Hidden Epidemic of Maternal, Fetal, and Neonatal Mortality and Injury from Crashes

A Case of Societal Neglect?

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From 1975 to 2001, the average annual number of vehicle miles driven by women of reproductive age increased from 3,721 to 8,258. This increase resulted from a combination of factors, including increased employment, population growth, urban sprawl, inadequate mass transportation, and rising affluence. Unfortunately, this boost in motor vehicle use among young women has had a major unintended consequence: it has led to a substantial increase in maternal and fetal exposure to the violence of motor vehicle crashes. Tragically, along with the higher levels of exposure of pregnant women to motor vehicle crashes have come the increasingly better understood impacts of pregnancy-related crash-associated deaths, injuries, and other adverse outcomes on pregnant women, fetuses, and infants. From a mortality perspective alone, it has been estimated that the rate of fetal deaths due to motor vehicle crashes now exceeds the rate of infant deaths due to motor vehicle crashes by a factor of 7. Yet, despite the documented risks and concerns from empirical studies, few crash and injury data systems accurately track and capture the magnitudes and trends of these events and their outcomes. This paper focuses on (*a*) societal changes that have led to the problem, (*b*) deficiencies in crash and transportation data systems that have led to its neglect, (*c*) the magnitude of the problem and the nature of related adverse fetal outcomes derived from recent research, and (*d*) steps that need to be taken to improve the tracking of pregnancy-related crashes so that they become more visible and a higher priority for transportation research and safety.

A truism in public health, attributed to James Marks, is that "what gets measured gets done." In a more informal vernacular, this idea is often expressed as "out of sight, out of mind." Perhaps nowhere is this sentiment better exemplified in transportation safety than through the problem of maternal and fetal involvement in motor vehicle crashes. Although statistics are not routinely available, data from empirical studies show that injury from motor vehicle crashes is the leading cause of maternal death in most demographic settings (*1*) and the top reason for hospital visits for injuries (*2*) by pregnant women (*3*). Yet, the agencies and data systems responsible for tracking motor vehicle injuries and deaths rarely capture pregnancy status and almost never count the fetus as a case. If these events are not counted, it is difficult to address them and bring them to the attention of policy makers and health and safety leaders. As the saying goes, they remain out of sight and out of mind.

The purpose of this paper is to describe how and why maternal crash involvement has become the problem that it is today and identify the specific deficiencies in crash and transportation data systems that have led to a condition of statistical neglect. This paper summarizes what has recently been learned about the magnitude of the problem and the nature of related adverse fetal outcomes from a growing body of epidemiologic, clinical, and biomechanical research. Last, it combines what is known with recommendations for what could be done to track the problem better. In this manner the currently hidden issue should become more visible. With greater visibility, a better placement of its priority within transportation research, reproductive health, and public safety can be achieved.

BACKGROUND

In the clinical literature, case reports of maternal and fetal involvement in motor vehicle crashes are common. One of the earliest reports of a motor vehicle crash leading to fetal death was reported by Jaroschka as early as 1929 (*4*). Woodhull referred to another earlier motor vehicle-related fetal death in 1940 (*5*). In that crash, a 20-year-old woman who was 7 months pregnant was a front-seat passenger in a head-on collision and was ejected from the vehicle. Fetal death was due to uterine rupture. Seear and Woeppel reported in 1953 on the case of a 21-year-old pregnant woman involved in a head-on automobile collision that resulted in a fractured pelvis and subsequent fetal death because of fetal skull fracture (*6*). In 1962, Dyer and Barclay reported on a case series of 53 pregnancy-related trauma cases in which 30 were automobile related, five were from penetrating wounds, 13 were from falls, and three were from assaults (*7*). In 1960 and 1961, Peckham and King conducted a prospective study of 3,072 pregnancies in women enrolled in a health maintenance organization in Northern California and reported a 7% rate (214 of 3,072 women) of maternal injury during pregnancy (*8*). The leading causes of injury were falls, closely followed by motor vehicle-related injuries.

