

ANALYSIS OF BLIND PEDESTRIAN DEATHS AND INJURIES FROM MOTOR VEHICLE CRASHES, 2002-2006

Christopher Hogan, Ph.D
Direct Research, LLC
226 Glen Ave., SW
Vienna, VA 22180
chogan@directresearch.com

April 21, 2008

No funding from any source was received for this analysis.

EXECUTIVE SUMMARY

Pedestrian Deaths

- From 2002 to 2006, an average of five legally blind pedestrians per year were killed in motor vehicle accidents in the US (Table 1).
- No deaths of legally blind pedestrians involved a Prius (Table 3) or any other hybrid vehicle (Table 4).
- For all US pedestrian deaths (blind and sighted), 11 deaths involved a Prius (Table 3). (The Prius was singled out here because it is the only model with large production volume that was produced solely as a hybrid).
- For all US pedestrian deaths, a Prius was no more likely to be involved in a pedestrian death than the average passenger vehicle (Table 5). The Prius accounted for 0.05 percent of passenger vehicles involved in fatal pedestrian accidents, and accounted for 0.05 percent of US registered motor vehicles, on average, over this period.
- For both blind and sighted individuals, only about 10 percent of pedestrian deaths occurred as the result of being struck while walking in a crosswalk. The rest occurred in other locations. More than two-thirds of both blind and sighted pedestrians were listed as contributing in some way to the accident. Of those tested, slightly more than one-third of both blind and sighted pedestrian decedents tested positive for alcohol.
- Data on hospitalization rates for pedestrian accidents confirm the death rate data (Table 6). In a typical year, roughly 40 legally blind pedestrians are hospitalized as the result of a motor vehicle accident.
- Based on population estimates, the average a legally blind person is *less* likely to be killed or hospitalized as a result of being hit by a car than the average sighted individual. Legally blind individuals accounted for 0.11 percent of deaths and 0.15 percent of hospitalizations. But they account for 0.43 percent of the US population, or 0.23 percent of the US population under age 80.

BACKGROUND

A bill has been introduced in the U.S. House of Representatives, HR 5734, focusing on hybrids and other motor vehicles that emit less noise than the typical vehicle. If passed into law, the bill would give the Secretary of Transportation two years to determine a standard for the best method for alerting blind pedestrians to the presence of a hybrid vehicle, and a further two years to require all new vehicles to adhere to that standard. While focusing on blind pedestrians, the bill suggests that more noise from hybrids would increase the safety of both blind and sighted pedestrians.¹

The language of the bill establishes a clear viewpoint on the issue. Two sections are worth quoting. First, there is an assumption that hybrids currently are dangerous:

“... when operating on their electric engines, hybrid vehicles cannot be heard by blind people and others, rendering such vehicles **extremely dangerous** [emphasis mine] when driving on the street, emerging from driveways, moving through parking lots, and in other situations where pedestrians and vehicles come into proximity with each other;”

Second, although the possibility for some other type of solution is left open, the bill strongly suggests that making hybrids noisier is the preferred answer.

“... determine the minimum level of sound emitted from a motor vehicle that is necessary to provide blind pedestrians with the information needed to make safe travel judgments ... which method assures the least reliance by blind and other pedestrians upon technology they must possess when traveling and thereby provides the greatest amount of independence and opportunity for spontaneous travel for these pedestrians.”

At the conclusion of the study, the Secretary of Transportation would issue a standard for all newly manufactured motor vehicles. Two years after issuance of the standard, all vehicles would be required to meet the standard. The standard would probably be a minimum level of noise at all operating speeds, but might conceivably be some other type of detection system.

PURPOSE OF STUDY

This study gathers the basic facts on pedestrian deaths and injuries in the US. How many blind pedestrians have been killed by hybrid vehicles in the US? Have there been any pedestrians whatsoever killed by hybrids? Are hybrids involved in pedestrian deaths at a disproportionate rate? Beyond deaths (the event for which the most detailed data are

¹ As of 4/21/2008, the text of the bill could be read at this URL at the Library of Congress: <http://thomas.loc.gov/cgi-bin/query/D?c110:1:./temp/~c110VCcZOD::>

available), is there any information to suggest that the blind are disproportionately at risk for pedestrian injuries than others?

