicates that they are identifying ninety-four percent of all abortion-related deaths, but they are probably doing even better than that.<sup>50</sup>

The degree to which the authors stretched to promote confidence in their weak "surveillance system"<sup>51</sup> arouses suspicions of bias. Even the tone used to bolster confidence in their results is reminiscent of a corporate report designed to instill confidence among investors or a politician's spin on the news to promote a partisan agenda. An objective evaluation of the CDC report in the direct light of a comparison to the conditions required for application of the Sekar-Deming methodology demonstrates that the authors were either consciously or subconsciously unwilling to consider that induced abortion could be as or more dangerous than childbirth. Regardless of the cause for these exaggerated claims, the CDC's misapplication of the Sekar-Deming analysis is sufficient to raise concerns about the reliability of everything the CDC has done in regard to "abortion surveillance."<sup>52</sup> This concern in turn underscores the importance of record-based studies that examine deaths associated with abortion and childbirth using a single uniform standard.

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48. *Id.* at 204.

49. *Id.* at 203-04.

50. *Id.* at 203.

51. *Id.* at 201; Cates, Jr., et al., *supra* note 21, at 193.

52. CRUTCHER, *supra* note 36, at 135-70.

## GENERAL FINDINGS USING AN OBJECTIVE STANDARD

To partially address some of the difficulties described earlier with accurately identifying deaths associated with pregnancy, the tenth revision of the ICD added two additional definitions for tracking mortality.<sup>53</sup> The first was "pregnancy-related death" which includes all deaths within forty-two days of pregnancy outcome irrespective of whether the death may be incidental. The second was a definition for "late maternal death," which requires exclusion of incidental deaths in the same manner as defined for maternal deaths, but includes deaths after forty-two days and less than one year after the pregnancy outcome. Still another classification, "pregnancy-associated death," has been proposed by the CDC and the American College of Obstetricians and Gynecologists (ACOG), which encompasses features of both pregnancy-related deaths and later maternal deaths by including all deaths within one year of pregnancy outcome, irrespective of cause of death or the anatomical site of pregnancy.<sup>54</sup> This latter definition significantly reduces the chance that deaths will be missed because they fall outside the forty-two day window and eliminates the inherent problems involved in subjective judgments about causality.

Because the definitions for both pregnancy-related death and pregnancy-associated death eliminate the effects of subjective errors, these new criteria are much better suited for large record-based studies which link death certificates to medical records for pregnancy, childbirth, and abortion. Only two such studies have been published, but both show with high statistical reliability that abortion is associated with elevated mortality rates compared to childbirth.

The first of these was a national study of all women aged fifteen to forty-nine in Finland who died from 1987 to 1994.<sup>55</sup> Death certificate identifiers were linked to the birth, abortion, and hospital registries to

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53. WORLD HEALTH ORGANIZATION, THE INTERNATIONAL STATISTICAL CLASSIFICATION OF DISEASES AND RELATED HEALTH PROBLEMS (10<sup>th</sup> rev. 1992).

54. Hani K Atrash et al., *Maternal and Perinatal Mortality*, 4 CURRENT OPINION IN OBSTETRICS & GYNECOLOGY 61, 62 (1992). Yet another proposal has been made to measure the "reproductive mortality rate," which would include deaths from complications of contraception as well as those from pregnancy, delivery, and abortion. This even broader definition has been proposed since deaths from contraception complications now appear to be more common than deaths from childbirth. See Benjamin P. Sachs et al., *Reproductive Mortality in the United States*, 247 JAMA 2789 (1992); Maternal Morality Committee, *I.M.A. Maternal Morality Committee Report 1981*, 75 IRISH MED. J. 484 (1982).

55. Gissler et al., *supra* note 7, at 652.

identify if the women had been pregnant during the last year of their lives. Because Finland has socialized medicine and a computerized central registry, the completeness of these records and quality of linkage is excellent. The researchers found that women who carried a pregnancy to term were half as likely to die in the year following their pregnancy as were women who were not recently pregnant (Odds Ratio = 0.50; 95% Confidence Interval = 0.32 to 0.78). The reduced risk of dying held true across all major categories: natural causes, suicide, accidents, and homicide. Women who had an induced abortion, by contrast, were significantly more likely to die than non-pregnant women (OR = 1.76; 95% CI = 1.27 to 2.42).<sup>56</sup>

This comparison to mortality rates for women who had not been recently pregnant suggests that the disparity in death rates between delivering and aborting women may reflect two active effects: (1) giving birth may have a protective effect, and (2) having an abortion may have a deleterious effect. Both effects are captured by means of making a direct comparison of women who deliver to women who have abortions. In this study, compared to Finnish women who delivered, the age-adjusted odds ratio of dying in the year following an induced abortion was 1.63 for deaths from natural causes, 4.24 for deaths from injuries related to accidents, 6.46 for deaths resulting from suicide, and 13.97 for deaths resulting from homicide.<sup>57</sup>

The second record-based study to compare deaths following abortion and childbirth linked Medicaid records for 173,279 California women who had state-funded abortions or deliveries in 1989 to death certificates from 1989 to 1997.<sup>58</sup> Approximately thirty percent of all abortions and deliveries in California in 1989 were funded by Medicaid. While the findings of this study paralleled the general findings in Finland, this study is particularly significant in that it demonstrated (1) that the elevated risk of death associated with abortion persists beyond one year; (2) the elevated risk of death following an abortion is not explained by prior psychiatric history, at least during the year preceding the target pregnancy; and (3) subsequent pregnancy events, for example a delivery following abortion, may significantly reduce the elevated mortality rate associated with an abortion. Controlling for age and psychiatric history, aborting women were sixty-one percent more likely to die

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56. *Id.*

57. *Id.* at 253. The odds ratios reported here are derived from the results reported in Table 3 by dividing the age-adjusted odds ratio reported for abortion by the age-adjusted odds ratio reported for childbirth.

58. Reardon et al., *supra* note 8, at 834.

from all causes over the eight years examined (OR = 1.61; 95% CI = 1.30 to 1.99), seventy-eight percent more likely to die of violent causes (OR = 1.78; 95% CI = 1.28 to 2.47), and forty-four percent more likely to die of natural causes (OR = 1.44; 95% CI = 1.08 to 1.91), and there is less than a one-in-a-thousand chance that these findings are due to chance ( $p < .001$ ).<sup>59</sup> Projected to the national population of women having abortions, these findings would suggest that there are between 2,132 and 7,036 excess deaths per year among women with a history of abortion.<sup>60</sup>

The Finland and California studies complement each other, with the strengths of one study counterbalancing the weaknesses of the other. For example, the Finland study was a national study that included all Finnish women, a racially homogeneous population, whereas the population in the California study was racially diverse. Similarly, while the California sample was restricted to low-income women, the Finland sample included women of all socioeconomic groups. While the analysis of Finnish women was restricted to one year, the analysis of California women showed the effects over a period of years. For example, the elevated risk of death from violent causes following an abortion appears to decline rapidly over a four-year period. The complementary nature of the two studies indicates that the higher mortality rates associated with abortion compared to childbirth are not explained by age, race, socioeconomic status, or psychiatric history. In the sections that follow, the findings of these two studies in regard to

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59. *Id.* at 838 tbl.3.

60. This estimate is based on a projection of the low and high odds ratios determined by the ninety-five percent confidence interval (1.30 to 1.99) reported in Table 3, *id.*, to an estimated 1.4 million women having abortions each year. It also assumes the base rate of 507.7 deaths per 100,000 for all causes of death over an eight-year follow-up period also reported in Table 3.

Another way to measure the potential cost of higher death rates is in terms of woman-years. If the average life expectancy of a woman is around seventy-six, and the average age at time of death among the excess number of deaths associated with abortion is twenty-eight, this translates to forty-eight woman-years lost per death. In the one-year follow-up study by Gissler et al., *supra* note 7, compared to delivering women there were 73.8 extra deaths per 100,000 for women who had abortions. Multiplied by forty-eight woman-years lost, this equals 3,542 woman-years per 100,000 abortions. Projected onto the entire population of approximately thirty million American women who have had abortions, this represents a potential loss of 1.1 million woman-years. Applying the same formula to the excess deaths identified in the eight-year period examined by Reardon et al., *supra* note 8, the same method and assumptions would produce an estimated loss of 14,400 woman-years per 100,000 abortions.

specific causes of death will be examined in the context of related literature on abortion and childbirth that sheds light on the interpretation of these results.

#### A CLOSER LOOK AT DIFFERENCES IN RATES OF DEATH FROM SUICIDE

Worldwide, suicide accounts for nearly as many deaths as homicide and wars combined.<sup>61</sup> Over the eight-year period examined with the population of Medicaid eligible women in California, after controlling for age and psychiatric history, aborting women were 3.1 times more likely to die from suicide compared to delivering women.<sup>62</sup> In the Finland study, as shown in Figure 1, women who had abortions were 3.7 times more likely to die from suicide in the year following abortion than non-pregnant women and 6.5 times more likely to commit suicide than women who had given birth.<sup>63</sup> Two of these suicides were also connected with homicides. Examples of post-abortive women killing their born children in concert with a suicide attempt following an abortion have also been documented in the United States.<sup>64</sup>

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61. WORLD HEALTH ORGANIZATION, WORLD REPORT ON VIOLENCE AND HEALTH (Etienne G. Krug et al. eds., 2002) at 10 tbl.1.2.

62. Reardon et al., *supra* note 8, at 838.

63. Gissler et al., *supra* note 7, at 653.

64. Clinicians who specialize in post-abortion counseling have reported case studies in which traumatic reenactment of a past abortion has been manifested by intrusive thoughts of hurting a woman's other children. THERESA K. BURKE & DAVID C. REARDON, FORBIDDEN GRIEF: THE UNSPOKEN PAIN OF ABORTION 182-85 (2002).

One week after Donna Fleming's second abortion, Donna was depressed and distraught and began to "hear voices." With the hope of reuniting herself and her two living sons with her aborted children, she jumped off a bridge in Long Beach, California, with her five-year-old and two-year-old sons in her arms. Donna and her five-year-old son were rescued; her two-year-old died. A. McFadden, *The Link Between Abortion and Child Abuse*, FAMILY RESOURCES CENTER NEWS, January 1998, at 20.