By the mid-1960s, the clinical problems and challenges of pregnancy-related trauma due to automotive crashes were well recognized in the trauma and obstetrics communities. Case series that quantified fetal outcomes were increasingly reported (*9–11*). In addition, the first experimental animal studies, which investigated the forces and physiology of restrained pregnant baboons, were initiated in 1968 by Crosby et al. (*12*). Crosby and Costiloe were also the first to conduct a follow-up study of pregnant occupants

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Transportation Research Record: Journal of the Transportation Research Board, No. 1956, Transportation Research Board of the National Academies, Washington, D.C., 2006, pp. 133–140.

involved in (rural) crashes (*10*). In that series, 208 pregnant victims of severe crashes were monitored. The research focused on studying the effects and safety of "lap belts" and pointed to the benefits of lap restraints for both the mother and the fetus. Crosby and Costiloe also identified placental separation as a leading cause of fetal death among maternal survivors (*10*).

ADVERSE OUTCOMES TO OFFSPRING

Over the last two decades, the medical literature has increasingly documented in larger and larger special studies the range of motor vehicle crash threats to the mother, the fetus, and newborns (*13–18*). The more important among the documented adverse outcomes for the offspring include substantially increased rates of fetal mortality, neonatal death, placental abruption, prematurity, low birth weight, birth defects, and other adverse birth outcomes. From a morbidity perspective, direct and indirect damage to the fetus from maternal crashes also leads to an as yet unquantified number of children who have acquired in utero damage to the brain and other organs. This can lead to many types of developmental problems. These types of disabilities are well documented in case reports throughout the literature. These events also leave families to cope, sometimes with great difficulty and usually with legal and financial barriers, with the grief of fetal loss or the burden of caring for survivors who may be permanently impaired.

The potential factors, mechanisms, and impacts on the developing fetus resulting from maternal crash involvement are usually multifaceted but, as yet, are rather incompletely understood. From a clinical perspective, many things can happen to the fetus during and after a crash (independently or in combination) to upset the mother, the fetus, or the delicate physiological balance between them that separates healthy from unhealthy pregnancies:

- There may be direct harm to maternal, fetal, or shared organ and organ systems;
- There may be indirect harm to the fetus from maternal physiologic adaptations to trauma, fluid loss, and shock;
- There may be effects from maternal stress, common in serious traumatic events, known by itself to affect the fetus; and
- There may be effects from diagnostic regimens, medical or surgical procedures, or the wide variety of prescription medicines and self-medication taken by the mother.

How all of these possible threats interact under different scenarios for different levels of severity at different gestational ages is not well understood. This is mainly because of a lack of study. Therefore, what is currently known about the effects of maternal crash involvement undoubtedly underestimates the extent of the related sequelae and the true costs and burden of the problem.

The benefits of restraint use for pregnant women have been well documented in several population-based studies (*13*, *17*, *18*). However, it is important to understand that the issue of crash-related adverse reproductive outcomes is not limited to events in which restraint use is absent or improper. Recent biomechanical analyses and computational models of restrained drivers at week 30 of pregnancy have predicted a 52% risk of fetal injury at crash speeds of only 25 km/h (*19*, *20*). Fetal injury was defined in that study as placental abruption, uterine rupture, direct fetal injury, maternal death, or fetal loss.

INCREASES IN DRIVING BY YOUNG AND PREGNANT WOMEN

As the medical literature paid increasing attention to the issue of pregnancy and crashes in the 1970s, 1980s, and beyond, major societal changes that were transforming the role of young women in society were gaining momentum. These changes increased their use and dependency on the automobile for transportation needs. Presumably, these changes also led to increased automobile use among pregnant women. Unfortunately, few if any data that can be used to quantify this presumption directly exist because pregnant women were not (and still are not) identified in surveys of population travel experiences (*21*). The Nationwide Personal Transportation Survey (NPTS) is a household survey of personal travel in the United States. It has been conducted every 5 to 7 years since 1969, but it has never asked about the pregnancy status of those surveyed. Without such data, it is not known why or how pregnant women use the transportation system. Therefore, one is left to extrapolate (with some caution) from driving surveys of young women, supplanted by other data (mainly occupational status) that quantify changes in the roles and activities of pregnant women in the United States. For example, from 1975 to 2001, the average number of annual vehicle miles driven by women of reproductive age (ages 15 to 39 years) increased from 3,721 to 8,258 (Figure 1).

