

Deaths Associated With Pregnancy Outcome: A Record Linkage Study of Low Income Women*

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ABSTRACT

Background. A national study in Finland showed significantly higher death rates associated with abortion than with childbirth. Our objective was to examine this association using an American population over a longer period.

Methods. California Medicaid records for 173,279 women who had an induced abortion or a delivery in 1989 were linked to death certificates for 1989 to 1997.

Results. Compared with women who delivered, those who aborted had a significantly higher age-adjusted risk of death from all causes (1.62), from suicide (2.54), and from accidents (1.82), as well as a higher relative risk of death from natural causes (1.44), including the acquired immunodeficiency syndrome (AIDS) (2.18), circulatory diseases (2.87), and cerebrovascular disease (5.46). Results are stratified by age and time.

Conclusions. Higher death rates associated with abortion persist over time and across socioeconomic boundaries. This may be explained by self-destructive tendencies, depression, and other unhealthy behavior aggravated by the abortion experience.

THE REDUCTION of maternal mortality rates is a major goal of national health care initiatives. The accuracy of maternal mortality figures has been questioned, however, because of inadequate reporting mechanisms and confusion about when a woman's pregnancy actually contributes to the cause of death. It is difficult, for example, to reliably determine whether pregnancy has contributed to death resulting from tumor, stroke, or suicide.

To overcome the difficulties involved when using an *a priori* definition of "pregnancy-related" deaths, researchers at Stakes, the National Research and Development Centre for Welfare and Health in Finland, undertook two important record linkage studies.^{1,2} They identified all death certificates from 1987 to 1994 for all women aged 15 to 49, linked them to Finland's centralized Birth, Abortion, and Hospital Discharge Registers, and examined death rates relative to all pregnancy events among these women during the year before their deaths.

The Stakes studies revealed remarkable variations in death rates relative to pregnancy outcome. Women who had given birth had half the death rate of women who had not been

pregnant in the year before death. By contrast, women who had had an induced abortion were 76% more likely to die than women who had not been pregnant, 102% more likely to die than women who miscarried, and 252% more likely to die than women who had carried to term. Compared with women who delivered, the age-adjusted odds ratio of dying during the year after an induced abortion was 1.6 for death from nonviolent causes, 4.2 for death from injuries related to accidents, 6.5 for suicide, and 14.0 for homicide.

If the findings reported by Stakes identify a true association between mortality rates and previous pregnancy outcomes, one would expect them to be replicable elsewhere. In addition,

KEY POINTS

- Low-income women in California have differential rates of death associated with childbirth and abortion that are similar to the pattern observed in Finland.
- Compared with women who give birth, those who had abortions were more likely to subsequently die of suicide, accidents, homicide, mental disease, and cerebrovascular disease.
- Previous psychiatric history does not appear to explain the higher relative death rates.
- The differential in subsequent death rates persists over a period of at least 8 years.
- Previous pregnancy outcomes may interact with the most recent pregnancy outcome to increase or decrease the relative risk of death.

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*Presented at the First World Congress on Women's Health, Berlin, Germany, March, 2001.

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TABLE 1. Overall Cause-Specific Risk of Death in 8 Subsequent Years for Women Whose First Pregnancy Event Was an Abortion or a Delivery (and No Subsequent Abortions)

Cause of Death	All Cases		Controlling for at Least 1 Year Previous Psychiatric History			
	Number of Deaths (Rate per 100,000)		Number of Deaths (Rate per 100,000)		Age-Adjusted Relative Risk (95% CI)	
	First Pregnancy Delivery (n = 83,690)	First Pregnancy Abortion (n = 50,260)	Delivery of First Pregnancy and No Abortions (n = 41,956)	Abortion of First Pregnancy (n = 17,472)	Delivery of First Pregnancy and No Abortions (n = 41,956)	Abortion of First Pregnancy (n = 17,472)
All deaths	490 (585.5)	366 (728.2)	213 (507.7)	141 (807.0)	1.30 (1.13 to 1.49)*	1.61 (1.30 to 1.99)*
Violent causes	207 (247.3)	179 (356.1)	82 (195.4)	63 (360.6)	1.43 (1.17 to 1.74)†	1.78 (1.28 to 2.47)†
Nonviolent causes	281 (335.8)	183 (364.1)	130 (309.8)	76 (435.0)	1.17 (0.97 to 1.12)	1.44 (1.08 to 1.91)**

*P < .0002.