Sandi Nieves was convicted of setting a fire in the kitchen of her home where she and her five children slept, which led to the death from smoke inhalation of four of her daughters. Nieves and her son survived the apparent suicide/homicide attempt. Nieves had been taking antidepressant drugs to cope with her abortion that occurred just five days before the fire. Caitlin Liu, *Mother Breaks Down in Tears at Murder Trial*, L.A. TIMES, June 20, 2000, at B3.

Notably, the risk of suicide following a birth was about half that of the general population of Finnish women. This finding is consistent with previous studies that have shown that an undisturbed pregnancy is associated with a reduced risk of suicide.<sup>65</sup> A fifteen-year study of nearly one million women has also shown that the number of children a woman has is strongly and inversely related to the relative risk of suicide.<sup>66</sup> Other research has shown that a greater sense of family obligation and a fear of hurting one's children are associated with fewer suicide attempts and suicidal thoughts.<sup>67</sup> In one study of women with a prior history of psychiatric problems, none of those who carried to term subsequently committed suicide over an eight-to-thirteen-year follow-up, while five percent of those who aborted subsequently committed suicide.<sup>68</sup> These findings suggest that for women with prior psychological problems, childbirth is likely to reduce the risk of subsequent suicide attempts.

By contrast, women with prior psychiatric illness appear to have higher suicide rates following their abortions.<sup>69</sup> This suggests that abortion may aggravate prior psychological illness and precipitate suicidal thoughts. Some have therefore proposed that the higher rate of suicide among aborting women may be completely explained by psychological differences between aborting and delivering women.

Renee Nicely of New Jersey experienced a "psychotic episode" the day after her abortion that resulted in the beating death of her three-year-old son, Shawn. She told the court psychiatrist that she "knew that abortion was wrong" and "I should be punished for the abortion." The psychiatrist who was the prosecution's expert witness testified that the killing was clearly related to Renee's psychological reaction to her abortion. Debra Braun, *Woman Kills 3-Year-Old Son One Day After Obtaining Abortion*, NAT'L. RIGHT TO LIFE NEWS, Oct.13, 1983, at 12.

65. See Louis Appleby, *Suicide During Pregnancy and in the First Postnatal Year*, 302 BRIT. MED. J. 137 (1991); Sandra J. Drower & Eleanor S. Nash, *Therapeutic Abortion on Psychiatric Grounds: Part I. A Local Study*, 54 SOUTH AFRICAN MED. J. 604 (1978); Bengt Jansson, *Mental Disorders After Abortion*, 41 ACTA PSYCHIATRICA SCANDINAVIA 87 (1965); Louis Appleby & Gill Turnbull, *Parasuicide in the First Postnatal Year*, 25 PSYCHOL. MED. 1087 (1995).

66. Georg Hoyer & Eiliv Lund, *Suicide Among Women Related to Number of Children in Marriage*, 50 ARCHIVES GEN. PSYCHIATRY 134, 137 (1993).

67. Marsho M. Linehan et al., *Reasons for Staying Alive When You Are Thinking About Killing Yourself: The Reasons for Living Inventory*, 51 J. COUNSELING & CLINICAL PSYCHOL. 276 (1983).

68. Jansson, *supra* note 65, at 87.

69. Esther R. Greenglass, *Therapeutic Abortion and Psychiatric Disturbance in Canadian Women*, 27 CANADIAN PSYCHIATRIC ASS'N J. 453 (1976).

Risk-taking and self-destructive women, for example, may be more likely to become pregnant and have abortions than “normal” women.

To investigate this theory, researchers at the South Glamorgan Health Authority in Great Britain (population 408,000) reviewed records on admissions for suicide attempts both before and after pregnancy events.<sup>70</sup> Among the women who aborted, researchers identified a shift from a roughly “normal” suicide attempt rate before the abortion to a significantly higher suicide attempt rate after the abortion. In the post-pregnancy period, there were 8.1 suicide attempts per thousand among those who had abortions compared to only 1.9 suicide attempts per thousand among those who had given birth.<sup>71</sup> The higher rate of suicide attempts subsequent to abortion was particularly evident among women under thirty years of age. The results of their analyses are even more striking when viewed graphically. Figure 2 shows that the attempted suicide rates, by age group, remained relatively flat or declined before and after pregnancies that resulted in deliveries. By contrast, the attempted suicide rates before and after pregnancies ending in abortion rose significantly for each age group (Figure 3). These findings disprove the hypothesis that suicidal women are more likely to become pregnant and choose an abortion. Instead, the researchers concluded, these findings indicate that “the increased risk of suicide after an induced abortion may therefore be a consequence of the procedure itself.”<sup>72</sup>

The hypothesis that differences in prior psychological illness account for the differences in suicide rates among aborting and delivering women is also contradicted by the analysis of suicide deaths among low-income women in California. This study revealed that the relative risk for suicide among aborting women compared to delivering women actually increased from 2.54 to 3.12 when cases were controlled for psychiatric history.<sup>73</sup> This suggests that prior psychiatric illness may play a bigger role in suicides following childbirth than it does in cases of suicide following abortion.<sup>74</sup> While it does not appear that prior psychological history can fully explain the higher suicide rates associated with abortion, it is true that an abortion may aggravate pre-existing psychological disturbances and place this subgroup of aborting women at a higher risk of suicide.

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70. Christopher Morgan et al., *Suicides After Pregnancy: Mental Health May Deteriorate as a Direct Effect of Induced Abortion*, 314 *BRIT. MED. J.* 902 (1997).

71. *Id.*

72. *Id.*

73. Reardon et al., *supra* note 8, at 838.

74. *Id.* at 836.

The above interpretation of record-based studies and case-control studies is strongly supported by reports of clinicians and self-reports of post-abortive women. A number of published case studies have drawn a direct correlation between abortion and subsequent suicides or attempted suicides.<sup>75</sup> In some cases, the attempted or completed suicides coincide with the anniversary date of the abortion or expected due date of the aborted child.<sup>76</sup> Questionnaire- and interview-based studies have consistently shown extraordinarily high levels of suicidal ideation (thirty to fifty-five percent) and reports of suicide attempts (seven to thirty percent) among women who have had an abortion.<sup>77</sup> In many of these studies, the women interviewed have explicitly described the abortion as the underlying cause of their suicidal impulses.<sup>78</sup> Suicide attempts among male partners following abortion have also been reported.<sup>79</sup>

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75. See generally E. Joanne Angelo, *Psychiatric Sequelae of Abortion: The Many Faces of Post-Abortion Grief*, 59 LINACRE Q. 69 (1992). See also David A. Grimes, *Second-Trimester Abortions in the United States*, 16 FAM. PLAN. PERS. 260 (1984); Myre Sim & Robert Neisser, *Post-Abortive Psychoses: A Report from Two Centers*, in THE PSYCHOLOGICAL ASPECTS OF ABORTION (David Mall & Walter F. Watts eds., 1979); ANNE SPECKHARD, THE PSYCHO-SOCIAL STRESS FOLLOWING ABORTION (1987).

76. Carl L. Tischler, *Adolescent Suicide Attempts Following Elective Abortion: A Special Case of Anniversary Reaction*, 68 PEDIATRICS 670, 670-71 (1981).

77. BURKE & REARDON, *supra* note 64, at 298; SPECKHARD, *supra* note 75, at 56.

78. One of many examples of women describing their suicidal impulses due to an abortion is that of Jane writing twelve months after her abortion:

And I just have no words to describe what I went through when I woke up from the anesthetic. I cry as I write this. I wanted to slice myself up, to get a gun and blow my head off. I wanted to do something violent and bloody to myself — I wanted to literally blow myself apart. How could I have agreed to an abortion? How did I let that happen? I ask myself those questions every day.

I did not feel I deserved to live. All I thought about was how I would kill myself, when I would kill myself. I wrote goodbye letters to my family, my good friend, and my flatmate and researched the most efficient and effective way to kill myself — I wasn't going to make any mistakes. After all, if I can kill my baby, I can sure as hell kill myself — and I deserve it. Because I couldn't even look after my baby when it was right there deep inside of me. Couldn't even do that.

If my mother hadn't been going on a trip to Antarctica, which I knew meant the world to her, I would have killed myself. I am quite sure of this. But I thought I would wait until after her trip. If I killed myself beforehand she wouldn't go. . . . The abortion has blown my life apart,

Teens are generally at higher risk for both suicide and abortion. In a survey of teenage girls, researchers at the University of Minnesota found that the rate of attempted suicide in the six months prior to the study increased tenfold — from 0.4 percent for girls who had not aborted during that time period to four percent for teens who had aborted in the previous six months.<sup>80</sup>

It is also worth noting the suicide rate among women in China is the highest in the world. Indeed, fifty-six percent of all female suicides occur in China, mostly among young rural women.<sup>81</sup> It is also the only country where more women die from suicide than men.<sup>82</sup> Thirty-one percent of all deaths among rural women between fifteen and thirty-four years of age are the result of suicide.<sup>83</sup> The extraordinarily high rate of suicide among Chinese women may be partially explained by China's unique "one child" family planning policy that forbids women from having all the children they desire, requires government

blown my entire self/psyche/soul/belief in myself apart. It has devastated me and I don't know how long this goes on for.

MELINDA TANKARD REIST, *GIVING SORROW WORDS: WOMEN'S STORIES OF GRIEF AFTER ABORTION* 53-55 (2000). See also BURKE & REARDON, *supra* note 64, at 39, 172-76.

79. One of the most recent examples was the suicide of Brad Draper, 44, who on September 10, 2002, shot himself in the head in front of the Planned Parenthood clinic in Overland Park, Kansas. The suicide occurred on the first anniversary of the abortion. Three months earlier, Draper published an obituary to his aborted son in the community paper that read, "Zachary Duncan Draper was beautiful as his mother, loved by God and others. My little baby boy didn't make it to his Daddy's arms. I never got to hold and kiss him, tell him stories or read him rhymes. I love you Zachary and look forward to seeing you in heaven." Kyle J. Cox, *Abortion Touches Us All*, TELEGRAPH HERALD, Nov. 18, 2002, at A4. Several case studies of eighteen-to-twenty-two-year-old males who became suicidal following news of their girlfriends' or wives' abortions are found in JC Dubouis-bonnefond & JR Galle-tessonneau, *Psychological aspects of voluntary induced abortion among fathers drafted into military service*, 14 PSYCHOL. MED. (Paris) 1187-89 (1982), available at [http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list\\_uids=12268237&dopt=Abstract](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list_uids=12268237&dopt=Abstract) (last visited Apr. 17, 2004); see also Angelo, *supra* note 75, at 76.

