Trends in Fatalities From Distracted Driving in the United States, 1999 to 2008

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Objectives. We examined trends in distracted driving fatalities and their relation to cell phone use and texting volume.

Methods. The Fatality Analysis Reporting System (FARS) records data on all road fatalities that occurred on public roads in the United States from 1999 to 2008. We studied trends in distracted driving fatalities, driver and crash characteristics, and trends in cell phone use and texting volume. We used multivariate regression analysis to estimate the relation between state-level distracted driving fatalities and texting volumes.

Results. After declining from 1999 to 2005, fatalities from distracted driving increased 28% after 2005, rising from 4572 fatalities to 5870 in 2008. Crashes increasingly involved male drivers driving alone in collisions with roadside obstructions in urban areas. By use of multivariate analyses, we predicted that increasing texting volumes resulted in more than 16 000 additional road fatalities from 2001 to 2007.

Conclusions. Distracted driving is a growing public safety hazard. Specifically, the dramatic rise in texting volume since 2005 appeared to be contributing to an alarming rise in distracted driving fatalities. Legislation enacting texting bans should be paired with effective enforcement to deter drivers from using cell phones while driving. (*Am J Public Health.* 2010;100:2213–2219. doi:10.2105/AJPH.2009.187179)

Concern is growing about the dangers of distracted driving, as underscored during a 2010 national summit that brought together safety experts, industry leaders, and several US senators to address the hazards of driving while distracted and to examine possible regulatory solutions. This concern is further underscored by the growing number of communities that are contemplating or implementing bans on cell phone use while driving. The Alliance of Automobile Manufacturers, which represents 11 major car companies, and the American Automobile Association joined this debate by announcing support for bans on the use of handheld devices while driving.[1,2]

Given the increasing visibility of the issue of distracted driving in the media and among policymakers, a need exists for data to inform public policy on this important public health issue. In 2008, approximately 1 in 6 fatal vehicle collisions resulted from a driver being distracted while driving.[3] The causes of distraction have recently been debated, and several studies implicated the use of cell phones or sending text messages while driving. For example, studies using a naturalistic methodology suggested that relative to nondistracted drivers, those drivers who text are 23 times as likely to crash.[4] Laboratory and naturalistic studies showed that talking on a cell phone raises the risk of collision by more than 30%.[4] Although compelling naturalistic and laboratory data suggest that handheld devices are a driving hazard, no population-based studies of distracted driving, particularly on the magnitude of traffic deaths associated with handheld devices, have been carried out.[5–13]

We examined trends in vehicle fatalities resulting from distractions by using a national database on all vehicular fatalities occurring on public roads in the United States. Trend data on cell phone subscriber and monthly texting volumes complemented the fatality data to provide an estimate of the relation between distracted driving fatalities and the use of handheld devices. We examined whether increasing cell phone use and texting volume may explain recent trends in distracted driving fatalities.

METHODS

The Fatality Analysis Reporting System (FARS) database contains detailed demographic and crash information on every accident that occurs on a public road in the United States that results in at least 1 fatality. To be recorded in FARS, a fatality must occur within 30 days of the corresponding crash. Information is collected from a variety of sources, including police reports, state registration files, state licensing files, vital statistics, death certificates, hospital medical records, and emergency medical or coroner reports. We examined the 10-year period from 1999 to 2008.

For each accident, FARS provides information on driver-related factors. A fatality was defined as being caused by distraction if a driver-related accident factor was recorded as being emotional, inattentive, or careless, or using a cellular phone, computer, or fax machine, or on-board navigation or heads-up display system. Inattentive or careless behavior included talking, eating, reading, using cell phones, text messaging, and using global positioning systems or other devices. This definition of distracted driving is used by the National Highway Traffic Safety Administration.[3] A total of 51 857 fatalities caused by driver distraction occurred from 1999 to 2008, according to FARS data.