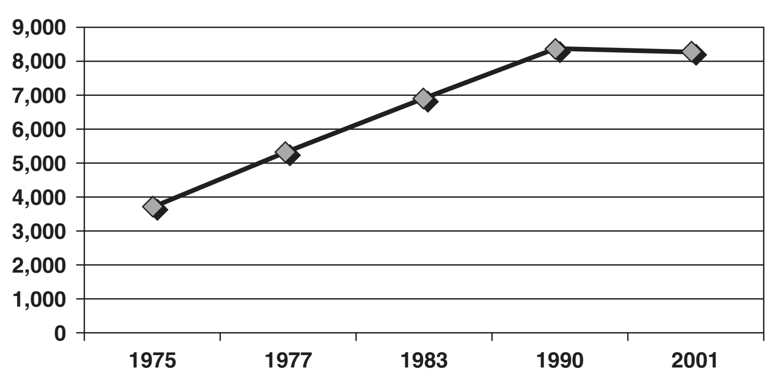

FIGURE 1 Average number of annual vehicle miles per driver for women of reproductive age (ages 15 to 39 years), 1969 to 2001. SOURCE: U.S. Department of Transportation, NPTS series; tabulations run from the 1977, 1983, 1990, and 1995 NPTSs and the 2001 National Household Travel Survey.

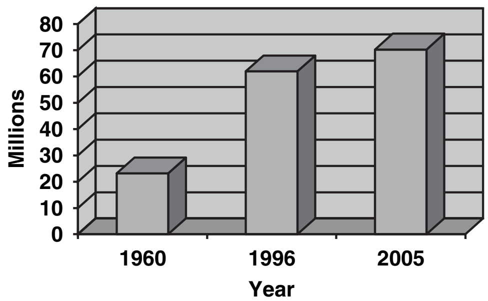

FIGURE 2 Number of employed women. SOURCE: Bureau of the Census, 1997.

This increase was fueled by a variety of factors. These include urban sprawl (suburbanization); inadequate mass transportation systems; increased affluence, which has led to more multiple-car families; and increased employment outside the home by young women. In the latter case, the Bureau of the Census reported that the number of women employed in the United States rose from 23.2 million in 1960 to 62 million in 1996 and was forecast to reach 70.3 million in 2005, which is far beyond the increase expected from population growth alone (Figure 2). This leads to estimates that 60% of women (those over age 14 years) are now engaged in the workforce (*22*).

Women of reproductive age are a large part of the population of employed women. This translates into a proportion of women who report that they work during their pregnancy that is similar to the proportion of women who report that they work when they are not pregnant (*23, 24*). Of equal importance is the increase in the number of pregnant women staying on the job later into their pregnancy (Figure 3*a* and *b*) (*25*). Increased employment by pregnant women has been an important factor in their increased use of transportation.

In summary, many more pregnant women are working now than in the recent past. When they do work, they are more likely to continue working throughout most of their pregnancy. It appears that in comparison with previous generations, today's pregnant women are driving more, driving more miles when they do drive, and driving longer into their pregnancy. Regrettably, though, and with little fanfare, this large increase in the rate of automobile use by pregnant women has had major unintended and unforeseen consequences. It has likely led to a major increase in maternal and fetal exposure to the forces and dangers of motor vehicle crashes.

With the likelihood of the greater exposure of pregnant women to motor vehicle crashes has, unfortunately, come a better understanding of the impact of pregnancy-related crash-associated deaths, injuries, and other adverse outcomes to pregnant women, fetuses, and infants. Why has this increase been missed by injury and crash surveillance and reporting systems? The answer to this question requires an examination of the major data systems and what they can or cannot indicate about pregnancy-related crashes and fetal outcomes.