†P < .001.

**P < .013.

the Stakes findings raise the question of how long the effects of previous pregnancy outcomes on mortality rates may persist. The goals of our study were to investigate whether the Stakes findings would be observed in a homogeneous socioeconomic population and to examine any associations between pregnancy history and subsequent mortality over a longer period.

MATERIALS AND METHODS

The California Department of Health Services (DHS) identified 249,625 women who had received funding for either abortion or delivery in calendar year 1989 under the state-funded medical insurance program known as Medi-Cal. Of this population, 194,694 were citizens whose beneficiary identification codes could be record linked to valid social security numbers, a provision that eliminated illegal immigrants whose medical needs are irregularly covered by Medi-Cal. All "short paid claim" records for these women were obtained for 6 fiscal years beginning in July 1988 and extending through June 1994 with encrypted social security numbers provided for data linkage. In addition, the social security numbers (SSNs) linked to these patient IDs were also linked by DHS to California death certificates between 1989 and 1998, resulting in the identification of 1,713 deaths. A file containing cause of death, date of death, and the appropriate encrypted social security number for linking the two data sets was provided to our research team. An important limitation in our study is that we were not provided with any information regarding race, marital status, and parity. This information was either not readily available in government records or was omitted to protect the privacy and anonymity of individual patients.

Since data were collected from government records representing medical claims reported by thousands of health care providers, data integrity was carefully examined. The record linkage to the death certificate file was carried out by the state of California using the encrypted social security numbers. The linkage of multiple events for the same individual was done by us, using the encrypted SSN provided.

Linkage errors by SSN are not uncommon.³ Therefore, we checked both our own linkages and those done by DHS to assure that a high quality match had been carried out. The confirmatory variables available on both the Medi-Cal and death certificate files used in this checking included the woman's date of birth, date of pregnancy event, and the cost of medical treatment.

Screening for aberrant, indeterminate, and out-of-scope data resulted in the elimination of 21,415 cases (419 deaths) for the following reasons: (1) unlinkable social security numbers, (2) the age recorded for an individual woman in the medical records and/or the death certificates could not be reasonably verified by reference to multiple records, (3) the abortion was identified as illegal or unknown (ICD-9 codes 636 and 637), (4) reported age below 13 or above 49 at the time of their first pregnancy event, (5) first delivery or induced abortion occurred after 1990, (6) the cost associated with the target pregnancy event was below \$100 (suggesting that only counseling for a possible procedure was received), or (7) the first recorded pregnancy event was a miscarriage.

Our primary analysis included all women in the sample who met the stated conditions. Since it has been postulated, however, that previous psychiatric problems may be a common risk factor for both abortion and shorter longevity, we also examined the subset of women who had their first known delivery after July 1, 1989. This allowed us to control for at least 1 year before psychiatric history.

All data handling steps were blind to the pregnancy outcome. Age-adjusted relative risks and 95% confidence intervals were calculated by means of a logistic regression using age as a covariate. In the secondary analysis, the number of psychiatric claims within a year of the target pregnancy event was also used as a covariate. In addition, sensitivity analyses based on alternative matching rules revealed that stricter matching rules, eg, allowing no date of birth discrepancies over 6 years of medical claims, would still have produced similar results. Often, stricter rules would have resulted in even higher odds ratios and greater statistical significance, despite the loss of cases. The software used for all statistical calculations was SPSS 10.0.

RESULTS

Overall Analysis

The first analysis compared death rates between women whose first pregnancy event was an abortion (average age: mean = 24.83, SD = 5.8) and women with no known history of abortion who had a delivery for their first pregnancy event (average age: mean = 25.63, SD = 5.8). As seen in Table 1, deaths from all causes in the 8 years after the first known pregnancy outcome were significantly higher among women with a known history of abortion.