Cell phone subscriber data were available from the US Federal Communications Commission's Wireline Competition Bureau.[14] Subscriber data included the total number of mobile wireless phone subscribers for each state in the United States. All local telephone carriers are required to report subscriber information to the Federal Communications Commission. The data were collected twice a year in June and December from 2001 to 2007. We collected information on text messaging volume from Commercial Mobile Radio Services Competition

Reports, which are annual reports submitted to Congress by the Federal Communications Commission, and from the semiannual wireless industry survey conducted by CTIA, the international association for the wireless telecommunications industry (formerly the Cellular Telephone Industries Association).[15] The average number of monthly SMS (short message service) or text messages sent in a year in the United States was available from 2002 to 2007. Most of the growth in messaging took place during this period. Unfortunately, state-level texting volume data were unavailable. We estimated state texting volume by multiplying each state's numbers of subscribers every 6 months by the national average of text messages per subscriber. We used these semiannual estimates on state texting volume in multivariate analyses for the period from 2002 to 2007.

We used state-level data on monthly average inches of precipitation and degrees of temperature for the continental United States in the analyses because climate is an important factor in the likelihood of driving and having a collision. These data are available from the National Climactic Data Center, part of the National Oceanic and Atmospheric Administration.

We presented the average number of annual fatalities from distracted driving, and driver and crash characteristics, for each year. We also examined trends in fatalities, cell phone subscribers, and text messaging graphically. We examined the relation between state-level semiannual text messaging volumes and the number of fatalities by using linear multivariate regression analyses adjusted for average precipitation in inches, temperature in degrees, percentage of state vehicle miles traveled on urban roadways, total state vehicle miles traveled, state unemployment rate, region, and year. Climate data were available only for the continental United States, and texting data were available from 2002 to 2007. We used Stata 10.1 to perform all analyses (StataCorp, College Station, TX).

RESULTS

The descriptive statistics of distracted fatalities and driver characteristics by year are presented in Table 1. Distracted deaths as a share of all road fatalities increased from 10.9% to 15.8% from 1999 to 2008, and much of the increase occurred after 2005. Fatalities related to distracted driving increased 28.4% from 2005 to 2008, rising to 5870 in 2008. Drivers in distracted fatal crashes were more likely to be male, White, non-Hispanic, and younger, but were less likely to have previous driving violations. However, significant changes in demographic characteristics occurred recently. The percentage of distracted drivers who were male gradually increased from 70.3% to 74.0% from 1999 to 2008. After declining nearly 10% from 1999 to 2006, the percentage of distracted drivers who were non-Hispanic Whites increased from 72.9% in 2006 to 76.4% in 2008. The

TABLE 1—Distracted Driving Fatalities in the United States, by Driver and Crash Characteristics: Fatality Analysis Reporting System, 1999–2008