STATUS OF ONGOING CRASH AND INJURY SURVEILLANCE SYSTEMS

Fatality Analysis Reporting System, NHTSA

The Fatality Analysis Reporting System (FARS) is the main motor vehicle crash fatality surveillance system in the United States. NHTSA's National Center for Statistics and Analysis (NCSA) designed and developed this data system to assist the traffic safety and public health communities in identifying traffic safety problems and evaluating motor vehicle safety standards and highway safety initiatives. The fatality information derived from FARS includes motor vehicle traffic crashes that result in the death of a "person" (the occupant of a vehicle or a nonmotorist) within 30 days of the crash. However, FARS excludes fetuses from its incident selection criteria definition. This means that reports of incidents in which a fetus died but no other child or adult died are considered out of scope. These types of crashes involving fetal deaths are the most likely, since most fetal deaths due to motor vehicle crashes are not accompanied by maternal death (*26*). Therefore, only a small fraction of the incidents involving fetal deaths are even potentially included in FARS.

In incidents in which a child or adult death was accompanied by a fetal death, there are variables in FARS that specify that there was a fetal death. There are codes in FARS for "mother of dead fetus" in the data dictionary in the sections on related factors—driver level and related factors—person level (*27*). However, the information captured from these cases does not include information about the fetus, such as gestational age or cause of death, and almost no information on cases of nonfatal fetal injuries. A look at these data by year from 1983 to 2002 showed a total of 444 cases (mean of 22.2 per year). In 91% of the reported cases, the mother also died (Table 1).

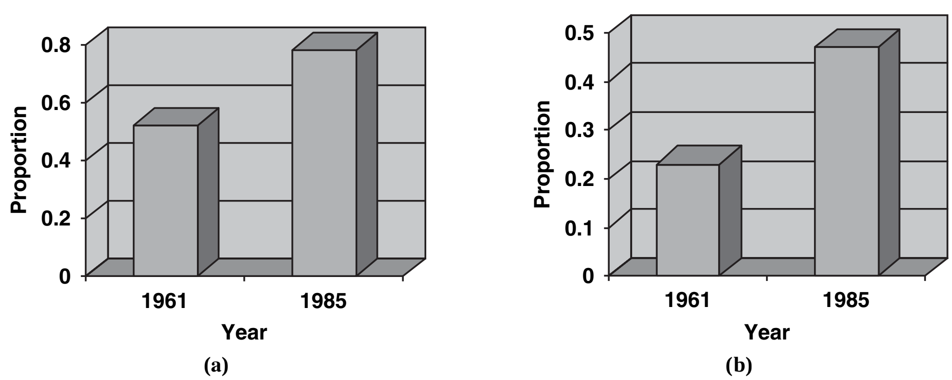

FIGURE 3 Proportion of employed women working during (*a*) last trimester and (*b*) last month of pregnancy (*25*).

TABLE 1 Fatal Crashes and Fatalities Involving Mother of Dead Fetus by Driver-Related Factor, FARS 1982–2001 Final and 2002 ARF

Years	Possible Injury	Non-incapacitating	Incapacitating	Fatal Injury	Injury Severity Unknown	Total
1983–1987	1	1	11	84	0	97
1988–1992	0	2	7	117	1	127
1993–1997	1	0	8	109	0	118
1998–2002	0	1	7	84	0	102
Total	2	4	33	404	1	444
Mean/year	0.1	0.2	1.65	20.2	0.05	22.2

SOURCE: Custom report generated by the Information Services Branch, NCSA (CMS# 2004.00669; Location 2004/DRIREFAC; 00669A1.SAS; PL; July 22, 2004).

Last, the completeness of the FARS data pertaining to the variable "mother of dead fetus" has never been measured, nor have the methods used to obtain those data been documented. Concerns as to the completeness of the data arise, because annual estimates from vital statistics of the expected number of cases of motor vehicle traffic deaths among pregnant women (based on the fatal crash risk to women of reproductive age) are about 368 deaths per year (*28*). This means that FARS probably captures less than 5% of the actual number of fetal deaths that are accompanied by maternal motor vehicle crash-related deaths.