80. B. GARFINKEL ET AL., *STRESS, DEPRESSION AND SUICIDE: A STUDY OF ADOLESCENTS IN MINNESOTA* (1986).

81. Elizabeth Rosenthal, *Women's Suicides Reveal China's Bitter Roots: Nation Starts to Confront World's Highest Rate*, N.Y. TIMES, Jan. 24, 1999, at A1.

82. *Id.*

83. Michael R. Phillips et al., *Suicide Rates in China, 1995-99*, 359 THE LANCET 835, 836 (2002).

permission to become pregnant, and involves coerced abortions when women become pregnant without a license.<sup>84</sup>

#### A CLOSER LOOK AT THE DIFFERENCE IN RATES FOR ACCIDENTAL DEATHS

In the Finland study, researchers found that the risk of death from accidents was more than four times higher for women who had aborted in the year prior to their deaths than for women who had carried to term (Figure 4).<sup>85</sup> Once again, giving birth appeared to have a protective effect compared to the general population of women who had not been pregnant. In the analysis of California women, women who had an abortion in 1989 and no known subsequent pregnancies were eighty-two percent more likely to die from accidental injuries during the eight years examined compared to women who delivered and had no subsequent pregnancies.<sup>86</sup>

One explanation for these findings is that women with newborn children are more careful to avoid risks which could endanger them or their children. Conversely, women who have had an abortion may become more prone to taking risks that could endanger their lives. This data is consistent with at least two other studies that have found that women who abort are more likely to be treated for accident-related injuries in the year following their abortions.

In a study of government-funded medical programs in Canada, researchers found that women who had undergone an abortion in the previous year were treated for mental disorders forty-one percent more often than postpartum women, and twenty-five percent more often for injuries or conditions resulting from violence.<sup>87</sup> Similarly, a study of Medicaid payments in Virginia found that women who had state-funded abortions had sixty-two percent more subsequent mental health claims (resulting in forty-three percent higher costs) and twelve percent more claims for treatments related to accidents (resulting in fifty-two percent higher costs) compared to a case-matched sample of

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84. David C. Reardon, *Suicide Rates in China*, 359 THE LANCET 2274, 2274-75 (2002).

85. Gissler et al., *supra* note 7, at 653.

86. Reardon et al., *supra* note 8, at 838 tbl.3.

87. R.F. BADGLEY ET AL., REPORT OF THE COMMITTEE ON THE OPERATION OF THE ABORTION LAW, GOVERNMENT OF CANADA, MINISTER OF SUPPLY AND SERVICES 319 (1977).

women covered by Medicaid who had not had a state-funded abortion.<sup>88</sup>

It is quite likely that some of the deaths classified as accidental in the Finland and California studies may actually have been suicides. Reports of post-abortive women deliberately crashing their automobiles, often in a drunken state, in an attempt to kill themselves have been reported by post-abortion counselors and in the published literature.<sup>89</sup>

Many of these accidental deaths may result from heightened risk-taking behavior among post-abortive women that is related to increased self-punishment or decreased concern for self-protection. Alternatively, some post-abortive women may use the adrenalin rush that accompanies risk-taking behavior to escape a general state of depression.<sup>90</sup>

Elevated rates of substance abuse may also play a role in the increased risk of death from accidents following abortion. Numerous studies have found a strong association between abortion and higher rates of subsequent alcohol consumption<sup>91</sup> and drug abuse,<sup>92</sup> both of

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88. Jeff Nelson, Interagency Memorandum, Virginia Department of Medical Assistance Services regarding Data Request from Delegate Marshall (Mar. 21, 1997) (source on file with the author).

89. Tischler, *supra* note 76, at 670 -71; Angelo, *supra* note 75; BURKE & REARDON, *supra* note 64, at 140, 170, 184.

90. Joel Osler Brende, *Post-Trauma Sequelae Following Abortion and Other Traumatic Events*, 7 ASSOCIATION FOR INTERDISCIPLINARY RESEARCH IN VALUES AND SOCIAL CHANGE NEWSLETTER 1-8 (1994) (subsequently renamed the RESEARCH BULLETIN).

91. Elizabeth R. Morrissey & Marc A. Schuckit, *Stressful Life Events and Alcohol Problems Among Women Seen At a Detoxication Center*, 39 J. STUD. ALCOHOL 1559, 1567, 1570 (1978); Richard W. Wilsnack et al., *Women's Drinking and Drinking Problems: Patterns from a 1981 National Survey*, 74 AM. J. PUB. HEALTH 1231 (1984); Albert D. Klassen & Sharon C. Wilsnack, *Sexual Experience and Drinking Among Women in a U.S. National Survey*, 15 ARCHIVES SEXUAL BEHAV. 363 (1986). The preceding two studies report on a national survey which found that the percentage of women who admitted a history of abortion was significantly higher among women identified as being heavy (13%) or moderate (13%) drinkers than among light drinkers (5%) or abstainers (4%). See Wilsnack et al., *supra*; see Klassen & Wilsnack, *supra*; see Tommijean Thomas et al., *Psychosocial Characteristics of Psychiatric Inpatients With Reproductive Losses*, 7 J. HEALTH CARE FOR THE POOR & UNDERSERVED 15, 18 (1996); Drower & Nash, *supra* note 65, tbl.VII; Priscilla K. Coleman et al., *History of Induced Abortion in Relation to Substance Use During Pregnancies Carried to Term*, 187 AM. J. OBSTETRICS & GYNECOLOGY 1673 (2002); J. Kuzma, & D. Kissinger, *Patterns of*

which tend to increase a woman's risk of fatal accidents. A recent study of a random sample of approximately 700 women found that among women without a prior history of substance abuse, the relative risk of substance abuse was 4.5 times higher subsequent to a first pregnancy among women who aborted their first pregnancy compared to women who carried to term.<sup>93</sup> A causal connection between abortion and subsequent substance abuse is supported by evidence from structured interviews and clinical assessments of women reporting stress after an abortion.<sup>94</sup>

#### A CLOSER LOOK AT THE DIFFERENCE IN RATES FOR DEATHS FROM HOMICIDE

Finland's record linkage study found homicide accounted for five percent of pregnancy-associated deaths between 1987 and 1994.<sup>95</sup> Most of these deaths occurred among women who had undergone an abortion. As shown in Figure 5, the risk of dying from homicide for post-abortive women was more than four times greater than the risk of

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*Alcohol and Cigarette Use in Pregnancy*, 3 NEUROBEHAVIORAL TOXICOLOGY & TERATOLOGY 211 (1981).

92. Louis G. Keith et al., *Substance Abuse in Pregnant Women: Recent Experience at the Perinatal Center for Chemical Dependence of Northwestern Memorial Hospital*, 73 OBSTETRICS GYNECOLOGY 715, 717 (1989); Thomas et al., *supra* note 91, at 15-23; Drower & Nash, *supra* note 65, at 604-8; Hortensia Amaro et al., *Drug Use Among Adolescent Mothers: Profile of Risk*, 84 PEDIATRICS 144, 147 (1989); Oro & Dixon, *Prenatal Cocaine and Methamphetamine Exposure: Maternal and Neo-Natal Correlates*, 111 PEDIATRICS 571 (1987); Deborah A. Frank et al., *Cocaine Use During Pregnancy: Prevalence and Correlates*, 82 PEDIATRICS 888 (1988). K. Graham & G. Koren, *Characteristics of Pregnant Women Exposed to Cocaine in Toronto between 1985 and 1990*, 144 CANADIAN MED. ASS'N J. 563 (1991). See generally Coleman et al., *supra* note 91.

93. David C. Reardon & Philip G. Ney, *Abortion and Subsequent Substance Abuse*, 26 AM. J. DRUG & ALCOHOL ABUSE 61, 68 (2000).

94. Brenda Major et al., *Personal Resilience, Cognitive Appraisals, and Coping: An Integrative Model of Adjustment to Abortion*, 74 J. PERS. SOC. PSYCHOL. 735 (1998) (self-assessment research shows that at least a minority of women report that they used drugs and alcohol as a means to cope with their feelings about the abortion); see also BURKE & REARDON, *supra* note 64, at 167-72; CANDACE DE PUY & DANA DOVITCH, *THE HEALING CHOICE: YOUR GUIDE TO EMOTIONAL RECOVERY AFTER AN ABORTION* 57, 130 (1997); JEANETTE VOUGHT, *POST-ABORTION TRAUMA: 9 STEPS TO RECOVERY* 111-12 (1991).

95. Gissler et al., *supra* note 7, at 654 tbl.III

homicide among the general population. Over the eight-year period examined in the mortality study of Medicaid eligible women in California, after controlling for age and psychiatric history, homicide deaths among aborting women were ninety-three percent higher (OR = 1.93, 95% CI = 1.11 to 3.33).<sup>96</sup> These findings are consistent with another study of pregnancy-associated deaths in Maryland that showed that homicide is the leading cause of pregnancy-associated deaths.<sup>97</sup>

Further investigation is necessary to more fully understand the association between abortion and increased risk of death from homicide. Increased risk-taking and substance abuse may play some role in this association, but it is also possible that many of these deaths are related to domestic violence. Women who become pregnant in a violent or potentially violent domestic situation may choose abortion to prevent a child from being born into an abusive situation. If this abortion is secretly obtained against an abusive male's wishes, subsequent discovery or disclosure of the abortion may result in violence and even death. Alternatively, if an abusive male partner is unwilling to accept or tolerate the birth of a child, the woman may become a victim of verbal or physical abuse aimed at compelling her to submit to an unwanted abortion.<sup>98</sup> According to one study of battered women, the target of battery during their pregnancies shifted from their face and breasts to their pregnant abdomens,<sup>99</sup> which suggests hostility toward the women's fertility. In one study of violent deaths among pregnant women, three out of every four were killed during their first 20 weeks of pregnancy.<sup>100</sup>

Research indicates that pregnant women are at higher risk of being abused.<sup>101</sup> Once the pattern of violence has escalated, it may not naturally recede simply because the woman submits to the unwanted

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96. Reardon et al., *supra* note 8, at 838.