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Distracted driving fatalities, no.	4563	4606	4611	5008	5744	4978	4572	5917	5988	5870
Proportion of all fatalities, %	10.9	11.0	10.9	11.6	13.4	11.6	10.5	13.9	14.6	15.8
Driver's gender, %										
Male	70.3	71.4	70.4	70.9	72.7	71.6	71.9	73.1	73.3	74.0
Female	29.7	28.6	29.6	29.1	27.3	28.4	28.1	26.9	26.7	26.0
Driver's race/ethnicity, %										
White, non-Hispanic	80.6	80.2	77.7	75.9	74.6	75.2	76.1	72.9	73.6	76.4
Hispanic	9.2	7.1	10.1	10.6	11.1	10.7	10.3	11.4	12.6	9.0
Black	7.0	9.1	9.6	10.6	10.7	11.1	9.4	12.4	10.2	11.4
Other	3.2	3.7	2.6	2.9	3.6	3.1	4.2	3.2	3.6	3.2
Driver's age, y, mean	40.0	39.5	39.3	38.7	39.6	39.8	39.3	38.9	39.1	39.4
Driver's age, %										
16–29 y	38.2	39.6	38.5	39.9	37.7	37.8	38.3	39.8	39.5	39.0
30–49 y	34.1	33.4	35.4	35.0	35.8	34.4	33.8	34.0	33.5	33.2
≥50 y	27.7	27.0	26.1	25.1	26.5	27.8	27.8	26.3	27.0	27.8
Driver's previous violation, %										
Yes	43.2	45.2	44.2	42.8	42.4	40.9	39.8	39.9	43.0	44.7
No	56.8	54.8	55.8	57.2	57.6	59.1	60.2	60.1	57.0	55.3
Driving alone, %										
Yes	60.4	58.7	59.6	59.8	61.3	61.5	63.8	64.4	66.1	65.5
No	39.6	41.3	40.4	40.2	38.7	38.5	36.2	35.6	33.9	34.5
Drinking alcohol while driving,[a] %										
Yes	26.0	26.9	27.1	28.1	25.8	24.6	24.5	25.9	28.1	30.8
No	74.0	73.1	72.9	71.9	74.2	75.4	75.5	74.1	71.9	69.2
Type of collision, %										
Rear-end	11.6	12.2	10.7	12.0	11.3	10.6	12.6	12.4	12.7	11.8
Head-on	12.1	12.4	14.0	10.9	11.7	10.0	10.8	10.0	9.1	9.2
Other[b]	23.1	22.6	22.0	24.4	26.0	24.5	24.4	22.6	20.1	19.9
Nonvehicular[c]	53.2	52.8	53.3	52.8	51.1	54.8	52.2	55.0	58.1	59.1
Location of crash, %										
Rural area	67.3	66.8	66.0	65.6	62.2	65.6	65.9	61.8	59.9	60.2
Urban area	32.7	33.2	34.0	34.4	37.8	34.4	34.1	38.2	40.1	39.8

[a]Drinking alcohol while driving determination was based on blood alcohol content testing or police-reported intoxication of the driver.
[b]Other includes vehicular collisions in which the crash vehicles impacted each other at an angle, sideswipe, rear-to-side, rear-to-rear, or end-swipe.
[c]Nonvehicular includes collisions that did not involve other moving vehicles. These collisions included impact with parked cars, trees, lamp posts, medians, and so forth.

percentage of distracted drivers aged 29 years or younger declined from 1999 to a low of 37.7% in 2003. After 2003, this percentage increased, reaching 39% of distracted drivers in 2008. By comparison, drivers involved in nondistracted fatal crashes were less likely to be younger than 30 years (32.8% vs 39.0% for distracted drivers), with an average age in 2008 of 41.3 years versus 39.4 years for distracted drivers. The proportion of distracted drivers with a previous moving violation declined from 1999 to 2005 but this proportion increased rapidly from 2006 to 2008, rising to 44.7% in 2008 from 39.9% in 2006. Although the percentage of total road fatalities from drinking while driving remained nearly constant at about 30% from 1999 to 2008, the proportion of distracted drivers who were also drinking alcohol while driving actually increased from 26% to 30.8% in 2008.

Other crash characteristics examined in Table 1 included whether there were any passengers with the distracted driver, the type of collision, and the urban or rural location of the crash. The percentage of individuals driving alone while distracted increased from 60.4% to 65.5% from 1999 to 2008. Crashes not involving other moving vehicles increased nearly 16% since 2003, from 51.1% of crashes to 59.1% in 2008. Although the percentage of rear-end collisions did not vary significantly after 1999, the percentage of head-on collisions declined from 12.1% of all crashes to 9.2% from 1999 to 2008, and other crash types declined from 23.1% of all crashes to 19.9%. Finally, more distracted crashes occurred in urban areas. The percentage of crashes in urban areas increased by more than 20%, rising from 32.7% of all crashes in 1999 to nearly 40% in 2008. Fatalities not involving distracted driving were more likely to occur on urban roads than were distracted driving deaths (45.1% in 2008 vs 39.8% in 1999) and were less likely to involve rear-end collisions (5.2% vs 11.8%).