National Automotive Sampling System, NHTSA

The National Automotive Sampling System (NASS) is composed of two systems: the Crashworthiness Data System (CDS) and the General Estimates System (GES). Both systems are based on sample cases selected from police crash reports. CDS focuses on passenger vehicle crashes and is used to investigate injury mechanisms to identify potential improvements in vehicle design. GES focuses on the bigger picture and is used to assess the problem size and to track trends. Neither system captures information directly on fetal injury because, like FARS, fetuses are excluded from the case criterion definition. However, NASS does attempt to capture whether women involved in the crash were pregnant at the time of the crash, based on the gender variable. An analysis of the pregnancy information in NASS CDS was first reported by Weiss and Strotmeyer in 2002 (*3*). In that study, 427 pregnant occupants were identified (weighted $n = 32{,}810$; standard error = 12,585), for a calculated crash rate of 13/1,000 person years. Pregnant women were drivers 70% of the time, whereas nonpregnant women were drivers 71% of the time. The rates of a lack of belt use were 14% and 13% for pregnant and nonpregnant women, respectively. The mean injury severity was lower for pregnant women, but they were more likely to be transported by emergency medical services (EMS) (59% of pregnant women versus 34% of nonpregnant women) or hospitalized (14% of pregnant women versus 5% of nonpregnant women). The rate of improper belt use decreased after the first trimester, and the proportion of pregnant women who were drivers varied little by trimester. Trimester status had little impact on crash risk, seating position, or restraint use.

In the study of the NASS CDS, it was found that about 1% of all births were reported to have been involved in utero in crashes reported to the police, but substantial undercounting was suspected. Evidence to support the notion of a large proportion of undercounting in NASS CDS comes from the differences seen between the data from NASS CDS and those from other cross-sectional empirical studies that estimated the proportions of crashes involving pregnant women that led to hospitalization of emergency department treatment by using hospital records and linkage to birth certificates to ascertain pregnancy status (*2, 18, 29*). These comparisons suggest that NASS CDS poorly captures pregnancy status, missing up to two-thirds of pregnant women involved in a crash that leads to a hospital visit.

Vital Statistics System, Centers for Disease Control and Prevention, National Center for Health Statistics

The National Center for Health Statistics (NCHS) collects data on births, deaths, and fetal deaths (generally those that occur at equal to or greater than 20 weeks of gestation) forwarded from almost all of the states. These data are combined and coded by using the International Classification of Diseases (ICD) published by the World Health Organization. Fetal death certificates are similar to normal death certificates but contain additional information about the parents, the pregnancy, and the birth.

Of interest to the tracking of fetal injury is that there is an ICD code [Code 760.5 for ICD, Ninth Revision (ICD-9), and Code P00.5 for ICD-10] for a fetus or newborn affected by maternal injury. This code is located in the ICD chapter on conditions originating in the perinatal period. However, because of coding guidelines (begun in 1977), codes for an external cause of injury are to be used only if the morbid condition is classifiable to codes in the diagnosis of injury chapter(s); therefore, few codes for an external cause of injury end up being assigned to these cases. Thus, by using the computerized coding available by state and national vital statistics agencies, one cannot differentiate a case of fetal death due to maternal injury from crashes from those due to falls, poisonings, violence, and so on. Another major drawback to understanding these events occurs because the code for maternal injury is not contained in the injury section. Therefore, they are almost never reported as injury events in injury data reports. They remain subsumed and usually hidden in mortality reports having to do with perinatal conditions.

Despite these coding and reporting barriers, fetal death certificates (which are almost always noncomputerized) do contain narrative text that can be used to identify cases of fetal death in which a motor vehicle crash was listed as the underlying cause. This approach was used by Weiss et al. in a manual review of all fetal death certificates from 16 states in which the fetal death was coded as being due to maternal injury (*26*). These data represented about half the population of the United States for the study period from 1995 to 1997 (*26*). That study identified 240 traumatic fetal injury deaths (3.7 fetal deaths per 100,000 live births). Motor vehicle crashes were the leading mechanism of trauma (82% of cases; 2.3 fetal deaths per 100,000 live births), followed by firearm injuries (6% of cases) and falls (3% of cases). Placental injury was mentioned in 100 cases (42%), and maternal death was noted in 27 cases (11%). A peak rate of 9.3 fetal deaths per 100,000 live births was observed among 15- to 19-year-old women.

