

OBSTETRICS

Pregnancy-associated homicide and suicide in 37 US states with enhanced pregnancy surveillance



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BACKGROUND: Pregnant and postpartum women may be at increased risk of violent death including homicide and suicide relative to nonpregnant women, but US national data have not been reported since the implementation of enhanced mortality surveillance.

OBJECTIVE: The objective of the study was to estimate homicide and suicide ratios among women who are pregnant or postpartum and to compare their risk of violent death with nonpregnant/nonpostpartum women.

STUDY DESIGN: Death certificates ($n = 465,097$) from US states with enhanced pregnancy mortality surveillance from 2005 through 2010 were used to compare mortality among 4 groups of women aged 10–54 years: pregnant, early postpartum (pregnant within 42 days of death), late postpartum (pregnant within 43 days to 1 year of death), and nonpregnant/nonpostpartum. We estimated pregnancy-associated mortality ratios and compared with nonpregnant/nonpostpartum mortality ratios to identify differences in risk after adjusting for potential levels of pregnancy misclassification as reported in the literature.

RESULTS: Pregnancy-associated homicide victims were most frequently young, black, and undereducated, whereas pregnancy-

associated suicide occurred most frequently among older white women. After adjustments, pregnancy-associated homicide risk ranged from 2.2 to 6.2 per 100,000 live births, depending on the degree of misclassification estimated, compared with 2.5–2.6 per 100,000 nonpregnant/nonpostpartum women aged 10–54 years. Pregnancy-associated suicide risk ranged from 1.6–4.5 per 100,000 live births after adjustments compared with 5.3–5.5 per 100,000 women aged 10–54 years among nonpregnant/nonpostpartum women. Assuming the most conservative published estimate of misclassification, the risk of homicide among pregnant/postpartum women was 1.84 times that of nonpregnant/nonpostpartum women (95% confidence interval, 1.71–1.98), whereas risk of suicide was decreased (relative risk, 0.62, 95% confidence interval, 0.57–0.68).

CONCLUSION: Pregnancy and postpartum appear to be times of increased risk for homicide and decreased risk for suicide among women in the United States.

Key words: postpartum, pregnancy, pregnancy-associated homicide, pregnancy-associated suicide, violence

Improvements in maternal health care in the United States since the mid-1950s have drastically reduced mortality caused by hemorrhage, hypertension, complications of cesarean delivery, and other obstetric causes.¹ Less attention has been paid to identifying and preventing injury-related fatalities and violent deaths including homicide and suicide among pregnant women and within the first year postpartum. Although pregnancy does not cause these deaths physiologically, it may be related to their occurrence, particularly for deaths resulting from intimate partner violence. Pregnancy does not appear to confer protection against victimization^{2,3} and in fact may add stress and

exacerbate vulnerable circumstances in abusive relationships.⁴

In an effort to encourage enhanced mortality monitoring beyond those deaths strictly classified as maternal, the American College of Obstetricians and Gynecologists and the Centers for Disease Control and Prevention defined pregnancy-associated mortality as the death of a woman while pregnant or within 1 year of the termination of pregnancy, regardless of the site or duration of the pregnancy and irrespective of the cause of death.⁵ Previous studies on pregnancy-associated mortality based on local city- or state-level data consistently find homicide ranks among the leading causes of death among women who are pregnant or recently postpartum, with variations by geographic area and demographic subgroup.^{4,6–14}

Despite the accumulating evidence of the magnitude of violent deaths, rigorous examination of mortality from non-obstetric causes in pregnancy and postpartum is rare, particularly in

comparison with nonpregnant women.¹⁵ The 2003 revision to the US Standard Certificate of Death included an item to classify pregnancy status of a female decedent in the year preceding death to improve routine monitoring of pregnancy-associated mortality.¹⁶ Specifically, checkboxes identify the temporal relationship of death to pregnancy: during, within 42 days, or 43 days to 1 year after pregnancy.¹⁷

Prior to the revision, ascertainment of pregnancy status differed across states, and although some states' certificates included a pregnancy checkbox, cases of deaths occurring during and around the time of pregnancy were underreported, with evidence of more than 60% missing cases from some jurisdictions.^{18–20} National implementation of the 2003 revision has been incremental; by 2005, 22 jurisdictions had adopted the revision or maintained equivalent pregnancy items on death certificates. By 2010, the number had increased to 37.