Trends in the share of traffic fatalities that resulted from distracted driving and the total number of cell phone subscribers per capita for each year are presented in Figure 1. Cell phone subscriber rates increased fairly steadily, growing an average of 12.6% annually. In 1999, about 1 in 3 persons on average had a cell phone subscription compared with

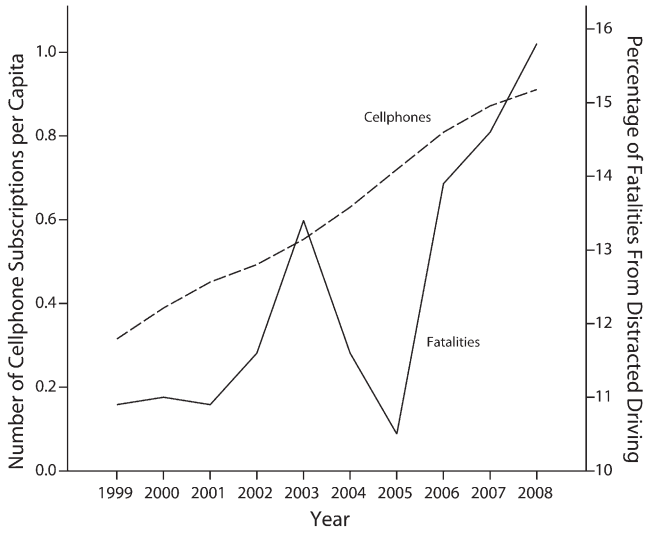


FIGURE 1—Percentage of fatalities resulting from distraction and number of cell phone subscriptions per capita, by year: Fatality Analysis Reporting System, 1999–2008.

91% of all persons by 2008. This linear trend in cell phone subscriptions from 1999 to 2008 stood in stark contrast with the uneven trend in distracted driving deaths from 1999 to 2005. Reasons for the sharp declines in fatalities in 2004 and 2005 are unclear. However, it seems unlikely that the steady growth in cell phone subscribership was responsible for the volatility in fatalities during this period.

Shares of distracted driver fatalities with average number of monthly text messages sent in the United States each year are shown in Figure 2. In 2002, an average of 1 million text messages were sent monthly, or 7.2 text messages per 1000 subscribers. By 2008, the monthly volume had increased to about 110 million messages, for an average of 397 monthly text messages per 1000 subscribers. The largest percentage of increases in texting volumes occurred after 2006, with texting volume per subscriber rising by 136% from 2006 to 2007 and by 117% from 2007 to 2008. By contrast, cell phone subscriptions per capita increased 7.8% from 2006 to 2007 and 4.5% from 2007 to 2008.

We used multivariate regression to estimate the number of distracted driving fatalities that would have occurred in the United States during the period 2002-2007 if text message volumes had been zero. Volume data were not available for 2008 or before 2002. Data were available semiannually for each state in the United States from 2002 to 2007. We adjusted the multivariate regression estimates for climate (mean inches of precipitation and degrees of temperature), state unemployment rate, percentage of urban miles versus rural vehicle miles traveled, total vehicle miles traveled, region, and year. The actual number of fatalities and the number of fatalities from distracted driving predicted by use of multivariate regression estimates are presented in Figure 3. The regression estimates suggested that distracted driving fatalities would increase 75.6% in an average state for every 1 million additional text messages sent per month. In fact, estimated monthly texting volumes increased from 19 500 texts for the average state in 2002 to more than 2 million monthly texts per state in 2008. The data presented in Figure 3 suggested that if texting volumes were zero after 2001, predicted fatalities from distracted driving would have declined from 4611 to 1925 per year from 2001 to 2007. This compares to the actual increase from 4611 fatalities in 2001 to 5988 in 2007 in the United States, a 30% increase. Overall, the regression analysis predicted that the increase in texting volumes after 2001 resulted in 16 141