Disaggregated Analysis

In our second analysis, we explored the interaction of multiple and varied pregnancy outcomes on differential cause-specific mortality. To do this, we used all of the reproductive history information available for the 6 years included in our data. This time all women (n = 8,703 including 48 deaths) with a history of both abortion and miscarriage (and possibly childbirth as well) were excluded to avoid confusing the effects of voluntary and involuntary pregnancy loss.

The remaining women were categorized into five groups by experience with each pregnancy outcome (Table 2). Women who had only abortion outcomes were more likely to die overall than women in each of the other four groups. Only in comparison to women who had a miscarriage after a birth was this finding not statistically significant ($P < .05$).

Stratification by cause of death revealed that the abortion only group had the highest death rate of all five groups for both natural and violent causes. The greatest number of significant differences occurred between the abortion only and delivery only groups.

Women in the three groups having both delivery and pregnancy loss (abortion or miscarriage) had lower deaths rates than the abortion only group for nearly every cause of death. Lower deaths rates for these three groups, however, would be expected since women in these groups must necessarily have lived long enough to have two or more pregnancies.

Single Known Pregnancy Events

For our third analysis, we limited our comparison to the two most disparate groups—births only and abortions only. To further control for the confounding factor of multiple pregnancy outcomes, this analysis included women with only one known pregnancy event. The mean age was 26.39 (SD = 5.9) for women who delivered and 25.96 (SD = 6.3) for women who aborted.

During the 8-year period after the first pregnancy event, women who aborted were 62% more likely to die (all causes) than women who carried to term (Table 3). They were also significantly more likely to die of nonviolent causes, suicide, and accidents.

The greatest number of deaths were due to nonviolent causes; therefore, these were disaggregated. Examination of major categories of

TABLE 2. Detailed Cause-Specific Deaths and Death Rates in 8 Subsequent Years for Women With a History of at Least One Abortion Compared With Women Having No Known History of Abortion, by Reproductive History

Cause of Death	Number of Deaths (Rate per 100,000)					*Significantly Different Pairs
	(1) Delivery Only	(2) Abortion Only	(3) Abortion Followed by Delivery	(4) Delivery Followed by Abortion	(5) Delivery Followed by Miscarriage	
All deaths	464 (549.6)	272 (853.9)	85 (462.4)	132 (514.2)	26 (612.3)	1 & 2, 2 & 3, 2 & 4
Nonviolent causes	266 (315.1)	137 (430.1)	39 (212.2)	53 (206.4)	15 (353.3)	1 & 2, 2 & 3, 2 & 4
Violent causes	196 (232.2)	132 (414.4)	45 (244.8)	79 (307.7)	11 (259.1)	1 & 2, 2 & 3
Suicides	21 (24.9)	20 (62.8)	3 (16.3)	7 (27.3)	2 (47.1)	1 & 2
Accidents	109 (129.1)	65 (204.1)	24 (130.6)	38 (148.0)	6 (141.3)	1 & 2
Homicides	66 (78.2)	47 (147.5)	18 (97.9)	34 (132.4)	3 (70.7)	1 & 2
AIDS	22 (26.1)	21 (65.9)	4 (21.8)	11 (42.8)	4 (94.2)	1 & 2
Circulatory disease	39 (46.2)	34 (106.7)	7 (38.1)	12 (46.7)	2 (47.1)	1 & 2, 2 & 3, 2 & 4

Number of cases by group: (1) 84,420, (2) 31,854, (3) 18,383, (4) 25,673, (5) 4,246.
 Mean age by group, in years: (1) 25.66, (2) 25.58, (3) 23.48, (4) 23.15, (5) 25.12.
 Standard deviation of age, by group: (1) 5.8, (2) 6.0, (3) 5.1, (4) 5.0, (5) 6.0.
 *Pairwise significance determined at $P < .05$ or less.

death from nonviolent causes revealed that the most significant differences were in relation to deaths from AIDS and from circulatory diseases (ICD-9 codes 390-459). Additional analysis of those who died of circulatory diseases revealed that aborting women had significantly higher rates of death from cerebrovascular disease (ICD-9 codes 430-438) and other heart diseases (ICD-9 codes 415-423, 425-429).

As shown in Table 4, stratification by 2-year increments revealed significant differences in the death rates during the first 2 years for overall deaths, deaths due to nonviolent causes, and deaths due to violent causes. Other significant differences were found in all but the fifth and sixth years.