In other words, are there any facts suggesting that hybrids are more dangerous to pedestrians, or even to suggest that blind pedestrians are at greater risk of death and injury than others?

SOURCES OF DATA AND METHODS

The US Fatality Analysis Reporting System (FARS) captures data on all US motor vehicle related deaths occurring in areas routinely open to the public. Data files are available showing the characteristics of the persons and vehicles involved, and describing each incident.² FARS data capture whether or not an individual is legally blind in a series of variables flagging factors that may have contributed to the accident.³ The main portion of this analysis uses the FARS contributing factor variables to flag legally blind pedestrians.

FARS is the main source of data used here because it provides detailed information on the vehicle crash. Other sources of data provide less information on the crash but were used to validate parts of the findings from FARS.

A related US Department of Transportation system collects data on a roughly 1 percent sample of all reportable accidents, not just deaths, called the General Estimates System (GES). However, too few reportable accidents with blind pedestrians occurred to make those data useful. (In the 2006 file, only one such accident occurred in the GES sample.).

The Healthcare Cost and Utilization Project (HCUP) data from the Agency for Healthcare Research and Quality (AHRQ) provides a roughly one-in-five sample of all US short-term general hospital discharges. The HCUP data were used to verify that the serious injury rate for blind pedestrians is roughly proportion to the death rate. (That is, focusing solely on deaths, where the vehicle information is available, does not appear to provide a distorted picture of vehicle accidents involving blind pedestrians).⁴ In the HCUP data, pedestrian accidents and blindness are both captured by diagnosis codes reported on the hospital discharge abstracts.

² An overview of FARS can be found here: <http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/FARS.html>

³ A person is legally blind if vision is 20/200 or worse with correction, or if field of view is limited to 20 degrees or less.

⁴ An overview of HCUP can be found here: <http://www.ahrq.gov/data/hcup/>

The Centers for Disease Control (CDC) Wonder system was used to query US death certificate data to check the FARS counts of vehicle-related pedestrian deaths.⁵

Counts of various items (number of legally blind Americans, US population, car registrations) are cited individually when used.

⁵ CDC Wonder can be accessed here: <http://wonder.cdc.gov/mortSQL.html>

METHODS AND RESULTS: BASIC STATISTICS

Based on the US FARS data, from 2002 and 2006 the US averaged roughly 5 blind pedestrian deaths from motor vehicle crashes (Table 1). Given the small numbers involve, the count of blind pedestrian deaths was remarkably stable from year to year. Legally blind individuals accounted for roughly a tenth of a percent of all pedestrian deaths over this period.

Table 1: U.S. Pedestrian Deaths in Motor Vehicle Accidents, 2002-2006				
Year	Total	Not Legally Blind	Legally Blind	Legally Blind as % of Total
2002	4851	4845	6	0.12%
2003	4774	4768	6	0.13%
2004	4675	4669	6	0.13%
2005	4892	4889	3	0.06%
2006	4784	4778	6	0.13%
Five-year average	4795	4790	5	0.11%
Source: Calculated from FARS person-level files, 2002-2006				

As a check, to see whether FARS may miss a significant number of deaths, I separately tabulated death certificate data from the US CDC Wonder system (referenced above). In each overlapping year, death certificates attribute about 10 percent more total pedestrian deaths than the FARS system does. However, the CDC data included a large category of non-specific pedestrian deaths, and so may have included a somewhat broader range of pedestrian accidents than the FARS data does. In general, the counts are close enough to suggest that the FARS is missing little relevant data.

Year	Deaths
2005	5652
2004	5536
2003	5584
2002	5640
Source: Calculated from CDC Wonder compressed mortality file data	
Note: Includes a large "not otherwise specified" category of pedestrian deaths with specific attribution to motor vehicles, as well as non-traffic deaths.	