Extrapolating from these data and correcting for missing cases because of coding errors, maternal deaths in which the fetal death was not reported, and infant deaths (fetal cases born live but who then die within the first year after birth), the authors conservatively estimated the annual number of fetal deaths due to motor vehicles crashes to be 369 per year. This estimate was conservative because it did not include adjustments for first-trimester fetal deaths, underreporting of crash-related deaths, or events leading to therapeutic abortion, all of which might add another 200 to 300 cases per year as a higher, but still incomplete, estimate. Figure 4 compares the conservative and higher estimates of fetal motor vehicle crash-related deaths with all child transportation-related deaths.

Hospital and Linked Crash Data

Because hospital data use an injury and diagnosis coding system derived in part from ICD and they generally lack a pregnancy status variable, they suffer similar limitations as vital statistics data for the direct identification of cases of maternal injury and fetal and child impacts. Another issue is that from a coder's perspective, the fetus or infant may not suffer an injury itself but instead may suffer an adverse effect that occurs as the result of the injury to the mother. Therefore, rather than noting that a baby was injured in utero, only the adverse outcome (for example, prematurity) or the reproductive tract-oriented diagnosis (such as placental abruption) is noted in the discharge coding system and the injury connection is lost or logistically difficult to recover.

Two techniques have been exploited by researchers using clinical data to work around these issues. The first technique, used by Wolf and colleagues in 1993, links the event of interest that identifies maternal crash involvement or injury (crash data or hospital inpatient or emergency department data) to birth certificates (*13*). Once the information is linked through common identifiers, the information about the timing of the event, the date of birth or death of the child, and the child's gestational age can be used to ascertain accurately whether the crash or injury occurred while the mother was pregnant (*13*). The second technique was pioneered by Greenblatt et al. in 1997 (*31*). This approach identifies pregnancies in hospital discharge data on the basis of screening for the accompanying diagnosis and procedure codes that indicate that the mother was pregnant during the hospital visit (*28, 31, 32*). Comparative analyses of the outcomes determined from the clinical data can then be accomplished (*16, 18, 33*).

COMPARISONS OF MATERNAL AND FETUS OR INFANT MOTOR VEHICLE CRASH EXPOSURE AND OUTCOMES

The availability of these special cross-sectional research techniques for the identification of pregnancies among clinical and crash data systems greatly improves the ability to understand the magnitude and the extent of the maternal and fetal crash and injury problem. To put these into perspective, Table 2 combines estimates of the rates of pregnancy-related crashes, morbidity, and fetal mortality and contrasts their estimated annual frequency to the equivalent experience of infants (from birth to 1 of year of age) with motor vehicle crash involvement and injuries.