97. Horan et al., *supra* note 22, at 1455.

98. BURKE & REARDON, *supra* note 64, at 167-72; R.M. Tolman, *Protecting the Children of Battered Women*, 3 J. INTERPERSONAL VIOLENCE 476, 476-483 (1988).

99. Elaine Hilberman & Kit Munson, *Sixty Battered Women*, 2 VICTIMOLOGY 460, 462 (1977-1978).

100. Cara J. Krulewich et al., *Hidden from View: Violent Deaths Among Pregnant Women in the District of Columbia, 1988-1996*, 46 J. MIDWIFERY & WOMEN'S HEALTH 4, 7 (2001).

101. Julie A. Gazmararian et al., *The Relationship Between Pregnancy Intendedness and Physical Violence in Mothers of Newborns*, 85 OBSTETRICS & GYNECOLOGY 1031 (1995); Hortensia Amaro et al., *Violence During Pregnancy and Substance Use*, 80 AM. J. PUBLIC HEALTH 575 (1990); J. McFarlane et al., *Abuse During Pregnancy and Femicide: Urgent Implications for Women's Health*, 100 OBSTETRICS & GYNECOLOGY 27, 27-36 (2002).

abortion. Negative post-abortion reactions may instead make matters worse.

Whether a woman is covertly or overtly coerced into an unwanted abortion, any post-abortion reaction — on either the part of the woman or man — that includes grief, resentment, or anger on the woman's part may increase the frequency and intensity of subsequent hostility and domestic conflicts.<sup>102</sup> This hypothesis is supported by clinical experience with abused women and at least one survey of women participating in post-abortion programs. In the Elliot Institute survey of 260 women, fifty-nine percent agreed with the statement that after their abortion, "I started losing my temper more easily," and forty-eight percent agreed that "I became more violent when angered."<sup>103</sup> In this same sample, fifty-six percent reported experiencing suicidal feelings, with twenty-eight percent actually attempting suicide one or more times.<sup>104</sup> Approximately thirty-seven percent described themselves as "self-destructive" with another thirteen percent "unsure" (that is, unwilling to rule out that they had become self-destructive).<sup>105</sup> Further analysis of this data found that increased post-abortion levels of self-hatred, hatred of the male, and hatred of men in general were all significantly correlated to each other. In addition, suicidal tendencies and self-destructive behavior were statistically associated with shorter tempers and increased levels of anger and violence ( $p < .00001$ ). In turn, short tempers and self-destructive behavior were also significantly associated with feeling less in touch with one's emotions, feeling unable to grieve, faking displays of happiness, and feeling less control over one's life. Women who are angry and self-destructive following an abortion may be less inclined to avoid violent confrontations. Some who may be unable to

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102. Curiously, research has shown that women who have less conflict over a decision to abort subsequently have higher levels of hostility. D.T. Moseley et al., *Psychological Factors That Predict Reaction to Abortion*, 37 J. CLINICAL PSYCHOL. 276, 277-78 (1981). The researchers observed that "[a] contradiction arises from the fact that if the decision was relatively easy, why the high level of hostility? It may be difficult simultaneously to feel guilt and hostility, and hostility is considered to be a major defensive response to guilt." *Id.* at 279. If hostility is employed as a defensive reaction to unresolved abortion issues, it may contribute to aggressive behaviors that may make post-abortive women more prone to accidents and homicide in addition to non-fatal injuries to themselves and others.

103. BURKE & REARDON, *supra* note 64, at 295 questions 7 & 8. The totals reflect the combined responses of those who indicated that they either agreed or strongly agreed with the statement.

104. *Id.* at 298 question 19.

105. *Id.* at 299 question 3.

commit a direct act of suicide may even gravitate toward abusive males who may do the job for them. According to one post-abortive woman,

One night during a drunken spree, he held a knife to my chest. I told him to kill me, that I wanted to die. I had nothing. No parents, no husband, really, no baby, and no self-respect. How *could* he respect me? I had killed our child. How could I look at myself in the mirror every day? I was a murderer. I truly wanted to die.<sup>106</sup>

This and similar self-reports suggest that post-abortion reactions may aggravate or precipitate domestic violence.<sup>107</sup>

Future investigations of the association between abortion and homicide may require examination of police records and interviews with domestic partners, friends, or relatives. Some cases may be convoluted. For example, in 1999 a Pennsylvania couple, Michael Oravec and Rhonda Jo Reller, allegedly entered into a suicide pact a month after an abortion which resulted in profound regret and depression.<sup>108</sup> Oravec survived, subsequently pled guilty, and was sentenced for the murder of Reller.<sup>109</sup>

#### OVERALL RISK OF DEATH FROM VIOLENCE

As the discussion above suggests, self-destructive tendencies may play an important part in any deaths resulting from violence, including deaths attributed to accidents and homicide. For this reason, a general assessment of all violent deaths associated with pregnancy outcome may also be instructive. Researchers in Finland did such an assessment. During the period examined, deaths from violent causes accounted for fifty-five percent of the deaths among women who had been pregnant in the previous year. Women who gave birth had only forty-seven percent of the risk of death from violence (suicide, accident, or violence) as women who had not been pregnant in the prior year (OR = 0.47; 95% CI = 0.30 to 0.74), while women who had

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106. David C. Reardon, *Abortion and Domestic Violence*, 4 POST-ABORTION REV. 13 (1996).

107. *Id.*

108. Daniel Reynolds, *Detective Says Woman Killed Over Abortion*, PITTSBURGH TRIBUNE REV., May 22, 1999, at C1.

109. *Man pleads in shooting death*, PITTSBURGH TRIBUNE REV., Mar. 13, 2001, available at <http://library.triblive.com/interconnect/intercon.dll> (last visited Apr. 17, 2004).

abortions had 181 percent of the risk of death as women who had not been pregnant (OR = 1.81, 95% CI = 1.31 to 2.50).<sup>110</sup> The ninety-five percent confidence limits (CI) for the latter indicates that after allowing for chance variance in the sample population, it is ninety-five percent likely that the true odds ratio of death from violence lies somewhere between 1.31 and 2.50 times higher relative risk for women who had an abortion in the prior year compared to non-pregnant women.

In the California study, there was not a comparison group to non-pregnant women. Instead, after controlling for age and prior psychiatric history, the researchers found that over the full eight-year period examined, aborting women had a risk of death from violence that was 178 percent of the risk of death for delivering women (OR = 1.78; 95% CI = 1.28 to 2.47).<sup>111</sup> Figure 6 represents a graph of the rate of death per 100,000 women by pregnancy outcome for this group. It shows that the disparity in deaths from violent causes is greatest nearest the event of abortion or delivery and rapidly declines over four years, after which differences in risk of death from violent causes are no longer statistically significant. This time-based effect would seem to support the hypothesis that abortion has a causal direct or indirect impact on risk of violent deaths at least within the first four years after an abortion. The decline in risk over four years may be explained by the healing effects of time as women process their grief and overcome self-destructive tendencies that were caused or aggravated by their abortions.

While more research is clearly warranted, these two large record-based studies have established that abortion is at least a marker, if not a causal factor, for increased risk of death from violence. A causal interpretation is supported by other research, clinical experience, and the self-reports of post-abortive women. The latter is especially important in regard to understanding the causes of death from violence. Together, the preponderance of evidence clearly refutes the claim that mortality rates associated with abortion are lower than those associated with childbirth.

While more research is needed, the potential impact of abortion on deaths from violent causes can be estimated by using the ninety-five percent confidence interval identified in the California study. It is ninety-five percent likely that the true difference in relative risk lies between 1.28 and 2.47, at least among low-income citizens of

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110. Mika Gissler & Elina Hemminki, *Pregnancy-Related Violent Deaths*, 27 SCANDINAVIAN J. PUBLIC HEALTH 54 (1999).

111. Reardon et al., *supra* note 8, at 835.

California. Assuming that this range is similar to all 1.4 million women undergoing abortions each year, we can estimate that between 766 and 4,021 deaths from violent causes each year may be related to or aggravated by a prior abortion.<sup>112</sup>

#### A CLOSER LOOK AT DIFFERENCES IN RATES OF DEATH FROM NATURAL CAUSES

In the Finland study, deaths from natural causes accounted for forty-five percent of the deaths among the recently pregnant women.<sup>113</sup> As seen in Figure 7, the age-adjusted odds ratio of dying from natural causes within a year following any pregnancy was lower than that of non-pregnant women. This finding suggests that women who are capable of becoming pregnant are simply healthier and less likely to die of natural causes than women who cannot or do not become pregnant. Conversely, the women who are most likely to die from natural causes may be least likely to become pregnant in the last year of their lives.

Comparing abortion to birth, however, the risk of death from natural causes was sixty percent higher for women who had abortions compared to women who gave birth. One possible explanation would be that the women who died after an abortion were already in ill health before the abortions and sought the abortion to protect their health. But the STAKES researchers rejected this hypothesis when an examination of abortion registry records showed that only a single woman in this group had her abortion for reasons of maternal health.<sup>114</sup>

Similarly, the comparative mortality study using low-income women in California showed that over the eight years following a pregnancy outcome, aborting women were forty-four percent more likely to die from natural causes than women who had delivered (OR = 1.44; 95% CI = 1.08 to 1.91).<sup>115</sup>

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112. This calculation assumes that the women who did not have abortions would have the same risk of death from violent causes as those who have deliveries, which was 195.4 deaths per 100,000 women over eight years.

113. Gissler et al., *supra* note 7, *passim*.

114. E-mailed explanation from Mika Gissler, researcher with the Health Service Research Unit, STAKES, National Research and Development Centre for Welfare and Health, Helsinki, Finland to David C. Reardon (Mar. 8, 2000) (on file with the author).