Stratification by age is shown in Table 5. Differences were significant for four of the six age groups. As would be expected, the risk of death from nonviolent causes increased with age, while the risk of death from violent causes generally declined.

Previous Psychiatric Claims

Our fourth analysis was that of women who had their first pregnancy event between July 1 and December 31, 1989. By limiting the analysis to these 6 months, we were able to examine any inpatient and outpatient psychiatric claims women had 1 year before the target pregnancy events. The resulting sample consisted of 17,472 women (mean age = 24.91, SD = 6.0) whose first pregnancy event was abortion and 41,956 women (mean age = 25.48, SD = 5.8) who had delivery as their first pregnancy event and no history of abortion. Among these women, number of previous psychiatric claims was significantly correlated with overall deaths ($r [59,428] = .020, P < .0001$), deaths by violent causes ($r [59,428] = .009, P < .023$), and deaths by nonviolent causes ($r [59,428] = .018, P < .0001$).

Logistic regression analyses were done using number of psychiatric claims within 1 year before the target pregnancy event and age as covariates. The results of these analyses are given in Tables 3, 4, and 5. In several circumstances, most notably deaths related to mental illness, the relative risk of death for aborting women compared with that of delivering women increased after removing the effects of previous psychiatric history.

DISCUSSION

The death rate from all causes was significantly higher for women with a history of

TABLE 3. Risk of Death by Specific Causes in 8 Subsequent Years for Women With Only One Known Pregnancy (Those With an Abortion vs Those With a Delivery)

Cause of Death	All Cases				Controlling for 1-Year Previous Psychiatric History			Age and Psychiatric History-Adjusted Relative Risk (95% CI)
	Number of Deaths (Rate per 100,000)		Age-Adjusted Relative Risk (95% CI)	Number of Deaths (Rate per 100,000)		Abortion of First Pregnancy		
	One Delivery Only	One Abortion Only		Delivery of First Pregnancy and No Abortions	Abortion of First Pregnancy			
All causes	335 (614.7)	173 (974.6)	1.62 (1.34 to 1.94)*	213 (507.7)	141 (807.0)	1.61 (1.30 to 1.99)†		
Violent causes	127 (233.0)	76 (428.2)	1.81 (1.36 to 2.41)*	82 (195.4)	63 (360.6)	1.78 (1.28 to 2.47)†		
Suicide	13 (23.9)	11 (62.0)	2.54 (1.14 to 5.67)*	8 (19.1)	11 (63.0)	3.12 (1.25 to 7.78)*		
Homicide	50 (91.7)	27 (152.1)	1.59 (1.00 to 2.55)	28 (66.7)	24 (137.4)	1.93 (1.11 to 3.33)*		
Accident or undetermined	64 (117.4)	38 (214.1)	1.82 (1.22 to 2.73)†	46 (109.6)	28 (160.3)	1.44 (0.90 to 2.30)		
Nonviolent causes	206 (378.0)	95 (535.2)	1.44 (1.13 to 1.84)†	130 (309.8)	76 (435.0)	1.44 (1.08 to 1.91)*		
AIDS	20 (36.7)	14 (78.9)	2.18 (1.10 to 4.31)*	10 (23.8)	12 (68.7)	2.96 (1.28 to 6.87)*		
Mental disease	11 (21.6)	7 (43.9)	2.05 (0.79 to 5.28)	6 (14.3)	8 (45.8)	3.21 (1.11 to 9.27)*		
Circulatory disease	28 (51.4)	26 (146.5)	2.87 (1.68 to 4.89)†	18 (42.9)	15 (85.9)	2.00 (1.00 to 3.99)*		
Cerebrovascular disease	4 (7.3)	7 (39.4)	5.46 (1.60 to 18.65)‡	3 (7.2)	5 (28.6)	4.42 (1.06 to 18.48)*		
Other heart diseases	12 (22.0)	10 (56.3)	2.59 (1.12 to 5.99)*	8 (19.1)	7 (40.1)	2.10 (0.76 to 5.82)		

*P < .0001.

†P < .005.

