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# Maternal Mortality Due to Trauma

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**Maternal mortality is an important indicator of adequacy of health care in our society. Improvements in the obstetric care system as well as advances in technology have contributed to reduction in maternal mortality rates. Trauma complicates up to 7% of all pregnancies and has emerged as the leading cause of maternal mortality, becoming a significant concern for the public health system. Maternal mortality secondary to trauma can often be prevented by coordinated medical care, but it is essential that caregivers recognize the unique situation of providing simultaneous care to 2 patients who have a complex physiologic relationship. Optimal management of the pregnant trauma victim requires a multidisciplinary team, where the obstetrician plays a central role. This review focuses on the incidence of maternal mortality due to trauma, the mechanisms involved in traumatic injury, the important anatomic and physiologic changes that may predispose to mortality due to trauma, and finally, preventive strategies that may decrease the incidence of traumatic maternal death.**


**KEYWORDS** trauma in pregnancy, maternal mortality, maternal death, domestic violence, motor vehicle crashes

Maternal mortality is an important indicator of adequacy of health care in our society. A remarkable decline in the maternal mortality rates was observed in the 20th century. Compared with the year 1950, when the rate was 83.3 deaths per 100,000 live births, the maternal mortality rate in 2007 was 12.7 per 100,000 live births.[1,2] Advances in technology as well as improvements in the obstetric care system have contributed to the reduction in maternal mortality rates. As a consequence, trauma has emerged as the leading cause of maternal death during pregnancy and continues to be a significant public health concern that requires considerable attention.

The International Statistical Classification of Diseases and Related Health Problems provides the basic guidance used in most countries to code and classify causes of death. It offers disease, injury, and poisoning categories as well as the rules used to select the single underlying cause of death for tabulation from the several diagnoses that may be reported on a single death certificate.[1]

According to the World Health Organization, **maternal death** is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes. **Late maternal death** occurs between 42 days and 1 year after pregnancy. To facilitate the identification of maternal deaths in circumstances in which cause of death attribution is inadequate, a new category has been introduced—pregnancy-related death, defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death.[3]

Maternal deaths are also classified as *Direct*—when it results from obstetric complications of pregnancy, delivery, and postpartum; *Indirect*—when it results from previous existing disease, or diseases that developed or were aggravated by physiological effects of the pregnancy; and *Nonobstetric*—considered accidental or incidental and includes deaths resulting from accidents, suicides, malignancies, some communicable diseases, and unknown causes.[3]

Trauma complicates up to 7% of all pregnancies.[4-6] In a retrospective review of maternal death certificates at Cook County Hospital in Chicago, trauma accounted for 46% of all maternal deaths, which was the leading cause of nonobstetric maternal death.[7] After inclusion of nonobstetric causes of maternal death in the national health reporting system databases, better estimates of the magnitude of the problem of maternal mortality secondary to trauma have been possible, facilitating the establishment of effective preventive measures and promoting research in this area.

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Because mortality can often be prevented by coordinated medical care after serious trauma during pregnancy, it is imperative that caregivers understand the unique situation of providing simultaneous care to 2 patients who have a complex physiologic relationship. Trauma protocols emphasize the basic understanding that the mother's stability and survival remain the top priorities, and because fetal well-being is largely dependent on maternal well-being, initial efforts should be directed toward resuscitation of a pregnant patient. Optimal management of the pregnant trauma victim requires a multidisciplinary team, including emergency medical technicians, emergency medicine physicians, trauma surgeons, and other specialists, depending on the type of injury. Obstetricians play a central role coordinating this multidisciplinary team. Their specific knowledge about the anatomic and physiologic changes that occur in pregnancy, the effects of various drugs on uterine blood flow, the potential teratogenic and mutagenic effects of diagnostic radiation and medications, the effect of surgery on pregnancy, and the assessment of gestational age are critical in the approach to diagnosis and treatment of these patients.

This review will touch on the incidence of maternal mortality due to trauma, the various mechanisms of traumatic injury, important physiologic and anatomic changes of pregnancy that may predispose to mortality due to trauma, if not recognized, and finally, prevention methods that may decrease the future incidence of traumatic maternal death.

## Incidence

As described previously, the medical records of the Cook County Hospital were reviewed for the years 1986-1989, and maternal death secondary to trauma was reported in 46.3% of the 95 cases. Among traumatic causes of maternal death, 57% of the cases were due to homicides and 9% were due to suicide. The mechanism of injury in traumatic maternal deaths included gunshots wounds (22.7%), motor vehicle crashes (20.5%), stab wounds (13.6%), strangulation (13.65), blunt head injuries (9.1%), burns (6.8%), falls (4.5%), toxic exposure (4.5%), drowning (2.3%), and iatrogenic injury (2.3%).[7]

In a more recent review, of the most common causes of trauma in pregnancy, 54.6% were motor vehicle crashes, 22.3% were domestic abuse and assaults, 21.8% were associated with falls, and 1.3% were secondary to burns, puncture wounds, or animal bites.[8,9]

Domestic violence (DV) is an important cause of trauma during pregnancy. It has been estimated that 1%-20% of pregnant women experience domestic abuse, and up to 60% experience more than one assault episode during pregnancy.[10,11]

Attempting to estimate the incidence of maternal mortality secondary to traumatic injuries has been a challenging task due to inadequate completion of death certificates.[12] For example, a review of New York City medical examiner records reported that 115 (39%) of 293 deaths in pregnant women were attributed to injury. Only 22 (35%) of these injury-related deaths were recorded in the New York City Department of Health's Maternal Mortality Surveillance System because the box on the death certificate indicating current or recent pregnancy was not checked in 65% of these cases. In this review, the largest proportion of injury-related deaths reported were homicides (63%) and suicides (13%), followed by motor vehicle crashes (12%) and drug overdoses (7%).[5]

There are several risk factors that have been associated with obstetric trauma, including younger age, drug use, alcohol use, and DV.[11,13-15] In fact, pregnancy itself has been identified as a risk factor for trauma, with the attacks often aiming at the gravid abdomen to cause fetal injury.[10,16]

## Anatomic and Physiologic Changes Associated With Pregnancy

Understanding of the normal physiologic adaptations that occur in pregnancy helps recognize the direct effect on maternal response to trauma and is an important basis for the pattern of injuries seen during pregnancy as well as the management of the injured pregnant woman. Table 1 provides a summary of these changes.

## Causes of Maternal Mortality

### Suicides

Suicides account for 10% of maternal deaths and are less common than homicide.[17,18] Underreporting of suicide is an inevitable problem because there is no standardized method used to identify pregnancy at the time of death.[5]

Being unmarried, having financial difficulties, and interpersonal conflict are considered risk factors associated with suicide during pregnancy.[19] Pregnant teenagers are at higher risk, and most suicides occur during the first trimester of pregnancy. Tablet intoxication after interpersonal conflict is the typical mode of suicide during pregnancy. Drug abuse seems to negatively influence suicidal behavior.[20]

In the general population, previous suicide attempt increases the risk of suicide by 38 times, and a family history of attempted or completed suicide increases the rate of suicide and suicidal behaviors by 2 to 3 times.[18,21]

In general, women during pregnancy and in the first year after childbirth have a low risk of suicide, despite their high rate of psychiatric morbidity. In some ways, motherhood may actually protect against suicide. However, those women who committed suicide after childbirth, most often did so in the first month, and there was a tendency to use violent methods (eg, jumping from heights, self-incineration).[20,22]

Higher rates of mortality due to suicide have been reported in women after stillbirth as well as in women admitted to a general psychiatric unit and separated from their infant.[17] Also, higher rates have been reported in women obtaining an