The types of vehicles causing pedestrian deaths broadly match the US distribution of vehicles (Table 3). Slightly more than half (45 percent out of 80 percent) of passenger vehicles involved in pedestrian fatalities were cars, slightly less than half were light trucks, SUVs, and minivans. A Prius was involved in 11 of the pedestrian deaths over this period, but none of the deaths of legally blind pedestrians.

Type of Vehicle	All Pedestrians	% of total	Not Legally Blind	% of total	Legally Blind	% of total
Car	11882	45%	11873	45%	9	32%
Pickup Truck	4628	17%	4618	17%	10	36%
SUV	3476	13%	3474	13%	2	7%
Minivan	1449	5%	1446	5%	3	11%
Subtotal, Passenger Vehicles	21435	80%	21411	80%	24	86%
Not passenger vehicle (Bus, Truck, Heavy Van, Motorcycle, Etc.)	5212	20%	5208	20%	4	14%
Total	26647	100%	26619	100%	28	100%
Memo: Toyota Prius	11		11		0	
Memo: Prius as % of pass. vehicles	0.05%					

Source: Analysis of FARS data files, 2002-2006.

Examination of the cars involved in blind pedestrian deaths over this period reveals no hybrids were involved in any blind pedestrian deaths (Table 4). As shown above, the most common class of vehicle involved in a blind pedestrian death was a pickup truck. (Note, however, that the differences between sighted and blind pedestrian deaths in Table 3 would not pass traditional tests of statistical significance.)

We can use the Prius as a proxy for hybrids to determine whether or not hybrids are more likely to be involved in fatal pedestrian accidents. The Prius is the only vehicle that can a) be identified as a hybrid within the FARS data and b) had a large production volume. For other makes, the FARS file does not distinguish hybrid and non-hybrid variants, or there are too few cars to allow for a reasonable analysis.

Table 4: Vehicles Involved in US Legally Blind Pedestrian Deaths, 2002-2006	
Make/Model	Number
BUIC Roadmaster	1
CHEV Blazer-fullsize/Tahoe	1
CHEV Caprice/Impala	1
CHEV Cavalier	1
CHEV Celebrity	1
CHEV CKRV-series Pickup	3
CHEV Lumina	1
FORD E-series Van	1
FORD F-series Pickup	2
FORD Ranger	2
FORD Taurus	2
FORD Windstar	1
GMC CKRV-series Pickup	2
GMC Safari	1
HOND Accord	1
INTL Unk eng loc	1
KW CBE	1
NISS Frontier	1
Other Vehicle	1
TOYT Minivan/Previa	1
TOYT RAV4	1
VOLV 40 Series	1
Source: Tabulated from FARS accident and vehicle files, 2002-2006	

The Prius appears neither more nor less likely to be involved in a pedestrian fatality than any other car. This is a conservative estimate, based on total Prius sales over this period, and assumes that all Prius vehicles sold remained on the road. A Prius was involved in

0.05 percent of all US pedestrian fatalities over this period, and cumulative Prius sales averaged 0.05 percent of all US car registrations over this period (Table 5).⁶

Table 5: Prius as a Percent of Registered Cars and Cars Involved in Pedestrian Deaths, Average 2002-2006	
Year	Cumulative US Prius Sales, June Each Year
2002	32006
2003	51941
2004	88487
2005	174002
2006	276747
Average, 2002-2006	124637
Memo: Total US Registered Passenger Vehicles, 2004 (midpoint of time period)	247421120
Memo: Prius as % of registered vehicles, 2002-2006	0.05%
Memo: Prius as % of vehicles in pedestrian deaths, 2002-2006 (from Table 3).	0.05%
Source: See text footnote for sources	

Finally, we can ask whether the detailed information on blind pedestrian deaths provides an adequate picture of the situation. On the one hand, does the FARS coding accurately capture the legally blind status of pedestrians? That is, could FARS undercount blind pedestrian deaths? On the other hand, could blind pedestrians suffer disproportionately from non-fatal injuries, so that the FARS death data under-represent the scope of the issue? While there are fewer than 5000 pedestrian deaths every year, there are at least 60,000 reportable pedestrian motor vehicle injuries each year.⁷