115. Reardon et al., *supra* note 8, at 838.

The findings would appear to support the view that induced abortion produces an unnatural physical and psychological stress on women that can result in a negative impact on their general health. This theory is also supported by studies that have examined the amount of health care sought by women before and after induced abortions. In a review of the records of a group general practice in northwest London treating about 10,000 patients, researchers discovered that on average there was as much as an eighty percent increase in requests for health care services in the year following an abortion compared to the year prior to an abortion.<sup>116</sup>

A number of questionnaire-based studies have also reported an increased rate of health problems post-abortion. Following clinical trials of RU-486 on 145 women, 7.6 percent reported increased health problems two weeks after their medical abortions. This figure rose to 13.8 percent by six to eight weeks post-abortion.<sup>117</sup>

Another study examined health ratings compiled by 1,428 patients chosen at random from office visits to sixty-nine general practitioners. The validity of these self-assessments was checked against ratings by their physicians and an independent physician's review of patients' medical records. The investigators found that women with a history of pregnancy loss, especially abortion, had significantly lower general health ratings than other women. The more pregnancy losses a woman had suffered, the more negative her general health score. Loss of a woman's most recent pregnancy was more strongly associated with lower health than were losses followed by successful deliveries.<sup>118</sup> While the researchers found that miscarriage was also associated with a lower health score, induced abortion was more strongly associated with a lower health assessment and more frequently identified by women as the cause of their reduced level of health. More than twenty percent of the women participating in the study expressed a moderate

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116. D. Berkeley et al., *Demands Made on General Practice by Women Before and After an Abortion*, 34 J. ROYAL COLLEGE GEN. PRACTITIONERS 310, 313 (1984). Another study examined treatment rates three months before and after abortion and found a thirty-six percent increased rate of hospital admissions following abortion. The elevated hospitalization rates were statistically significant. Truls Ostbye et al., *Health Services Utilization After Induced Abortions In Ontario: A Comparison Between Community Clinics and Hospitals*, 16 AM. J. MED. QUALITY 99 (2001).

117. Warren B. Miller et al., *Testing a Model of the Psychological Consequences of Abortion*, in *THE NEW CIVIL WAR: THE PSYCHOLOGY, CULTURE, AND POLITICS OF ABORTION* 235, 244 (Linda J. Beckman & S. Marie Harvey eds., 1998).

118. Phillip G. Ney et al., *The Effects of Pregnancy Loss on Women's Health*, 38 SOC. SCI. & MED. 1193, 1193-94 (1994).

to strong need for professional help to resolve their loss. From these data, the psychiatrist who led the research team concluded that pathological grief after the loss of an unborn child, whether by miscarriage or abortion, has a detrimental effect on the psychological and physical health of women. He proposed several possible reasons for this: (1) aborting women may be hesitant to discuss feelings of loss or to seek professional help because of the moral, familial, and political controversies surrounding abortion; (2) losses that are not mourned may lead to pathological grief which is associated with depression, and depression is associated with a suppression of the immune system,<sup>119</sup> increasing the risk of infections and cancers; (3) psychological conflict may consume energy that would otherwise be spent in more healthy ways; and (4) prolonged or unresolved mourning may distract the woman from taking care of other health needs or confuse her interpretation of crisis situations.<sup>120</sup>

In addition to these factors, a history of abortion has been linked to heightened anxiety,<sup>121</sup> sleeping disorders,<sup>122</sup> eating disorders,<sup>123</sup> and promiscuity,<sup>124</sup> all of which can have a direct negative impact on a

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119. Michael Iriwn et al., *Life Events, Depressive Symptoms and Immune Function*, 144 AM. J. PSYCHIATRY 437 (1987).

120. Ney et al., *supra* note 118, at 1193-1200.

121. CATHERINE A. BARNARD, *THE LONG TERM PSYCHOLOGICAL EFFECTS OF ABORTION* 61 (1990); Ellen W. Freeman et al., *Emotional Distress Patterns Among Women Having First or Repeat Abortions*, 55 OBSTETRICS & GYNECOLOGY 630 (1980); Jesse R. Cougle et al., *Generalized Anxiety Following Unintended Pregnancies Resolved Through Childbirth and Abortion: A Cohort Study of the 1995 National Survey of Family Growth*, J. ANXIETY DISORDERS (forthcoming 2004). Anxiety following abortion is reported by as many as eighty-two percent of women who experience post-abortion maladjustments, with many reporting symptoms of general anxiety related to fear of punishment from God, fear of another pregnancy, fear of another abortion, fear of others learning of the abortion, fear of making decisions, and preoccupation with thoughts of death. BURKE & REARDON, *supra* note 64, at 291-92.

122. BARNARD, *supra* note 121, at 56-58. In the Elliot Institute survey of women who experienced post-abortion maladjustments, forty-five percent reported bouts of insomnia with this reaction statistically associated with nightmares. BURKE & REARDON, *supra* note 64, at 125.

123. Mark A. Blais et al., *Pregnancy Outcome and Impact on Symptomatology in a Cohort of Eating-Disordered Women*, 27 INT'L J. EATING DISORDERS 140 (2000); VOUGHT, *supra* note 94, at 110; BURKE & REARDON, *supra* note 64, at 187-200, 293. *See generally* SPECKHARD, *supra* note 75.

124. Judith S. Wallerstein et al., *Psychological Sequelae of Therapeutic Abortion in Young Unmarried Women*, 27 ARCHIVES GEN. PSYCHIATRY 828 (1972). In a

woman's health. Other unhealthy behaviors that have been linked to abortion are increased alcohol consumption,<sup>125</sup> drug abuse,<sup>126</sup> and smoking.<sup>127</sup> Heavier smoking has been correlated to higher levels of anxiety among women with a history of abortion<sup>128</sup> and is a major cause of respiratory diseases and death. Since lung cancer develops slowly, however, one would not expect an association between lung cancer and abortion to be detected in a study examining only eight years of death certificates associated with pregnancy outcome, as was done in the California study. A review of the literature on elevated smoking levels following abortion, however, has concluded that even the lowest estimate of a two percent increased smoking rate following abortion would lead to 4,310 additional cancer cases in the lifetime of the 1.4 million women having an abortion each year—of whom, at current

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survey of women who had suffered from post-abortion maladjustments, forty-seven percent describe themselves as becoming promiscuous following their abortions. BURKE & REARDON, *supra* note 64, at 297.

125. See sources cited and accompanying text *supra* note 91.

126. See sources cited and accompanying text *supra* note 92.

127. Drower & Nash, *supra* note 65, *passim*; S. Kullander & B. Kallen, *A prospective study of smoking and pregnancy*, ACTA OBSTETRICA ET GYNECOLOGICA SCANDINAVICA 50, 83-94 (1971); Susan Harlap & A. Michael Davies, *Characteristics of Pregnant Women Reporting Previously Induced Abortions*, 52 BULL. WORLD HEALTH ORG. 149 (1975); Ann Aschengrau Levin et al., *Association of Induced Abortion With Subsequent Pregnancy Loss* 243 JAMA 2495 (1980); Erik B. Obel, *Pregnancy Complications Following Legally Induced Abortion: An Analysis of the Population With Special Reference to Prematurity*, 26 DANISH MED. BULL. 192 (1979); A. Lopes et al., *The Impact of Multiple Induced Abortions on the Outcome of Subsequent Pregnancy* 31 AUSTRALIAN & NEW ZEALAND J. OBSTETRICS & GYNAECOLOGY, 41 (1991); Jerker Liljestrand et al., *Characteristics of Young Female Smokers in a Swedish Primary Health Care Area*, 11 SCANDINAVIAN J. PRIMARY HEALTH CARE 157 (1993); Olav Meirik & Karl-Gosta Nygren, *Outcome of First Delivery After 2nd Trimester Two-Stage Induced Abortion: A Controlled Historical Cohort Study*, 63 ACTA OBSTETRICA ET GYNECOLOGICA SCANDINAVICA 45 (1984); Carol J. Hogue, *Low Birth Weight Subsequent to Induced Abortion: A Historical Prospective Study of 948 women in Skopje, Yugoslavia*, 123 AM. J. OBSTETRICS & GYNECOLOGY 675 (1975); Carol Madore, *A Study on the Effects of Induced Abortion on Subsequent Pregnancy Outcome*, 139 AM. J. OBSTETRICS & GYNECOLOGY 139 (1981); Margaret T. Mandelson et al., *Low Birth Weight in Relation to Multiple Induced Abortions*, 82 AM. J. PUBLIC HEALTH 391 (1992).

128. Richard Henshaw et al., *Psychological Responses Following Medical Abortion (Using Mifepristone and Gemeprost) and Surgical Vacuum Aspiration: A Patient-Centered, Partially Randomised Prospective Study*, 73 ACTA OBSTETRICA ET GYNECOLOGICA SCANDINAVICA 812, 817 (1994).

mortality rates for lung cancer, 3,750 would die from this disease.<sup>129</sup> If all smoking-related deaths were taken into account, a two percent increase in smoking rates among women who have had abortions would lead to 11,250 additional deaths annually.<sup>130</sup>

Heart disease is another major cause of death that may be impacted by a history of abortion. In the California study, among women with only one known pregnancy, during the eight years following their pregnancies those who had abortions were nearly three times more likely to die from circulatory diseases (OR = 2.87; 95% CI = 1.68 to 4.89) and over five times more likely to die of cerebrovascular disease (OR = 5.46.; 95% CI = 1.60 to 18.65) compared to women who delivered.<sup>131</sup> The impact of abortion on subsequent substance abuse, eating disorders, smoking, and substance abuse may explain part of this finding. Also, since it is known that women who abort are at higher risk of long term clinical depression than women who carry unintended pregnancies to term,<sup>132</sup> and depression is an independent

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129. Thomas W. Strahan, *Women's health and abortion: Risk of premature death in women from induced abortion, preliminary finding*, 5 (2) ASSOCIATION FOR INTERDISCIPLINARY RESEARCH IN VALUES AND SOCIAL CHANGE NEWSLETTER 1-8 (1993) (subsequently renamed the RESEARCH BULLETIN) [hereinafter *Women's health and abortion*].

