

ANALYSIS OF FETAL DEATH RATES FROM AUTOMOBILE CRASHES

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INTRODUCTION

According to the Center for Disease Control, 25,600 fetal deaths occurred in the United States in 2002 from all causes. The exact incidence of fetal deaths that occur from trauma during motor vehicle crashes (MVCs) is not well documented. Current literature estimates come from various methods that indicate the number of fetal deaths per year from motor vehicle trauma can be as low as 92 or as high as 4800. The objective of this study is to analyze all previous estimates of fetal loss rates from motor vehicle trauma and to determine a more accurate range that represents all of the various methods in the literature.

METHODOLOGY

A review of the available literature for pregnant occupant data and fetal loss rates was completed. All papers which included estimations of the annual fetal loss data in the United States from motor vehicle trauma were included in the study. The underlying data used by the individual studies come from individual National Automotive Sampling System (NASS) studies, Center for Disease Control (CDC) live birth and fetal mortality records, Traffic and Safety Facts, and previous literature regarding fetal loss. The minimum and maximum values for estimated fetal deaths from each study were used to calculate a more accurate range.

RESULTS

The results include a description of the calculations as well as the resulting maximum and minimum estimates of fetal losses per year in the US from MVCs for the 10 methods found in the literature. Weiss (2001) used the percentage of fetal deaths that have trauma as calculated from Pennsylvania death certificates (0.0065%) and the percentage of fetal injuries that are a result of MVC (80%) to calculate the number of fetal deaths each year equal to 208. Similarly, Weiss (1999) used the same calculation with a percentage of fetal deaths as a result of MVC, 0.0023%, determined from death certificates in 16 states during 1995-1997 to approximate 92 fetal deaths from MVC each year.

Jernigan (2002) used the NASS database (1995-2000) to determine the number of pregnant women who died directly from MVC (509) and the number of severe placental injuries that resulted in fetal loss over a 6 year period (434) to acquire a minimum estimate of fetal losses per year equal to 157.

Klinich *et al.* (1999) estimated the number of pregnant women injured in crashes with vehicle damage to be 29923. This value in conjunction with the percentage of pregnancies that have trauma with subsequent fetal loss (1-3%) plus the number of pregnant women killed (163) estimates the average number of fetal deaths each year to be 462 to 1061. This estimate does not include fetal losses from accidents in which there was no vehicle damage or the woman was uninjured and is based on an approximation of pregnant women injured in crashes.

Klinich *et al.* (1999) also used the percentage of women with an ISS score greater than or less than 20 and the respective risk of fetal loss based on the severity to approximate the number of fetal deaths from pregnant women injured in vehicle damage crashes. Those approximations, in addition to the number of pregnant women killed, estimates 496 fetal losses each year.

Jernigan *et al.* (2002) utilized the NASS database to calculate the number of crashes involving pregnant women for three different crash severities. The groups included crash severities with a change in velocity greater than 30 mph, between 15 and 30 mph, and those less than 15 mph. The incidence by crash severity was combined with the risk curve previously developed by Klinich (1999) relating the risk of adverse fetal outcome with crash severity. The associated risk of adverse fetal outcome and the percentage of that number that was fetal death were used accordingly to determine an average number of fetal losses. Each of these estimates were averaged over the 6 year period and combined to get an average annual fetal death rate from MVC ranging from 743 to 1858.

Pearlman and Phillips (1996) used the national average number of births, the percentage of pregnancies that have trauma (6.5%), the percentage of trauma that is MVC (50%), and the percentage of MVC that result in death (1-3%) to obtain a range of fetal deaths per year of 1300 to 3900. Klinich *et al.* (1999) used the same equation assuming the percentage of pregnancies that have trauma as 6% and the percentage of trauma that is MVC as 67% which changed the estimated fetal deaths per year to 1600-4800.

Klinich *et al.* (1999) used the total number of pregnant women in crashes with vehicle damage in which the occupant was killed, injured, or uninjured (128255) and multiplied that by the percentage of pregnancies that have trauma and subsequent fetal loss (1-3%). The result was an average number of fetal deaths from MVC trauma equal to 1283 to 3848 each year.

Moreover, Klinich *et al.* considered the total number of women injured in crashes with vehicle damage and multiplied that number by the percentage of women at childbearing age in the NASS database that experienced crashes with a change in velocity greater than 30 mph, between 15 and 30 mph, and less than 15 mph (Klinich *et al.* 1999). The associated risk of adverse fetal outcome from the risk curve relating adverse fetal outcome to crash severity and the percentage of that number that was direct fetal deaths were used to determine an average number of fetal losses. This value plus the number of women killed estimates 1653 to 3887 fetal deaths each year.

A final range of all motor vehicle trauma fetal death rates for fetal ages equal to or greater than 20 weeks gestation is calculated from averaging the minimum and maximum approximations from each of the 10 methods (Table 1). The range of rates is substantially narrowed to a low of 865 fetal deaths per year and a high of 2795 fetal deaths per year.

Table 1. Estimations of annual fetal death rate from motor vehicle crashes in the United States.

<i>Author</i>	<i>Brief Description</i>	<i>Minimum</i>	<i>Maximum</i>
Weiss	Pennsylvania Death Certificates	n/a	208
Weiss	US Death Certificates	92	n/a
Jernigan	NASS	157	n/a
Klinich	1-3% Fetal Loss of Pregnant Women Injured plus Pregnant Women Killed	462	1061
Klinich	Fetal Loss Adjusted for Crash Severity plus Pregnant Women Killed	496	n/a
Jernigan	Fetal Loss Calculated by DeltaV	743	1858
Pearlman	6.5% Trauma, 50% MVC, 1-3% Fetal Loss	1300	3900
Klinich	6.0% Trauma, 67% MVC, 1-3% Fetal Loss	1600	4800
Klinich	1-3% Fetal Loss of Pregnant Women in MVC with Damage	1283	3848
Klinich	Fetal Loss Calculated by DeltaV plus Pregnant Women Killed	1653	3887
<i>Average</i>		865	2795

CONCLUSIONS

First, this study provides a summary of fetal death rates as estimated in the literature. Second, this study incorporates 10 different methods in order to narrow the broad range. As a result of this study, the average number of fetal fatalities per year in the United States from motor vehicle crashes range from 865 to 2795.

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