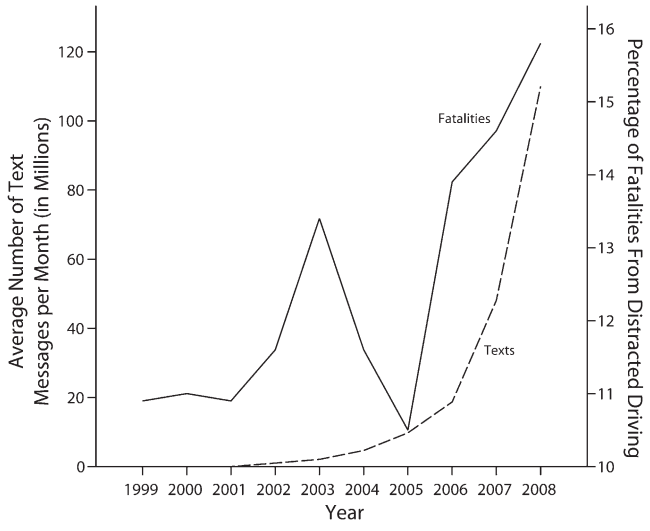


FIGURE 2—Percentage of fatalities resulting from distraction and average number of monthly text messages sent (in millions), by year: Fatality Analysis Reporting System, 1999–2008.

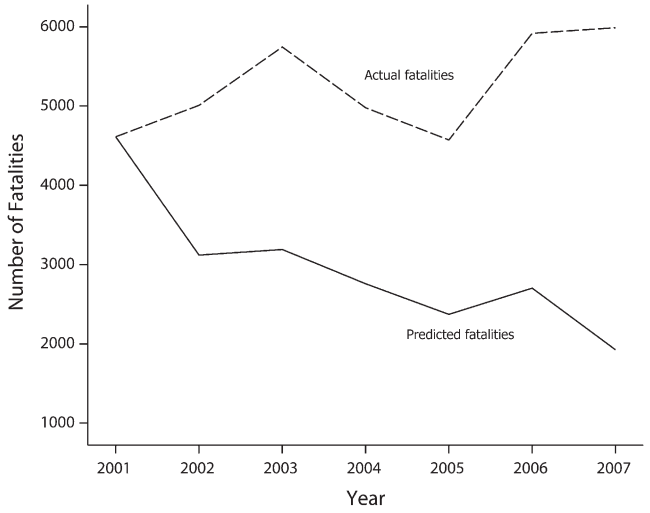
additional distracted driving fatalities for the years 2002-2007. A multivariate regression of distracted driving deaths and cell phone subscribers showed that 1 million additional cell phone subscribers would result in 19.0% more fatalities for the average state. This prediction implied a smaller, though significant, impact upon fatalities compared with increases in monthly texting volumes.

DISCUSSION

In this study, we were the first to examine and empirically test the relations between national trends in road fatalities, cell phone subscriber rates, and estimated text message volumes. After trending downward from 1999 to 2005, distracted driving fatalities rapidly increased in numbers and as a share of all road fatalities after 2005. The characteristics of distracted drivers also changed recently, with drivers becoming increasingly likely to be male with previous driving violations and to be driving alone. Nonvehicular crashes have also become more typical since 1999. Urban areas saw an increasing share of distracted driving fatalities. The increase in distracted driving fatalities from 2005 to 2008 may have been a result of the rapid increases in text messaging volumes during this period. Multivariate regression analysis suggested that upward trends in text messaging resulted in thousands of additional fatalities from distracted driving since 2001.