The purpose of this analysis was to use these newly available data to

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describe mortality among 4 groups of reproductive-aged women in the United States from 2005 through 2010: pregnant, early postpartum (pregnant within 42 days of death), late postpartum (pregnant within 43 days to 1 year of death), and nonpregnant/nonpostpartum women. Second, we aimed to compare risk across demographic characteristics of victims of pregnancy-associated violent deaths and finally to determine whether pregnancy/postpartum represents a time of increased risk for violent death.

Materials and Methods

Study population

The National Center for Health Statistics provided death records for all women in 50 US states and the District of Columbia from 2005 through 2010, inclusive. For the purpose of this analysis, data were limited to women aged 10–54 years to ensure complete coverage of the population with reported pregnancy-associated deaths and to states and years with a temporal pregnancy item on death records that allowed for identification of decedents who were pregnant within 12 months of death ($n = 465,097$). This includes 36 states and the District of Columbia that had adopted the 2003 temporal pregnancy variable or

retained equivalent items for at least 1 year (Table 1). Nine states were excluded for lack of a pregnancy item on records for the study years, and the remaining 5 were excluded for records that captured pregnancy status only up to 90 days prior to death.

For jurisdictions with midyear implementation of the revision, we limited our analyses to the first full year of data. Five of the 37 included jurisdictions (California, Iowa, Kentucky, Minnesota for all study years and Texas until 2006) had items asking only whether the decedent had been pregnant within the past 12 months. These states were excluded from pregnant and postpartum proportionate mortality calculations. Where pregnant/postpartum status was unknown, we examined *International Classification of Diseases*, 10th revision, codes for underlying cause of death and identified additional maternal deaths based on codes within the Pregnancy, Childbirth, and the Puerperium classification. Where possible, these deaths were classified temporally (Supplemental Table 1).

When temporality could not be determined, women were excluded from proportionate mortality calculations but were included in all analyses where pregnant and postpartum women were

combined (pregnancy-associated mortality). The remaining women with an unknown pregnancy status were classified in the nonpregnant/nonpostpartum group. This analysis of deidentified death records was exempt from institutional review board approval.

Explanatory variables

We compared women across characteristics available on the death record: age (5 year age groups), race (non-Hispanic black, non-Hispanic white, Hispanic, and other), marital status (married, not married), and education (less than high school; high school graduate or general education degree; higher than high school). Because the education item differs across death certificate versions, the continuous values from the 1989 certificate format (0 [no formal education] to 17 [5 or more years of college]) were grouped with the 2003 values as follows: 0–11 years with less than high school; 12 with high school graduate; and 13–17 with some college but no degree; associate's, bachelor's, master's, or PhD degree all grouped as greater than high school.

Stratification by education status was limited to women who were ages 20 years or older at the time of death because younger women may not have completed educational attainment. *International Classification of Diseases*, 10th revision, codes for underlying cause of death were grouped as follows: natural (including obstetric and nonobstetric diseases and conditions), transport-related injury, other injury, homicide, suicide, and other external causes (Supplemental Table 2).

Outcome measures

Pregnancy-associated homicide ratios were defined as the number of homicides among pregnant or postpartum women divided by the number of live births in states and years included in this analysis, available from annual natality data reported by the Centers for Disease Control and Prevention.²¹ Likewise, pregnancy-associated suicide ratios were the number of suicides among pregnant or postpartum women divided by the number of live births from states and

TABLE 1
States and years for records included in analysis

Years	States
2005–2010	Connecticut, Florida, Idaho, Kansas, Michigan, Montana, Nebraska, New Hampshire, New Jersey, New York, Oklahoma, South Carolina, South Dakota, Utah, Washington, Wyoming; excluded from proportionate mortality for lack of detailed temporality: California, Iowa, Kentucky, Maryland, Montana, Texas (2005 only)
2006–2010	District of Columbia, New Mexico, Oregon, Rhode Island
2007–2010	Delaware, Ohio
2008–2010	Arkansas, Georgia, Illinois, Indiana, Nevada, North Dakota
2009–2010	Vermont
2010	Arizona, Missouri
Excluded from analysis	Cannot identify late postpartum (pregnancy within past 12 months): Alabama, Louisiana, Mississippi, Virginia Utilized pregnancy prompt, not question: Maine No pregnancy information: Alaska, Colorado, Hawaii, Massachusetts, North Carolina, Pennsylvania, Tennessee, West Virginia, Wisconsin

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