130. *Id.*

131. Reardon et al., *supra* note 8, at 838.

132. David C. Reardon & Jesse R. Cogle, *Depression and Unintended Pregnancy in the National Longitudinal Survey of Youth: A Cohort Study*, 24 BRIT. MED. J. 151, 151-52 (2002). As there is a correlation between depression and guilt following abortion, evidence that women who had abortions after it was legalized by *Roe v. Wade* in 1973 are more likely to express feelings of guilt than women who had abortions before 1973 suggests that legalization of abortion may be associated with higher risk of post-abortion depression. See Douglas Brown et al., *Prolonged Grieving After Abortion: A Descriptive Study*, 4 J. CLINICAL ETHICS 118 (1993). Legalization of abortion may have increased the risks that undergo "unwanted" abortions in response to the pressure of other persons. When abortion was not readily available, the hurdles women had to go through to find a legal or illegal abortion may have served as a mechanism for screening out women who were ambivalent and for reducing the pressure from others to have an abortion. Since 1973, high levels of ambivalence are common among women seeking an abortion. See MARY K. ZIMMERMAN, *PASSAGE THROUGH ABORTION: THE PERSONAL AND SOCIAL REALITY OF WOMEN'S EXPERIENCES* (1977); M.B. Bracken, *A Causal Model of Psychosomatic Reactions to Vacuum Aspiration Abortion*, 13 SOCIAL PSYCHIATRY 135 (1978); DAVID C. REARDON, *ABORTED WOMEN, SILENT NO MORE* 16-17 (1987).

risk factor for death from heart disease,<sup>133</sup> an association between abortion and heart diseases may be mediated by depression.

Depression is also a risk factor for development of several forms of cancer.<sup>134</sup> Breast cancer<sup>135</sup> and cervical cancer<sup>136</sup> are also significantly associated with abortion and/or delayed childbirth. Women who abort also lose the protective effect of childbirth, which reduces the risk of cancers of the breast, cervix, colon and rectum, ovaries, endometrium, and liver.<sup>137</sup> Projecting the increased relative risk for contracting just three of these cancers (breast, ovarian, and endometrium) on mortality rates associated with each type of cancer, as many as 32,000 cancer deaths each year may be attributable to negative effects of abortion on maternal health.<sup>138</sup> Record linkage studies examining pregnancy

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133. Brenda W. J. H. Pennix et al., *Depression and Cardiac Mortality*, 58 ARCHIVES GEN. PSYCHIATRY 221 (2001); Robert M. Carney et al., *Depression and Coronary Heart Disease: A Review for Cardiologists*, 20 CLINICAL CARDIOLOGY 196 (1997); K. Ranga Rama Krishnan, *Depression as a Contributing Factor in Cerebrovascular Disease*, 140 AM. HEART J. 70 (2000); O'Connor et al., *Depression and Ischemic Heart Disease*, 140 AM. HEART J. 63 (2000).

134. Robert W. Linkins & George W. Comstock, *Depressed Mood and Development of Cancer*, 132 AM. J. EPIDEMIOLOGY 962, 962 (1990).

135. Joel Brind et al., *Induced Abortion as an Independent Risk Factor for Breast Cancer: A Comprehensive Review and Meta-Analysis*, 50 J. EPIDEMIOLOGY & COMMUNITY HEALTH 481 (1996). Twenty-eight studies examining data relevant to breast cancer and prior reproductive history are examined in this meta-analysis.

136. Numerous studies show that there is a twofold to threefold increased risk of cervical cancer associated with prior history of abortion. The increased risk of cervical cancer associated with prior abortion history may be mediated through numerous factors. As previously noted, smoking and promiscuity, which are risk factors for cervical cancer, are known to increase following abortion. Abortion may also have a direct impact via mechanical trauma and infection associated with the surgery, chronic inflammatory lesions, and general endocrine stress. See Larissa I. Remennick, *Induced Abortion as Cancer Risk Factor: A Review of Epidemiological Evidence*, 44 J. EPIDEMIOLOGY & COMMUNITY HEALTH 259 (1990). See also A. Hildesheim et al., *HPV Co-Factors Related to the Development of Cervical Cancer: Results from a Population-Based Study in Costa Rica*, 84 BRIT. J. CANCER 1219 (2001); Ramiro Molina et al., *Oral Contraceptives and Cervical Carcinoma in Situ in Chile*, 48 CANCER RESEARCH 1011 (1988); F. Parazzini et al., *Reproductive Factors and the Risk of Invasive and Intraepithelial Cervical Neoplasia*, 59 BRIT. J. CANCER 805 (1989); THOMAS W. STRAHAN, DETRIMENTAL EFFECTS OF ABORTION: AN ANNOTATED BIBLIOGRAPHY WITH COMMENTARY 214-19 (3d ed. 2001).

137. STRAHAN, *supra* note 136, 206-27.

138. *Women's health and abortion*, *supra* note 129.

outcomes with death certificates over periods of twenty to forty years will be required to better identify the actual risk.

The California study also found that abortion was significantly associated with an elevated risk of death from AIDS (OR = 2.18; 95% CI = 1.10 to 4.31).<sup>139</sup> This finding is consistent with previous research identifying higher rates of HIV-1 infection among women who have abortions compared to those who deliver.<sup>140</sup> Abortion may be a contributing factor in AIDS since pelvic inflammatory disease, which is a relatively common complication of abortion,<sup>141</sup> may increase the risk of HIV transmission.<sup>142</sup> Increased levels of substance abuse and promiscuity following abortion may also contribute to a higher risk of HIV infection and death from AIDS.<sup>143</sup>

It is also known that induced abortion is associated with a subsequent risk of placenta previa and premature delivery.<sup>144</sup> Increased rates of genital tract infection, pelvic inflammatory disease, endometritis, ectopic pregnancy, retained placenta, preeclampsia, and other complications of pregnancy and delivery in subsequent pregnancies have also been identified in the literature.<sup>145</sup> All of these complications are associated with higher risk of maternal and neonatal

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139. Reardon et al., *supra* note 8, at 838.

140. Damiano D. Abeni et al., *Deliveries, Abortion and HIV-1 Infection in Rome, 1989-1994*, 13 EUR. J. EPIDEMIOLOGY 373, 373-374 (1997). A. Desgrees et al. *HIV-1 Infection and Reproductive History: A Retrospective Study Among Pregnant Women: Abidjan, Cote d'Ivoire*, 9 INT'L J. STD & AIDS 452 (1998).

141. Lars Heisterberg, *Pelvic Inflammatory Disease Following Induced First-Trimester Abortion*, 35 DANISH MED. BULL. 64 (1988); Jette Led Sorensen et al., *Early- and Late-Onset Pelvic Inflammatory Disease Among Women with Cervical Chlamydia Trachomatis Infection at the Time of Induced Abortion—A Follow-Up Study*, 22 INFECTION 242 (1994); Susan D. Hillis et al., *Delayed Care of Pelvic Inflammatory Disease as a Risk Factor for Impaired Fertility*, 168 AM. J. OBSTETRICS & GYNECOLOGY 1503 (1993).

142. Jay A. Levy, *Transmission of AIDS: The Case of the Infected Cell*, 259 JAMA 3037, 3037 (1988).

143. Judith A. Stein et al., *Psychosocial Correlates and Predictors of AIDS Risk Behaviors, Abortion, and Drug Use Among a Community Sample of Young Adult Women*, 13 HEALTH PSYCHOL. 308, 308-15 (1994).

144. John M. Thorp et al., *Long-Term Physical and Psychological Health Consequences of Induced Abortion: Review of the Evidence*, 58 OBSTETRICAL & GYNECOLOGICAL SURV. 67 (2003).

145. See STRAHAN, *supra* note 136, at 168-204; THOMAS W. STRAHAN, *DETRIMENTAL EFFECTS OF ABORTION: SUPPLEMENT NO. 1* (Supp. 2002).

death.<sup>146</sup> Even if these deaths are actually traceable to latent abortion morbidity (scarring of the uterus, for example), these deaths would be classified as maternal deaths rather than abortion-related deaths, and would therefore confound the comparison of mortality rates between abortion and delivery.

Abortion is also associated with a subsequent increased need for treatments for mental illness compared to delivery.<sup>147</sup> In the California study, after controlling for prior mental illness, researchers found that women who had abortions were three times more likely to die from causes attributed to mental disease than women who carried to term.<sup>148</sup>

## CONCLUSIONS

In arriving at the conclusion that abortion's mortality rates are lower than those of childbirth in *Roe v. Wade*, Justice Blackmun relied on the studies and opinions of population control advocates Christopher Tietze, Malcolm Potts, and Lawrence Lader, all of whom were zealous promoters of liberalized abortion laws.<sup>149</sup> The studies they relied on, however, had many methodological problems, including very limited access to patients for follow-up, no control group of delivering women, and lack of an objective standard for comparing mortality rates of delivering and aborting women. The focus of these abortion advocates appeared to be limited to identifying the risk of death from short-term complications of abortion such as septic infection or therapeutic misadventure. But subsequent experience has shown that abortion can have both subtle and profound effects on women's psychological and physical wellbeing. In the 1960s and early 1970s, abortion advocates erroneously believed, without any recourse to supporting data, that the risk of death from suicide after an abortion was negligible while the

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146. Thomas W. Strahan, *Induced Abortion as a Contributing Factor in Maternal Mortality or Pregnancy-Related Death in Women*, 10 RESEARCH BULLETIN 1 (1996).

147. David C. Reardon et al., *Psychiatric Admissions of Low-Income Women Following Abortion and Childbirth*, 168 CANADIAN MED. ASS'N J. 1253, 1255-56 (2003); Priscilla K. Coleman et al., *State-funded abortions vs. deliveries: A comparison of outpatient mental health claims over five years*, 72 COLEMAN AM. J. ORTHOPSYCHIATRY 141-52 (2002); Henry P. David et al., *Post-Abortion and Postpartum Psychotic Reactions*, 13 FAM. PLAN. PERSP. 88, 89 (1981).

148. Reardon et al., *supra* note 8, at 838. The odds ratio for death from mental disease was 3.21, 95% CI 1.11 to 9.27. *Id.*

149. *Roe v. Wade*, 410 U.S. 113, 149 n.44 (1972).

risk of suicide among women with unintended pregnancies was high. Similarly, in making their estimates of abortion mortality rates, abortion advocates did not consider the impact of abortion morbidity on longevity. Death arising from conditions created or aggravated by abortion complications, such as ectopic pregnancy, pelvic inflammatory disease, depression, and breast cancer, should also be considered in any comparison of mortality rates. Nor did their appraisals recognize nor account for the protective effects of early and frequent childbirth against a variety of cancers and other ailments.