**P < .05.

‡P < .01.

abortion than for delivering women with no known history of abortion (Table 1). Comparisons across the five possible combinations of pregnancy experiences analyzed here (Table 2) suggest that childbirth without any pregnancy losses (abortion or miscarriage) may have a protective effect, while abortion without any childbirth experiences may have a deleterious effect. These effects, over the course of a combination of pregnancy outcomes, may also interact.

The most pronounced differences in relative risk of death by various causes were found between women with a history of only one known pregnancy comparing women who aborted and women who carried to term (Tables 3, 4, and 5). The key finding is that the elevated death rates associated with women who had abortions were observed throughout the 8 years examined. This indicates that the association between abortion and higher subsequent mortality rates previously observed in Finland is a persistent one.

Higher deaths rates after abortion may be explained by a number of factors. Women who have children may be more likely to avoid risk-taking and to take better care of their health. Alternatively, a history of abortion may be a marker for other stress factors that decrease longevity; or the higher death rate among aborting women may stem from increased psychologic stresses related to unresolved guilt, grief, or depression. This hypothesis is supported by another analysis of this same population in which it was found that even after controlling for previous psychiatric treatment, women who had abortions, across all age groups, had significantly higher rates of subsequent psychiatric admissions.⁴ The highest relative risks (>2.5) were related to adjustment reactions, bipolar disorder, and depressive psychoses.

The findings of this study are consistent with a substantial body of literature demonstrating an association between abortion and suicide.⁵⁻¹¹ A record-based measurement of suicide attempts before and after abortion has shown that the increase in suicide rates among aborting women is not related to previous suicidal behavior but is most likely related to adverse reactions to the procedure.¹² Pregnancy and childbirth, on the other hand, reduce the risk of suicide.¹³⁻¹⁵

The greater risk of fatal accidents and homicides may result from unrecognized suicides or increased risk-taking behavior.

TABLE 4. Risk of Specific Causes of Death in 8 Subsequent Years (in 2-Year Increments) for Women With Only One Known Pregnancy (Those With an Abortion vs Those With a Delivery

Cause of Death	Time Interval (years)	All Cases				Controlling for 1-Year Previous Psychiatric History			
		Number of Deaths (Rate per 100,000)		Age-Adjusted Relative Risk (95% CI)	Number of Deaths (Rate per 100,000)		Age and Psychiatry History-Adjusted Relative Risk (95% CI)		
		One Delivery Only	One Abortion Only		Delivery of First Pregnancy and No Abortions	Abortion of First Pregnancy			
Overall deaths	1-2	97 (178.0)	61 (343.7)	1.95 (1.42 to 2.69) *	47 (112.0)	40 (228.9)	2.03 (1.33 to 3.10) †		
	3-4	84 (154.1)	42 (236.6)	1.56 (1.07 to 2.25) *	40 (95.3)	33 (188.9)	1.98 (1.25 to 3.15) †		
	5-6	76 (139.5)	29 (163.4)	1.19 (0.78 to 1.83)	63 (150.2)	35 (200.3)	1.35 (0.89 to 2.05)		
	7-8	78 (143.1)	41 (231.0)	1.64 (1.12 to 2.39) ‡	63 (150.2)	33 (188.9)	1.29 (0.84 to 1.96)		
Violent causes	1-2	52 (95.4)	37 (208.5)	2.12 (1.39 to 3.23) †	19 (45.3)	23 (131.6)	2.62 (1.42 to 4.82) †		
	3-4	32 (58.7)	23 (129.6)	2.18 (1.28 to 3.73) †	14 (33.4)	18 (103.0)	3.00 (1.49 to 6.04) †		
	5-6	28 (51.4)	7 (39.4)	0.77 (0.34 to 1.76)	27 (64.4)	13 (74.4)	1.15 (0.59 to 2.24)		
	7-8	15 (27.5)	9 (50.7)	1.85 (0.81 to 4.23)	22 (52.4)	9 (51.5)	0.98 (0.45 to 2.13)		
Nonviolent causes	1-2	45 (82.6)	24 (135.2)	1.66 (1.01 to 2.72) *	28 (66.7)	17 (97.3)	1.49 (0.81 to 2.73)		
	3-4	51 (93.6)	18 (101.4)	1.10 (0.64 to 1.88)	26 (62.0)	15 (85.9)	1.40 (0.74 to 2.66)		
	5-6	47 (86.2)	22 (123.9)	1.46 (0.88 to 2.42)	35 (83.4)	22 (125.9)	1.54 (0.90 to 2.63)		
	7-8	63 (115.6)	31 (174.6)	1.53 (0.99 to 2.35)	41 (97.7)	22 (125.9)	1.33 (0.79 to 2.23)		

*P < .0001.
 †P < .005.
 **P < .05.
 ‡P < .01.

