

The 2006 Societal Cost of Crashes Involving Drivers 15-17 Years Old

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Introduction

This report presents the first estimates of societal costs and numbers of deaths, injuries, and crashes involving drivers 15-17 years old. The estimates are broken down by male vs. female teen driver and by single vs. multi-vehicle crash. They include all vehicle occupants involved in such crashes and also any pedestrian or pedalcyclist deaths/injuries resulting from them. The societal costs include lifetime medical cost, work loss, property damage, quality of life loss, and other related costs.

Methods

Modeling crash costs requires estimates of the number of people involved in a crash, the medical details of each person's injuries (ideally, body part injured, nature of the injury, and injury severity, e.g., skull fracture not resulting in loss of consciousness), and the costs of those injuries and associated vehicle damage and travel delay. The next section describes the methodology used to estimate the costs per person. The succeeding section explains how the incidence of deaths, injuries, and crashes involving drivers 15-17 years old was estimated.

Costs per Person

No data system that contains a nationally representative sample of recent U.S. data on non-fatal crash injuries records both crash type and medical descriptions of the injuries, which are necessary for costing them. The National Highway Traffic Safety Administration's (NHTSA's) National Accident Sampling System (NASS) collected data containing medical descriptions of injuries for a representative sample of all police-reported U.S. motor vehicle injury victims in 1984–1986. In 1988, NASS was replaced by two ongoing sampling systems. The Crashworthiness Data System (CDS) collects data similar to NASS but focuses on crashes involving automobiles and automobile derivatives, light trucks and vans with gross vehicle weight less than 10 000 pounds (4 537 kg) that are towed due to damage, and excludes data on the injuries of pedestrians and non-motorists involved in towaway crashes. The General Estimates System (GES) collects data on a representative sample of all police-reported crashes, but the only injury description it gives is the severity that a police officer assigned in the police incident report.

GES, like the police reports, uses the KABCO severity scale (National Safety Council, 1990) to classify crash victims as K-killed, A-disabling injury, B-evident injury, C-possible injury, or O-no apparent injury. The codes are selected by police officers without medical training, typically without the benefit of a hands-on examination. Some victims are transported from the scene before the police officer who completes the crash report even arrives. Thus, police reporting does not accurately describe injuries medically. Moreover, KABCO ratings are coarse and inconsistently coded between states and localities and over time (Miller et al., 1991, Blincoe and Faigin, 1992, O'Day, 1993). Viner and Conley (1994, working paper) found one cause of this variability was differing state definitions of A-injury. Miller et al. (1987) found police-reported injury counts by KABCO severity systematically varied between states because of differing state crash reporting thresholds (the rules governing which crashes should be reported to the police) and that state reporting thresholds often changed over time. GES verifies that all crash deaths are coded as K and all crash victims coded as K died.

NASS and CDS record both the KABCO codes assigned by police and medical descriptions of injury in the Occupant Injury Coding system (OIC). OIC codes include detailed medical descriptions plus AIS threat to life severity scores. The NASS data were coded with the 1980 version of OIC/AIS, which differs slightly from the 1985 version; but NHTSA made most OIC/AIS-85 changes well before their formal adoption (Association for the Advancement of Automotive Medicine [AAAM], 1985). The 1999–2001 CDS data used in this paper were coded in AIS-90 (AAAM, 1990).

Starting with Miller et al. (1997), NHTSA's past costing studies and ours have met the challenge posed by the lack of an adequate data system by simulating the records that CDS would have collected if it had sampled the non-CDS strata (i.e., injuries to passenger vehicle occupants involved in non-tow-away crashes and to pedestrians, pedalcyclists, and heavy vehicle occupants). Combining the simulated data with the actual CDS data yields a synthesized, nationally representative sample of crashes with both crash types and medical descriptions of the injuries of all people involved in the crashes.

Our simulation uses the 1984–1986 NASS records for the non-CDS strata and applies the cost per person by KABCO, restraint use, and alcohol involvement to the 2006 GES data on the non-CDS strata crashes. Weighting the NASS data to GES restraint use levels updates the NASS injury profile to a profile reflecting contemporary belt use levels. This procedure assumes that particular crash types generate typical profiles of injury outcomes that are stable over time, an assumption that Australian research supports (Andreassen, 1986). Sample size considerations drove the decision to pool and average 3 years worth of NASS data. We combined the CDS data with the NASS data on the non-CDS strata. This hybrid file was comprised of 2004–2006 CDS records for non-heavy vehicle, tow-away crashes and of 1984–86 NASS records for all other crashes, and became our study's analytical file for estimating costs per person involved in a crash.