The original comparisons of reported abortion deaths to national maternal mortality rates relied upon in *Roe* were also flawed by the fact that even the deaths attributable to immediate complications of abortion occurred primarily among healthy women who had little or no risk of death from childbirth. In this sense, they were “extra” deaths. They were not simply unsuccessful attempts to save these women from dying during dangerous pregnancies and deliveries. In fact, there are no studies that have established when, if ever, abortion reduces a woman’s risk of death compared to childbirth.<sup>150</sup> In one of the few studies undertaken to determine if maternal deaths could have been avoided by abortion, it was concluded that therapeutic abortion would not have prevented any of the twenty-one maternal deaths which occurred among the 74,317 pregnancies examined.<sup>151</sup>

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150. John F. Murphy & Kieran O’Driscoll, *Therapeutic Abortion: The Medical Argument*, 75 IRISH MED. J. 304, 305-06 (1982). While it is known that some illnesses increase the risk of death during pregnancy or delivery, there does not appear to be any studies that have demonstrated lower mortality rates among women with a particular class of disease who elect abortion. At least some researchers have concluded that while it may be inadvisable for women with these diseases to become pregnant, once they are pregnant there is no evidence to support the view that abortion poses less risk to their health than careful management of their pregnancy. *Id.*

151. *Id.* According to the authors,

Among the 21 maternal deaths, 7 were not connected with pregnancy and for this reason would not have been prevented by therapeutic abortion, 11 were a direct result of pregnancy but, as these cases suffered from complications which could not have been foreseen, the question of therapeutic abortion would not have arisen, and 3 were the result of chronic disease which deteriorated to such a degree as to lead to a fatal outcome.

*Id.* at 305. In a careful analysis of each of the three cases where chronic disease was present, the researchers concluded that a therapeutic abortion would not have been recommended in any of these cases. They also noted that there is a severe absence of research indicating when, if ever, abortion might actually reduce the

It is also noteworthy that as many as ninety percent of maternal deaths related to childbirth are associated with caesarean section deliveries which have a maternal mortality rate of approximately 100 per 100,000 c-section deliveries, compared to only 1.1 per 100,000 for vaginal deliveries.<sup>152</sup> The hundred-fold higher mortality rate reported following c-section deliveries compared to vaginal deliveries may reflect a combination of the following three factors: (1) women who are ill or faced with higher-risk deliveries are more likely to be delivered by a c-section; (2) a coroner is less likely to miss the fact that a woman who has undergone a recent c-section was recently pregnant; and (3) there are significant surgical risks associated with c-sections and this procedure is arguably overused.<sup>153</sup> Since a doctor should normally anticipate that a healthy, young pregnant woman is able have an uncomplicated vaginal delivery, a strong argument can be made that the most relevant comparison for healthy women would be a comparison of mortality rates associated with abortion compared to those associated with a vaginal delivery. Conversely, for women with known health problems, there is not yet any research showing that abortion is less dangerous for these women than childbirth;<sup>154</sup> there is only the presumption that this may be true. Clearly, carefully designed case-control studies are needed to determine when, if ever, abortion is associated with a reduced mortality risk compared to delivery.

Medical intervention in a health natural process such as pregnancy should only be undertaken when there is clear medical evidence that the treatment produces clearly defined benefits that outweigh any related risks. As David Grimes, M.D., has noted, interventions based on theories that are not substantiated by research place patients at risk

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risk of death for pregnant women with severe health problems, particularly since the abortion itself may involve as much or more risk than childbirth.

152. M. Lanska et al., *Mortality From Abortion and Childbirth*, 250 JAMA 361-362 (1983).

153. S. Taffel et al., *Trends in the United States Cesarean Section Rate and Reasons for the 1980-1985 Rise*, 77 AM. J. PUBLIC HEALTH 955 (1987).

154. Murphy & O'Driscoll, *supra* note 150, at 305 (noting that even in cases such as Eisenmenger's Syndrome, which poses a serious risk to a pregnant woman's life, the same disease that makes delivery problematic makes *any surgery*, including abortion, problematic to the point where the surgery may pose risks that equal or exceed those associated with a spontaneous delivery. This observation highlights an important problem: Even after decades of experience with abortion, there have not been any case-control studies published showing that abortion has statistically significant benefits compared to childbirth. This is true in regard to both the general population of healthy women and in regard to the population of unhealthy pregnant women.).

of injury: “Uncritical thinking has hurt women and children around the world. Notable examples include diethylstilbestrol, the Dalkon Shield, and bottle feeding. We cannot afford, either economically or ethically, to allow good intentions to dictate practice without the check of scientific controls. Our practices need dispassionate scientific scrutiny.”<sup>155</sup>

While some medical experts will certainly continue to defend the opinion that abortion is a safe alternative to childbirth, this opinion can no longer be characterized as a “now-established fact.”<sup>156</sup> It is at best an unsubstantiated opinion, most likely a hope, and at worst, an ideological mantra. While “[d]octors often differ in their estimate of comparative health risks and appropriate treatment,”<sup>157</sup> responsible differences of opinion must be reconcilable with empirical evidence. In the case at hand, it is clear that prior comparisons of mortality rates associated with abortion and childbirth have been crudely constructed on the basis of an incomplete and inaccurate reporting system. Using the standards developed for evidence-based medicine, the recent record-based case-control studies represent the best available medical evidence on this issue and supercede any “expert opinions” that diverge from this evidence.<sup>158</sup>

After thirty years of experience with legal abortion in the United States, it is now clear that mortality risks associated with abortion significantly exceed those associated with childbirth, both in the short term (under one year) and in the longer term. While statistical association is not proof of causation, it is clear that abortion is, at the very least, a marker for elevated mortality rates. In the context of the additional studies reviewed in this paper, it is also clear that the interpretation of a causal effect cannot be ruled out. It is therefore reasonable for legislators to conclude that abortion, at any stage of pregnancy, poses a significant risk to women’s health. Since *Roe* established comparative mortality rates as the standard for determining when states can regulate abortion to protect the health interests of women, this new medical evidence would appear to be sufficient to establish a compelling state interest in regulating abortion throughout all stages of pregnancy.

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155. David A. Grimes et al., *Teaching Critical Appraisal to Medical Students in Obstetrics and Gynecology*, 92 *OBSTETRICS & GYNECOLOGY* 877, 880 (1998).

156. *Roe*, 410 U.S. at 163.

157. *Stenberg v. Carhart*, 530 U.S. 914, 937 (2000).