Deaths from accidents may also be related to higher rates of alcohol consumption^{16,20} or drug abuse²¹⁻²⁶ among aborting women. The higher risk of death from homicide may reflect increased levels of anger, self-destructive behavior, or domestic violence after abortion.^{27,28}

The heightened risk of death from nonviolent causes may reflect a decline in general health after abortion, as reported elsewhere.^{29,31} Other unhealthy behaviors linked to abortion are increased alcohol consumption, drug abuse, and smoking.^{32,40}

In regard to the unexpected finding of increased deaths related to cardiovascular disease, a substantial body of research has shown that psychologic problems, especially depression, increase cardiovascular morbidity and mortality.⁴¹⁻⁴⁴ Compared with delivering women, women who abort have significantly higher rates of depression an average of 10 years after their first pregnancy event, even after controlling for previous psychologic state.^{45,46} It is possible that persistent emotional reactions to abortion may aggravate or cause cardiovascular illnesses. Additional investigation of this association is warranted.

Unfortunately, as in the case of the Finland study of pregnancy-associated deaths, this data set did not include any information on race, marital status, or parity, all of which may be significant variables. This limitation is partially offset by the fact that these data represent a homogeneous socioeconomic population. The fact that it includes only low income women, who would generally face similar stressful life events, would tend to help control for socioeconomic factors. By comparison, the Finland studies, which included a heterogeneous national population without controls for socioeconomic factors, also revealed a trend toward substantially higher death rates after abortion. The fact that these large prospective record-based studies, using different types of populations (heterogeneous population of Finns and a racially diverse population of low income Americans), found such similar results indicates that the trend in higher death rates among aborting women is likely to hold across racial, economic, and national boundaries.

In addition, comparison of these results with national data suggests that these findings are likely to hold true across race, marital status, and parity. The 1997 suicide rate per 100,000 American women aged 15 to 24 for all races was 3.5—3.7 for whites and 2.4 for blacks. For ages 25 to 44, the suicide rate was 6.0 for all races—6.6

TABLE 5. Risk of Specific Causes of Death in 8 Subsequent Years for Women With Only One Known Pregnancy (Those With an Abortion vs Those With a Delivery) Based on Age at Time of First Pregnancy Event