⁶ Sources: Total US passenger vehicles: http://en.wikipedia.org/wiki/Passenger_vehicles_in_the_United_States#Total_number_of_vehicles
 Total US cumulative Prius sales: <http://www.automotive-usenet.com/alt-autos-lexus/4198-toyota-lexus-hybrid-unit-sales-history-usa.html>

⁷ National Highway Transportation Safety Administration, Transportation Safety Facts 2006, Pedestrians, publication number DOT HS 810 810. http://www.nhtsa.dot.gov/portal/nhtsa_static_file_downloader.jsp?file=/staticfiles/DOT/NHTSA/Traffic%20Injury%20Control/Articles/Associated%20Files/TSF2006_810810.pdf

The only other data source large enough to capture rare events of this type (blind pedestrian injuries) is the HCUP database (described above), a sample of roughly 20 percent of all US short-term general hospital inpatient discharges. There are about 8 million hospital discharges per year in the database. Using HCUP, I looked for cases coded as pedestrians injured in automobile collisions, and looked for diagnoses flagging either legally blind or any of several types of severe visual impairment.

The HCUP data show an average of about 40 legally blind pedestrians hospitalized for vehicle-related injuries every year (Table 6). This reported hospitalization rate for legally blind pedestrians is somewhat higher than the FARS reported death rate (Table 6). Where FARS showed an average of 0.11 percent of pedestrian deaths were legally blind individuals, the HCUP database shows 0.15 percent of pedestrian admissions were for persons coded as legally blind. Thus, the death experience in FARS may modestly understate the actual relative risk of death or serious injury for the legally blind.

Table 6: U.S. Hospitalizations for Pedestrians Involved in Motor Vehicle Accidents, 2001-2004						
					Percent of Total	
Year	Total	Any Blindness (Including Legally Blind)	Legally Blind	Not Blind or Legally Blind	Any Blindness	Legally Blind
Pedestrians in motor vehicle accidents						
2001	23237	52	*	23185	0.22%	0.02%
2002	27728	75	42	27653	0.27%	0.15%
2003	27866	53	48	27813	0.19%	0.17%
2004	26733	94	59	26639	0.35%	0.22%
Average	26391	68	38	26323	0.26%	0.15%
Pedestrians in motor vehicle accidents, died in hospital						
2001	962	*	*	*		
2002	1155	*	*	*		
2003	1317	*	*	*		
2004	1327	*	*	*		
Average	1190	*	*	*		

Source: Analysis of HCUP National Inpatient Sample Files, 2001-2004						
Notes: * Data suppressed to comply with AHRQ privacy guidelines -- too few observations to publish.						

We cannot accurately assess the risk of being a legally blind being a pedestrian without accurate information on the amount of time spent in that activity. That is, ideally, we would like to calculate expected deaths or injuries per person-year or per hour of that activity. For example, legally blind individuals might walk more or less than the typical sighted person. Further, US legally blind individuals are highly concentrated among the oldest old (those over age 80, see below), who may or may not be capable of independent ambulation.

The only thing we can do to show relative risk is to compare the rates of death and injury above to the rates of legal blindness in the US. A 2004 estimate from the US National Eye Institute (of the National Institutes of Health) showed roughly 937,000 Americans age 40 or older were legally blind. Of those, 648,000 were age 80 and older.⁸ The American Foundation for the Blind (AFB), by contrast, cites a 10-year-old estimate of roughly 1.3 million legally blind Americans of all ages.⁹

Using the AFB estimate, 0.43 percent of the US population is legally blind. Even netting out the oldest old (those over age 80), 0.23 percent of the US under-80 population is legally blind. Based on this crude measure (per person, not per hour walked), pedestrian activity does not appear particularly risky for the legally blind. Their fraction of pedestrian deaths (0.11 percent) and hospitalizations (0.15 percent) is smaller than their fraction of the US population, even if the oldest old are excluded.