We followed the methods described in Blincoe et al. (2002) to estimate costs for fatalities and we adopted injury costs from Zaloshnja et al. (2004) for the rest. That article gives costs per victim in 2000 dollars by body part, whether or not a fracture was involved, and AIS (for both AIS85 and AIS90). We updated the costs to 2006 dollars and merged them onto the hybrid CDS/NASS file. Societal costs represent the present value, computed at a 3% discount rate, of all costs that result from a crash over the victim's expected life span. We included the following major categories of costs: (1) lifetime medical cost, (2) work loss, (3) property damage, (4) quality of life loss, and (5) other related costs.

Zaloshnja et al.'s (2004) medical cost estimates drew on data from 1992–1994 Civilian Health and Medical Program of the Uniformed Services (CHAMPUS) data for physician and emergency department fees, 1994–95 data on hospital costs in MD and NY (the only two states where costs, not charges or payments were known), and 1987 National Medical Expenditure Survey (NMES) and 1979–1987 National Council on Compensation Insurance (NCCI) data on the percentage of costs that occur more than 6 months post injury.

Zaloshnja et al. (2004) based short-term work loss on information from the CDS 1988–1991 (for AIS85) and CDS 1993–1999 (for AIS90) about the probability an employed person would lose work for a specific injury and the 1993 Survey of Occupational Injury and Illness (SOII) of the U.S. Bureau of Labor Statistics on the days of work lost per person who lost work. Mean probabilities of work loss

were estimated from just those CDS records that had the relevant information, which frequently was missing. Sample size considerations drove the decision to pool several years of CDS data. Long-term productivity loss by diagnosis was based on 1979–1987 NCCI Detailed Claims Information (DCI) data on the probability that injuries would cause permanent partial/total disability and 1997 DCI data on the percentage loss of earning power for partially disabled injury victims.

Zaloshnja et al. (2004) included a variety of other direct costs. Among them were emergency services, property damage, travel delay, insurance claims administration, legal and court costs, and workplace disruption costs. These estimates used insurance data, recent data on travel delay that crashes cause motorists whose vehicles did not crash, and data from prior NHTSA studies.

Following Miller et al. (1995), Zaloshnja et al. (2004) based quality of life loss on physicians' estimates of the functional capacity lost over time by injury diagnosis and a systematic review of the survey literature on the loss in value of life that results from different functional losses. These losses were costed based on meta-analyses (Miller 1990; Miller 2000; and Viscusi and Aldy, 2003) examining what people pay for small changes in fatality risk and surveys on what they state they are willing to pay. The mean value of statistical life recommended by Miller (1990) and subsequently adopted for official use by NHTSA was used in Zaloshnja et al. (2004)'s quality of life loss cost calculations.

All costs were adjusted to state-specific prices using ACCRA price adjusters drawn from the US Statistical Abstract.

Incidence

We used 2006 GES data to estimate the incidence of non-fatal crashes and injuries. After merging onto these data the cost per person by KABCO, restraint use, and alcohol involvement derived from the hybrid CDS/NASS file, we made some adjustment to the weights of each case in the GES file. First, the GES is a sample of crashes that are reported to the police, but many crashes, especially those that involve property damage only, are not reported. Second, the GES systematically undersamples injuries (Blincoe et al., 2002). Third, given that coding of injuries is made by police officers, as explained above, it is highly probable that some uninjured will be coded as injured and vice versa. To address these shortcomings, we inflated weights in the CDS/NASS file with inflators by AIS from Blincoe et al. (2002). These inflators account for unreported crashes and the undersampling of injuries. After calculating the ratios of inflated vs. uninflated counts by KABCO, we merged them onto the GES file. Further, we estimated from the CDS/NASS the mean numbers of injured (as defined by the more accurate AIS scale) by KABCO and merged them onto the GES file (e.g, the mean number of injured for O – no injury – was 0.05 and for A – incapacitating injury – was 0.87, which means that for every 100 people reported by the police as non-injured, 5 actually were injured, and for every 100 people reported as severely injured, 87 were actually injured). Finally, we adjusted GES weights with the above factors to estimate the number of non-fatal crashes and injuries.

We used NHTSA's 2006 Fatality Analysis Reporting System (FARS) to calculate the incidence of fatal crashes and deaths. Because very few fatal crashes in the District of Columbia involved a driver ages 15-17, we report its average annual incidence for 2004-2006. FARS is a census of all fatal crashes in the U.S. and like GES, uses the KABCO severity scale to classify the injuries of crash

victims. Therefore, we multiplied its injury counts in fatal crashes times costs per crash survivor by KABCO, estimated from fatal crashes in CDS/NASS.