Cause of Death	Age at First Pregnancy	All Cases				Age-Adjusted Relative Risk (95% CI)	Controlling for 1-Year Previous Psychiatric History		
		Number of Deaths (Rate per 100,000)		Abortion Only	Number of Deaths (Rate per 100,000)		Abortion of First Pregnancy	Age and Psychiatry History-Adjusted Relative Risk (95% CI)	
		One Delivery Only	One Abortion Only		Delivery and No Abortions				Abortion of First Pregnancy
Overall deaths	13-19	37 (636.9)	22 (866.5)		1.38 (0.81 to 2.35)	32 (494.3)	24 (703.0)	1.45 (0.85 to 2.48)	
	20-24	60 (346.1)	40 (692.9)		1.99 (1.33 to 2.98)*	53 (379.0)	35 (605.4)	1.60 (1.04 to 2.45)†	
	25-29	94 (590.2)	40 (844.8)		1.44 (1.00 to 2.09)	48 (419.3)	31 (688.9)	1.63 (1.03 to 2.56)†	
	30-34	80 (816.2)	38 (1389.4)		1.71 (1.16 to 2.52)*	44 (663.1)	28 (1155.6)	1.73 (1.07 to 2.79)†	
	35-39	46 (1050.5)	29 (2032.2)		1.93 (1.21 to 3.09)*	26 (944.1)	19 (1814.7)	1.77 (0.97 to 3.26)	
	40-49	18 (1444.6)	4 (739.4)		0.49 (0.17 to 1.45)	10 (1515.2)	4 (1302.9)	0.75 (0.23 to 2.47)	
	13-19	26 (447.6)	15 (590.8)		1.35 (0.71 to 2.55)	22 (339.8)	15 (439.4)	1.31 (0.68 to 2.55)	
	20-24	31 (178.8)	29 (502.3)		2.79 (1.68 to 4.64)**	29 (207.4)	26 (449.7)	2.17 (1.28 to 3.69)**	
Violent causes	25-29	39 (244.9)	12 (253.4)		1.04 (0.54 to 1.98)	17 (148.5)	11 (244.4)	1.67 (0.78 to 3.57)	
	30-34	23 (234.6)	14 (511.9)		2.19 (1.13 to 4.26)†	9 (135.6)	7 (288.9)	2.15 (0.80 to 5.80)	
	35-39	7 (159.9)	6 (420.5)		2.61 (0.88 to 7.79)	4 (145.2)	3 (286.5)	1.39 (0.27 to 7.07)	
	40-49	1 (80.3)	0 (00.0)		-	1 (151.5)	1 (325.7)	1.82 (0.11 to 31.04)	
	13-19	11 (189.4)	7 (275.7)		1.46 (0.56 to 3.80)	10 (154.5)	8 (234.3)	1.56 (0.61 to 3.99)	
	20-24	29 (167.3)	11 (190.5)		1.13 (0.57 to 2.27)	24 (171.6)	9 (155.7)	0.90 (0.42 to 1.95)	
	25-29	54 (339.0)	27 (570.2)		1.70 (1.07 to 2.70)†	30 (262.1)	20 (444.4)	1.66 (0.94 to 2.93)	
	30-34	56 (571.3)	24 (877.5)		1.54 (0.95 to 2.48)	35 (527.5)	21 (866.7)	1.62 (0.94 to 2.80)	
Nonviolent causes	35-39	39 (890.6)	22 (1541.7)		1.72 (1.02 to 2.92)†	22 (798.8)	15 (1432.7)	1.74 (0.89 to 3.38)	
	40-49	17 (1364.4)	4 (739.4)		0.52 (0.17 to 1.55)	9 (1,363.6)	3 (977.2)	0.66 (0.18 to 2.48)	

*P < .01.

†P < .05.

**P < .0001.

‡P < .005.

for whites and less than 3.7 for blacks.⁴⁷ In our sample (Table 3), the average annual suicide rate for women with a history of delivery was only 3.0, while it was 7.8 for women with a history of abortion. Our findings bracket the national averages, regardless of race, suggesting a strong protective effect related to childbirth and a strong detrimental effect related to abortion.

Our finding that pregnancy events may affect mortality over several years, and may counterbalance each other when childbirth and pregnancy loss are both experienced, underscores another limitation of both this study and the Stakes studies: incomplete obstetric histories. It appears most likely that more complete data could have revealed an even greater disparity between “abortion only” and “delivery only.” This is likely since unknown childbirth events would have a protective effect on women otherwise identified as being in the “abortion only” group (Table 2). Conversely, however, unknown abortion events would tend to inflate the association between death and the delivery only group.

It may be that the diluting effect of unknown previous pregnancies is seen in the age stratification results shown in Table 5. The level of significance generally appears to drop with increasing age. Indeed, in the oldest age group, 40 to 49, not only is all statistical significance lost, but also the relative rate of death suddenly appears to shift in favor of those who had an abortion. However, it is certainly true that the oldest age groups of women will proportionally have far more pregnancy events that are unknown to us than the younger women for whom the 6-year data set captures a major portion of their reproductive years. Our classification of women as “abortion only” or “delivery only” would therefore be increasingly inaccurate with increasing age. The use of data sets that include complete reproductive histories would eliminate this problem.

Finally, at the request of the California DPH, this population was limited to only those women who had

a Medi-Cal funded abortion or hospital delivery in 1989. This made it impossible for us to compare these women to a group of Medi-Cal eligible women without any pregnancy history or to a group of women who had miscarriages in 1989. In future research, comparisons with both nulliparous women and women who miscarry would be valuable.

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