⁸ . Taken from the National Eye Institute of the National Institutes of Health, URL http://www.nei.nih.gov/eyedata/pbd_tables.asp. The original source was published in the Archives of Ophthalmology, Volume 122, April 2004.

⁹ The American Foundation for the Blind cites a decade-old estimate of 1.3 million. Adjusted for population growth, that would yield slightly over 1.4 million currently. The citation can be found at: <http://www.afb.org/Section.asp?SectionID=15&DocumentID=1367>. The original data source for that estimate was the National Center for Health Statistics, National Health Interview Survey - Disability Supplement, 1994 and 1995.

Many factors might reasonably account for this. The legally blind may be less likely to be pedestrians, or might be significantly more cautious than others. The FARS provided little insight into this issue due to the small number of observations.

Age does not appear to explain the below-average rate of pedestrian deaths for the legally blind. The incidence of pedestrian deaths rises with age, from 2 incidents per 100,000 for those age 20-24 to 4 incidents per 100,000 persons for those age 85 and older (calculated from CDC Wonder, cited above.) But the FARS data show that the average legally blind pedestrian decedent was *older* than sighted pedestrian decedents (58 years versus 45 years). By itself, that suggests the legally blind ought to have an *above-average* rate of pedestrian deaths, instead of below-average.

Beyond that, the FARS suggests little difference between blind and sighted pedestrian decedents. In both cases, only a tiny minority of fatal accidents occurred to pedestrians in crosswalks (11 percent for the blind versus 9 percent for the sighted). Similarly, the majority of decedents were listed as contributing to the accident in some fashion (for example, “improper crossing”), with 74 percent of blind decedents and 62 percent of sighted decedents so noted. Finally, there appeared to be little difference in alcohol use when that was noted. Among those tested, 37 percent of both blind and sighted pedestrian decedents tested positive for alcohol.

SUMMARY

The decision to mandate noise-making devices on hybrid and other “quiet” cars is being made in the absence of facts. This brief examination of publicly-available data was an attempt to get the facts on the table.

I found no evidence to support the hypothesis that hybrids are more dangerous than other cars, either to blind pedestrians or to pedestrians in general. The best-selling US hybrid, the Prius, was neither more nor less likely than average to be involved in a pedestrian death. Its rate of involvement in all pedestrian deaths over this period exactly matched its prevalence among all registered US passenger vehicles over this period.

One of the difficulties in making a fact-based analysis of this issue is that there are few blind pedestrian deaths. This makes it difficult to generalize about accident causes and potential benefits from policy intervention. On average, there are about 5 deaths and 40 hospitalizations per year for blind pedestrians struck by cars. By and large, the circumstances surrounding blind pedestrian deaths appear similar to those of sighted pedestrian deaths. Only a small minority of either blind or sighted pedestrian decedents were in a crosswalk at the time of accident. Rates of alcohol use and rates of behavior cited as contributing to the accident were roughly similarly for blind and sighted pedestrian decedents. The only notable difference from the FARS data is that blind pedestrian decedents were older, on average, than sighted pedestrian decedents.

Legally blind individuals appear less likely than others to be killed or hospitalized as a result of being hit by a vehicle. Whether this is because they have lower exposure (spend less time as pedestrians) or are more cautious is impossible to determine from the data examined here.

Together, the facts suggest that the Congress should move with caution in mandating noise-making or other devices on hybrid and electric vehicles. First, there is no evidence of a problem. The reported rate of pedestrian deaths from the Prius (a proxy for hybrids) was no higher than average, and as of 2006 there have been no reported blind pedestrian deaths due to collisions with hybrids. Second, the current number of blind pedestrian deaths and hospitalizations is small, while the number of cars to be modified is large. Even a modest cost per vehicle may result in a very large cost per putative life saved. Finally, as far as the data show, there is little qualitative difference between blind and sighted pedestrian decedents other than age, and the generally lower rate of pedestrian accidents for the blind (relative to their prevalence in the population).. Research should demonstrate the specific harm and risk to the blind *before* the Congress mandates policy in this area.