GES, being a national sample, does not estimate crash incidence and severity by State. Therefore, we used the State distribution of fatal crashes to extrapolate the incidence and severity distribution of non-fatal crashes by State. We used 2004-2006 FARS fatal crash counts involving a driver ages 15-17 by state to apportion the incidence and costs of crashes with drivers ages 15-17 among states.

Results

Table 1 shows that approximately 1 million crashes in 2006 in the U.S. involved teen drivers ages 15-17 years. Among these crashes, there were 2.0 multi-vehicle crashes per each single-vehicle crash and 2.5 male teen driver related crashes for each crash in which a female teen driver was involved. Incidence differences were the main drivers of total costs for different types of crashes; the costs per crash did not differ noticeably among crash types.

California, Texas, and Florida were by far the states with highest societal costs from such crashes (Table 2). However, the total costs for these States seem to have been driven mostly by their large population of teens. Wyoming, Alabama, and Mississippi were the States with the highest cost per resident ages 15-17. None of those three states had graduated licensing laws.

Crashes involving drivers ages 15-17 caused 2,541 deaths in 2006 (Table 3). Similarly to the incidence of crashes, there were 2.1 male teen driver related deaths for each death in a female teen driver related crash. Again, that was the main driver of total costs for deaths in this type of crash because the costs per death did not differ noticeably among crash types. On the other hand, deaths were distributed evenly between single- and multi-vehicle crashes.

Crashes involving drivers ages 15-17 in 2006 (Table 4) caused an estimated 406 thousand injuries. Similarly to the incidence of crashes, there were 2.3 multi-vehicle crash injuries per each single-vehicle crash injury and there were 2.7 male teen driver related injuries for each injury in a female teen driver related crash. Again, that was the main driver of total costs for the injuries in these two types of crashes because the costs per injury did not differ noticeably among crash types.

Table 1. The U.S. Societal Cost of Crashes Involving Drivers Ages 15-17, 2006
(In million dollars, except costs per crash and per resident)

Crash Type	Number of Crashes	Medical Cost	Work Loss	Property Damage	QALYs	Other Costs	Total Cost
All Crashes	974,000	2,643	11,188	3,874	11,558	5,150	34,413
Multi-Vehicle Crashes	644,711	1,779	7,050	2,637	7,410	4,024	22,900
Single-Vehicle Crashes	329,289	864	4,137	1,236	4,147	1,126	11,510
Male Teen Driver Crashes	692,861	1,946	8,046	2,862	8,116	3,787	24,757
Female Teen Driver Crashes	281,139	697	3,142	1,012	3,441	1,364	9,656

Table 2. State Societal Cost of Crashes Involving Drivers Ages 15-17, 2006
(In million dollars, except costs per crash and per resident)

State	Number of Crashes	Medical Cost	Work Loss	Property Damage	QALYs	Other Costs	Total Cost M of \$
Alabama	32,551	110	353	135	365	185	1,148
Alaska	1,964	9	23	11	24	13	80
Arizona	23,852	86	242	99	250	117	794
Arkansas	17,117	40	157	64	163	75	499
California	66,785	211	884	343	911	461	2,810
Colorado	17,258	55	229	70	237	92	683
Connecticut	6,735	19	97	30	100	39	285
Delaware	4,069	15	54	20	55	25	169
Dist of Columbia	561	1	9	3	10	3	26
Florida	65,102	187	731	264	756	337	2,275
Georgia	38,023	95	411	141	425	179	1,251
Hawaii	2,245	8	25	14	26	18	91
Idaho	7,576	25	74	32	76	40	247
Illinois	34,655	102	461	135	476	179	1,353
Indiana	27,780	64	296	97	306	132	895
Iowa	13,189	29	149	47	154	65	444
Kansas	14,031	34	155	51	161	66	467
Kentucky	23,571	52	232	79	240	106	709
Louisiana	18,520	38	189	71	196	94	588
Maine	6,033	13	64	23	67	31	198
Maryland	16,135	40	224	58	231	80	633
Massachusetts	10,944	40	168	54	173	72	507
Michigan	29,184	70	352	116	363	160	1,061
Minnesota	20,064	50	260	78	268	105	761
Mississippi	24,133	65	208	88	216	116	693
Missouri	33,814	93	390	124	404	164	1,175
Montana	3,929	9	37	14	38	18	116
Nebraska	10,102	26	117	34	121	46	344
Nevada	7,436	24	87	33	90	40	274
New Hampshire	4,209	7	54	15	55	22	153
New Jersey	11,645	38	186	60	192	82	558
New Mexico	9,120	26	81	35	84	46	272
New York	26,097	84	364	142	376	200	1,166
North Carolina	36,620	78	382	131	395	181	1,167
North Dakota	4,069	7	40	12	41	17	117
Ohio	32,551	81	315	122	325	165	1,008
Oklahoma	19,222	46	191	71	198	92	598