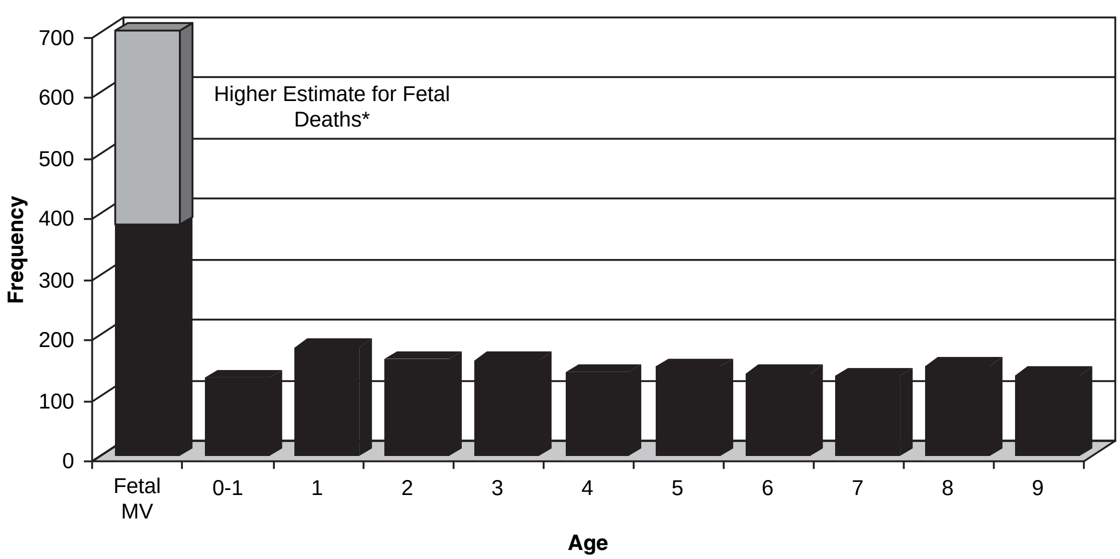

FIGURE 4 Estimated number of fetal motor vehicle-related deaths versus all U.S. child transportation-related deaths among children ages 0 to 9 years, by year of age. SOURCE: Fetal death estimates were extrapolated from adjusted rates reported from a 16-state study, 1995 to 1997 (*26*); child deaths were derived from the National Center for Injury Prevention and Control (*30*).

TABLE 2 Comparison of Estimated Annual Frequency of Fetal and Infant Crashes, Injuries, and Deaths Related to Motor-Vehicles

Level of Motor-Vehicle Incidents and Injury	Fetal Cases Extrapolated to U.S. on Basis of 4 Million Births per Year (rate, period, and reference)	Infant Comparison (source)
A. Police-reported crashes	120,778 (3/100 pregnancies, 1995–1999)(*13*)	24,000 (1995–1999 NASS data)
B. Motor vehicle occupant emergency department visits	40,259 (1/100 pregnancies, 1997–2001)(*30*)	7,713 (2002 CDC WISQARS)
C. Motor vehicle occupant hospital discharges	4,000 (1/1000 pregnancies, 1997)(*31*)	400 (1995–1999 NASS data)
D. Motor vehicle occupant deaths	~400 to 700 (fetal death certificates, 1995–1997)(*32*)	120 (2002 CDC WISQARS)

CDC WISQARS = Centers for Disease Control and Prevention Web-Based Injury Statistics Query and Reporting System.

Once the data are uncovered and interpreted, the disconcerting magnitude of the problem of crashes to pregnant women and fetuses begins to emerge. Consistently, across several different data sources, at all levels of motor vehicle crashes and injury, fetuses have several times the risk of infants. Indeed, the risk (in person years) is even higher than that shown in Table 2 because fetuses are exposed for only 9-month periods, whereas infant cases are measured over the course of a full year. It is difficult at this juncture of understanding of the problem to quantify all the reasons why fetuses appear to be at such a higher risk, but the higher risk is consistent across all the various measures and is undoubtedly real. Qualitatively, the factors that come into play may include (*a*) the greater vulnerability of the fetus to injury; (*b*) fewer treatment options for injured fetuses; (*c*) better passenger protection for infants, who mostly travel in car seats; (*d*) less occupant protection for fetuses (they depend on proper maternal seatbelt use, and cars are not engineered to provide maximum protection to pregnant women or the fetus); and (*e*) the greater exposure of fetuses during crashes (they take on the driving exposure of the mother).

One last area to be mentioned is the paucity of data on what happens to the babies who had been exposed to a crash in utero but survived, as most do. These children cannot be identified in any kind of registry, and no longitudinal outcome studies have been conducted with them. If related developmental problems occur as the children grow, as suggested by various case reports (*34–38*), the problems may never be attributed to the crash or, at best, are attributed to secondary conditions, such as prematurity and low birth weight. The full impacts of crashes during pregnancy on children and the population have yet to be elucidated.

DATA SYSTEM RECOMMENDATIONS

To address the problem of crashes during pregnancy, many actions need to be taken by government agencies and the transportation safety research establishment to improve the ability of crash and injury surveillance and data systems to track the problem. Although some of these changes will take time, personnel, and likely, some additional funding, they are necessary steps toward solving the problem.