158. See generally Grimes et al., *supra* note 155.

*Figure 1*

## Death by Suicide

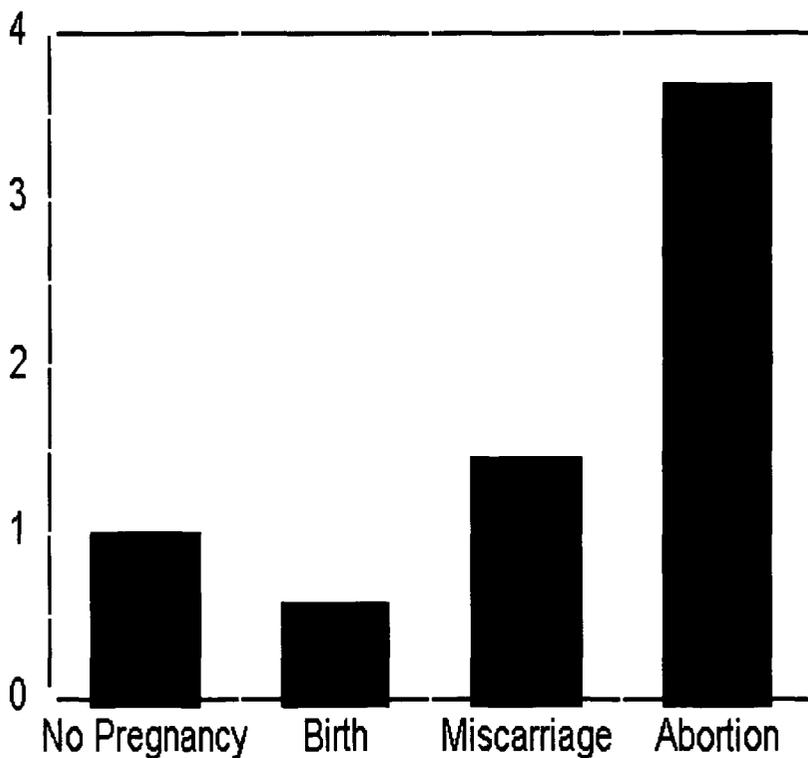


Figure 2

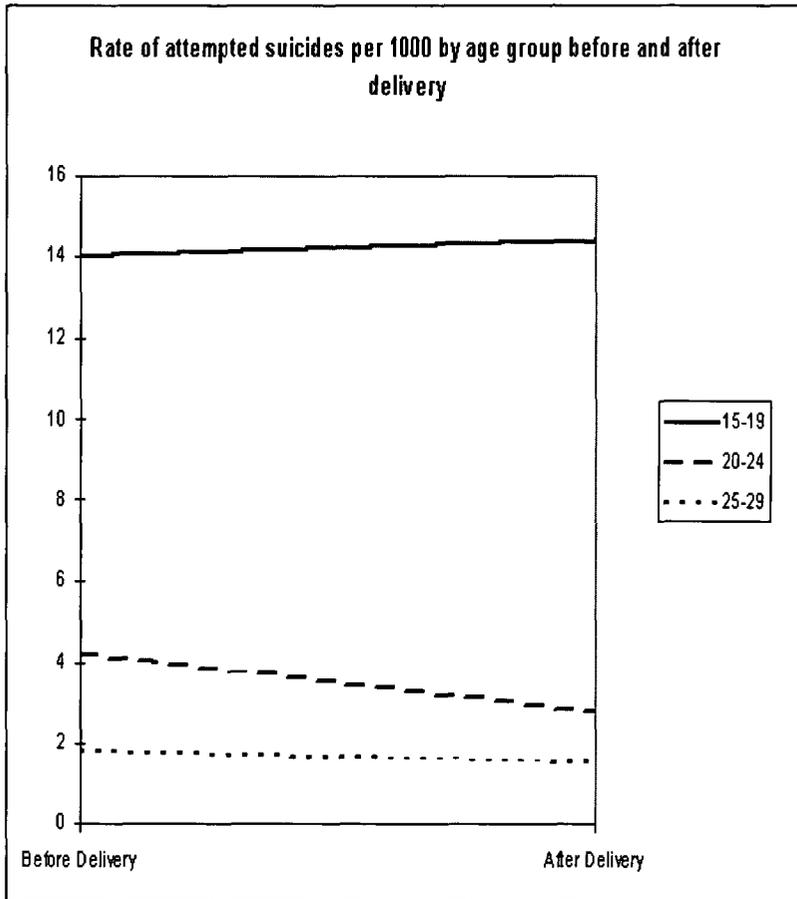
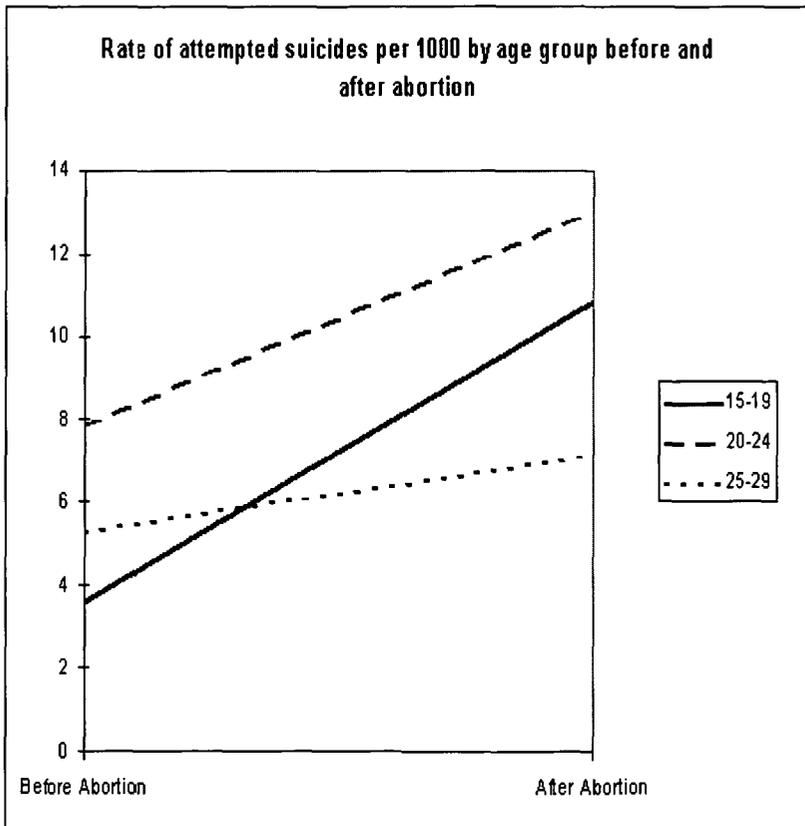


Figure 3



*Figure 4*

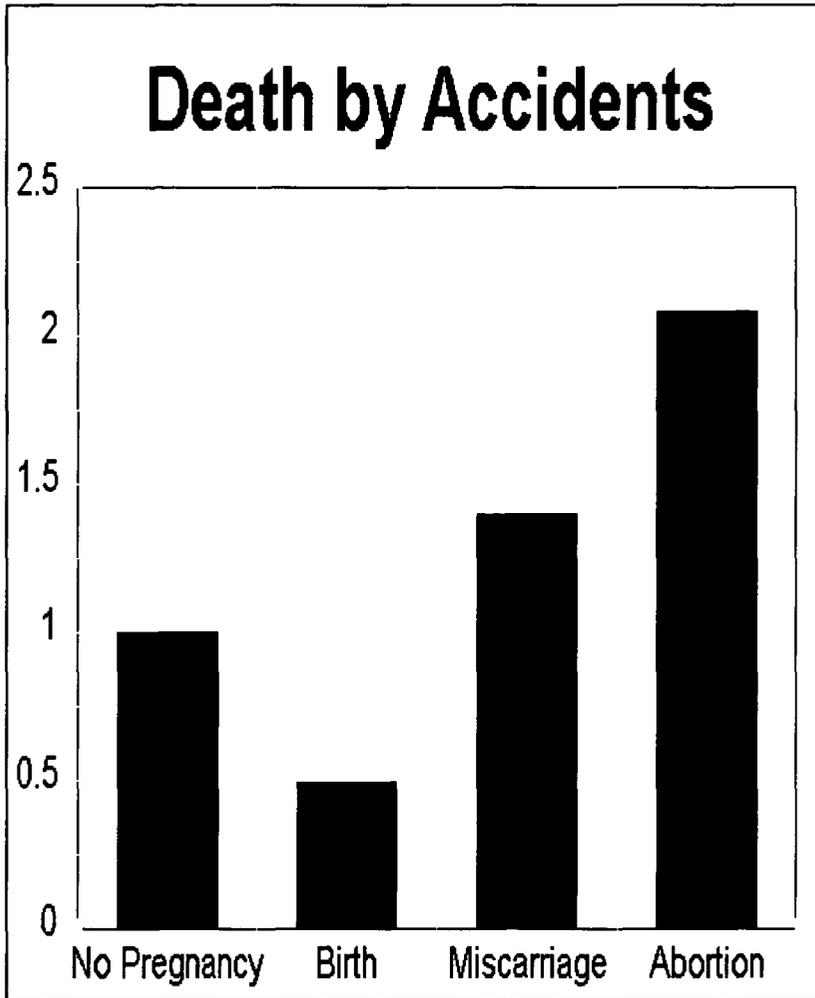
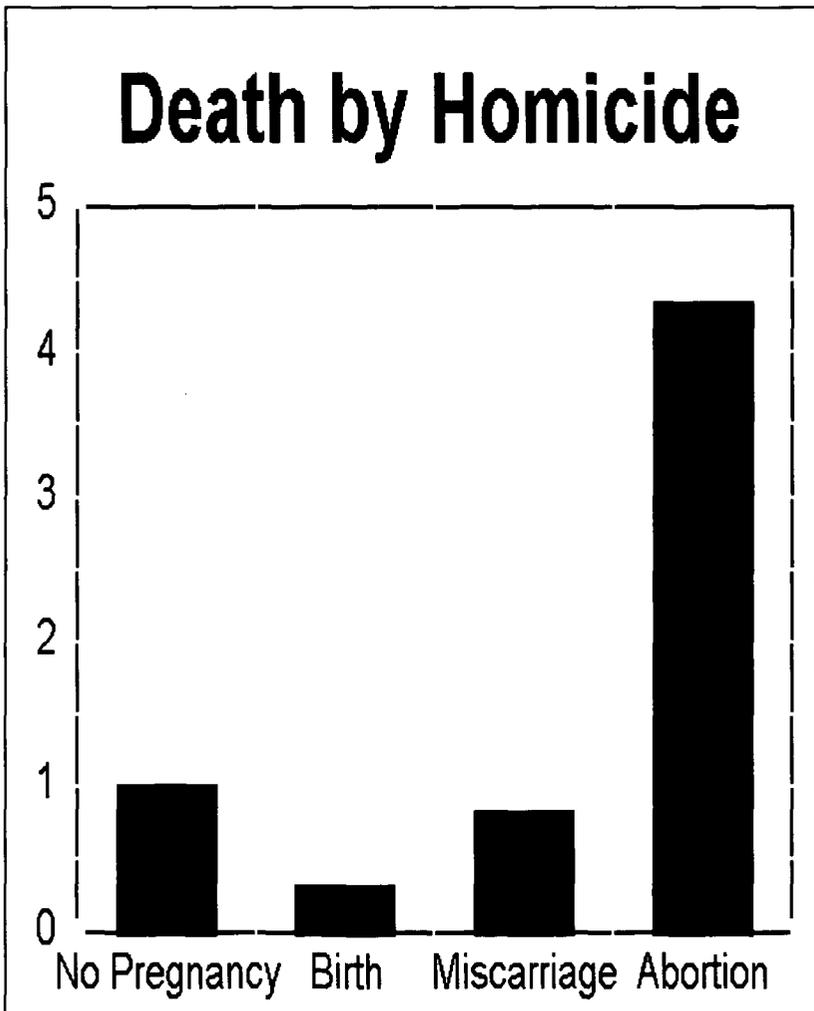


Figure 5



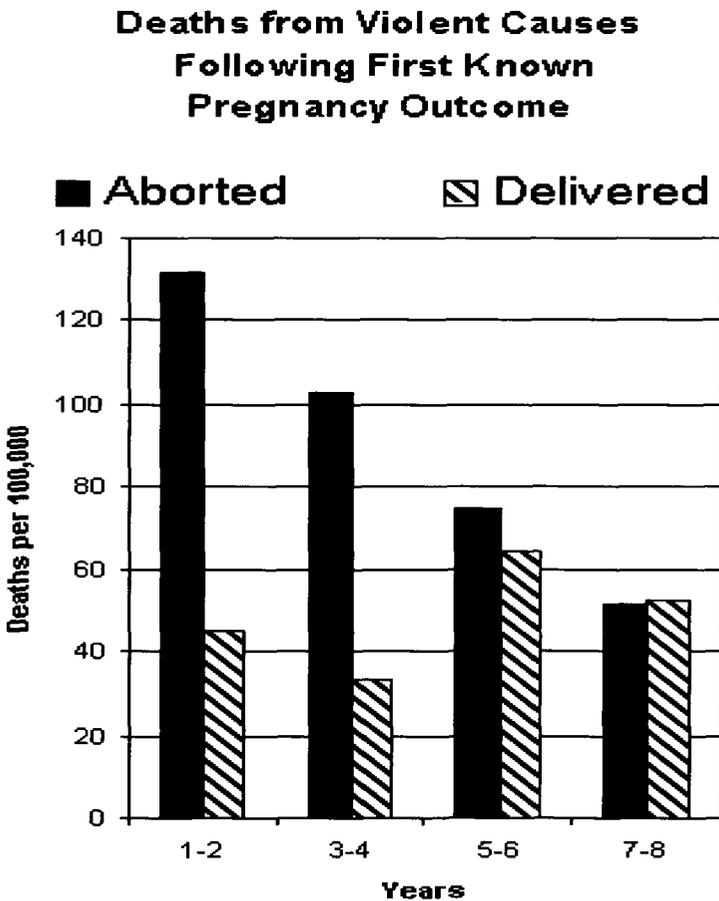
*Figure 6*

Figure 7