Oregon	8,278	25	95	34	98	50	302
Pennsylvania	33,252	82	403	133	412	174	1,204
Rhode Island	2,385	6	29	11	30	16	92
South Carolina	20,204	49	198	77	205	100	629
South Dakota	5,191	11	56	17	58	24	166
Tennessee	29,885	75	333	105	344	141	998
Texas	71,696	181	828	267	854	362	2,492
Utah	9,260	31	91	41	94	51	308
Vermont	2,666	6	29	11	30	15	91
Virginia	23,291	62	295	81	306	116	860
Washington	12,066	39	155	53	160	70	477
West Virginia	7,296	18	65	24	67	33	207
Wisconsin	23,431	67	271	86	281	114	819
Wyoming	4,209	14	49	18	51	21	153

Table 3. The U.S. Societal Cost of Deaths in Crashes Involving Drivers Ages 15-17, 2006
(In million dollars)

Crash Type	Deaths	Medical Cost	Work Loss	Property Damage	QALYs	Other Costs	Total Cost	Cost per Death (\$)
Fatally Injured People	2,541	82	2,850	31	6,410	385	9,757	3,841,522
In Multi-Vehicle Crashes	1,252	40	1,404	15	3,157	197	4,813	3,847,415
In Single-Vehicle Crashes	1,289	42	1,446	16	3,253	188	4,944	3,835,804
In Male Teen Driver Crashes	1,716	55	1,925	21	4,329	259	6,588	3,841,667
In Female Teen Driver Crashes	825	27	925	10	2,081	126	3,169	3,840,738

Table 4. The U.S. Societal Cost of Injuries in Crashes Involving Drivers Ages 15-17, 2006
(In million dollars)

Crash Type	Non-Fatal Injuries	Medical Cost	Work Loss	Property Damage	QALYs	Other Costs	Total Cost	Cost per Injured person (\$)
Non-Fatally Injured People	406,437	2,463	7,763	1,529	4,784	3,992	20,530	50,512
In Multi-Vehicle Crashes	297,742	1,680	5,264	1,044	4,028	3,216	15,232	51,157
In Single-Vehicle Crashes	108,696	783	2,499	486	755	776	5,299	48,748
In Male Teen Driver Crashes	297,742	1,824	5,710	1,131	3,544	2,960	15,169	50,947
In Female Teen Driver Crashes	108,696	638	2,053	398	1,240	1,032	5,361	49,321

Table 5. State Deaths and Injuries in Crashes Involving Drivers Ages 15-17, 2006

State	Deaths	Injuries
Alabama	98	13,583
Alaska	7	820
Arizona	61	9,953
Arkansas	40	7,143
California	177	27,869
Colorado	41	7,201

Connecticut	13	2,810
Delaware	5	1,698
Dist of Columbia	1*	234
Florida	169	27,166
Georgia	103	15,866
Hawaii	5	937
Idaho	20	3,162
Illinois	109	14,461
Indiana	64	11,592
Iowa	37	5,503
Kansas	34	5,855
Kentucky	66	9,836
Louisiana	47	7,728
Maine	23	2,518
Maryland	34	6,733
Massachusetts	29	4,567
Michigan	67	12,178
Minnesota	54	8,372
Mississippi	59	10,070
Missouri	90	14,110
Montana	11	1,639
Nebraska	33	4,215
Nevada	18	3,103
New Hampshire	7	1,756
New Jersey	40	4,859
New Mexico	23	3,806
New York	64	10,890
North Carolina	93	15,281
North Dakota	16	1,698
Ohio	84	13,583
Oklahoma	46	8,021
Oregon	17	3,454
Pennsylvania	73	13,876
Rhode Island	5	995
South Carolina	64	8,431
South Dakota	16	2,166
Tennessee	75	12,471
Texas	174	29,918
Utah	26	3,864
Vermont	7	1,112
Virginia	59	9,719
Washington	47	5,035
West Virginia	21	3,044
Wisconsin	58	9,777
Wyoming	11	1,756

*Average of 2004-06

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