FARS Improvement

The case definition for inclusion in FARS should be changed to include the death of a fetus at 20 weeks of gestation or greater (the same as that required for fetal death certificates). The database and data system should be adjusted accordingly to find such cases so that crash-related fetal deaths can be tracked and factors related to motor vehicle crash-related fetal deaths can be aggregated and studied. The identification of such cases will require working with coroners, medical examiners, and vital statistics systems at the state and local levels to improve the detection and reporting of deaths of pregnant women.

NASS Improvement

NASS needs to better differentiate between confirmed pregnancy status and nonpregnant status. Ways to improve the completeness of pregnancy status should be explored. The data collection should be expanded to include the fetus as a passenger and should document any death or injury to these fetuses. If the system is improved in this manner, it could be used to conduct ongoing studies of crashes during pregnancy to better characterize the threat to pregnant women and their offspring.

Institutionalize Routine Linkage of Crash Data with Birth and Fetal Death Certificates

Reliance on police reports to identify pregnancy status is problematic, especially for the more common incidents in which the fetus does not die from a crash-related injury or its sequelae. To solve this problem, it is recommended that all states annually link their police-reported crash data (for drivers) to birth certificates, fetal death certificates, and crash data to ascertain pregnancy status more accurately. This effort could be added to the work of NHTSA's state-based Crash Outcome Data Evaluation System projects, which already link crash data to hospital and EMS data.

U.S. National Household Travel Survey (NPTS) Improvement, FHWA

Pregnancy should be included as a variable in the next and all future versions of NPTS. Also, the sample selection scheme should be adjusted accordingly by oversampling pregnant women by trimester to make data on travel during pregnancy available and meaningful.

National Center for Health Statistics

NCHS should work with the World Health Organization to change ICD to allow coding of the external cause of the mother's injury that led to a fetal or neonatal death. NCHS should establish a task force to look at the pregnancy check box issue on death certificates and make recommendations and fund pilot efforts to improve the completeness and accuracy of this field. Better methods are needed to establish pregnancy status for all victims of injuries in coroner and medical examiner systems.

If coding guidelines were changed so that fetal deaths from injury were reported as being due to external injury codes (mechanisms) instead of being noted that they were due to maternal injury, it would be much easier to track cases in vital statistics data. This, in turn, would make it much easier for injury prevention professionals to include such cases in the scope of their work.

CONCLUSION

The urgency around implementing these recommended actions is based on the evidence that over the past 30 to 40 years the United States has experienced a steadily advancing epidemic of fetal loss and injury as more pregnant women drive, drive more miles, and drive later into their pregnancies (*39*). In a real sense, as driving during pregnancy reaches a saturation point among pregnant women (or, put another way, approaches the driving experiences and crash risks of all young women), the country may now be entering the pandemic stage of the epidemic (defined as an epidemic over a wide geographic area and affecting a large proportion of the population).

All drivers and vehicle occupants, including pregnant women, gain from many of the advances that have reduced the motor vehicle injury rate. This includes higher rates of seat belt use, lower rates of driving while the driver is intoxicated, a vehicle fleet equipped with better and safer air bags, improved vehicle structures, an improved road safety infrastructure, and other factors. Nevertheless, it is not known how pregnant women specifically and proportionally benefit from these broader improvements because of the lack of data about their experiences. Furthermore, the improvement in injury rates per mile driven has probably not kept pace with the increase in the numbers of miles driven by this population. Perhaps the rate of increase of the epidemic has slowed in recent years, but the risk probably remains widespread in most sectors of the population because of the current pervasive automobile use by pregnant women.

It is true in highway safety, women's health, reproductive health, and public health: what gets measured gets done. The challenge is to acknowledge the deficiencies of the past and begin to measure, on an ongoing basis, the hidden problem of motor vehicle injuries among pregnant women. The well-being of the future generation requires it.

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The Women's Issues in Transportation Committee sponsored publication of this paper.