Current research on the risks of cell phone use while driving has not examined reported road fatalities occurring from distraction. Studies largely used driving simulators, test tracks, and naturalist methodologies to show how driving is affected by different distractions such as talking on cell phones or texting.[3–12,16] While a driver is talking on a cell phone, the driver's eyes may remain fixed on the road, but sending and reading text messages requires a driver to take his or her eyes away from the road. Thus, texting while driving is much more hazardous than talking on a cell phone while driving. In another example, 1 study using driving simulators and iPod (Apple Inc., Cupertino, CA) interactions found that drivers manipulating an iPod glanced away from the road more than twice as long as when they were not using an iPod.[17]

Cell phone subscriber rates have increased significantly since the 1990s, and that rate of increase was steady throughout much of the 2000s. However, the rapid increase in distracted driving deaths in recent years was more consistent with national trends in monthly texting volumes than with trends in cell phone subscriptions. In fact, the National Highway Traffic Safety Administration reports that 6% of US drivers are observed using a cell phone, a percentage unchanged since 2005.[18] The increase in traffic fatalities since 2005 appears to be related to a shift in how handheld devices are used; such devices require more consistent interaction. In addition to lower attention given to



Note. Estimates were based on multivariate regression analysis adjusting for average inches of precipitation, average temperature, state unemployment rate, percentage of urban vs rural vehicle-miles traveled, total vehicle-miles traveled, region, and year.

FIGURE 3—Predicted number of distracted driving fatalities without text messaging compared with the actual number of fatalities: Fatality Analysis Reporting System, 2001–2007.

the task of driving—the problem identified with talking on a cell phone—the use of other handheld devices diverts a driver's eyes away from the road. Although cell phones have saturated the market with subscriptions per capita reaching 90%, the market is growing for smart phones and other handheld devices, given the increasing popularity of texting, social networking sites, and applications. Smart phones such as the iPhone (Apple Inc., Cupertino, CA) provide Internet browsing and access to a variety of applications such as games and navigation programs. Many of these applications involve the same inherent hazard as text messaging while driving, because the applications divert a driver's eyes away from the road.[17]

Since 2003, the percentage of distracted drivers aged 29 years or younger involved in fatal crashes has increased slightly, and nearly 2 out of 5 drivers in distracted driving fatal accidents were younger drivers in 2008. Results from national surveys commissioned by the AAA Foundation for Traffic Safety show that 14% of drivers reported text messaging use while driving in the previous 30 days. Nearly half of these drivers were younger than 25 years of age and they were more likely to be male.[19] Both are consistent with our results showing that distracted drivers are younger on average than drivers involved in other types of fatal crashes, and that distracted drivers are increasingly likely to be male.

We expected that a driver would be less likely to text message if there were other passengers in the vehicle, and our results suggested that the number of distracted driving fatalities involving individuals driving alone has increased steadily since the early 2000s. Drivers may be more likely to text when alone and bored, but are perhaps more likely to have a passenger use their cell phone to text if needed. In fact, research suggests that people generally drive more safely in the presence of passengers, although adolescent drivers may increase their risky behaviors in the presence of other adolescent passengers.[20–29] Interestingly, the number of fatal crashes from distraction involving collisions with parked cars, trees, lamp posts, and other nonvehicular collisions has increased rapidly since the mid-2000s. Such crashes also increased in frequency on urban roadways, where the risks of having an accident while using a cell phone are much greater.

The proportion of distracted drivers who were also drinking alcohol at the time of a fatal accident increased by 26% since 2005. However, the percentage of total road fatalities involving alcohol-impaired drivers remained nearly constant since 1999. This suggests that the availability of handheld electronic devices is compounding the hazards of drinking while driving, because alcohol-impaired drivers may be less inhibited from trying to use handheld devices while driving. In addition, impairment of physical motor skills when intoxicated means that manipulation of cell phones or texting will be more difficult, will take longer to perform, and thus will result in longer periods of distraction for intoxicated drivers compared with nonintoxicated drivers.

The results of the multivariate analysis suggested that if text messaging volumes were nonexistent after 2001, predicted fatalities from distracted driving in 2007 would have decreased by nearly two thirds from the actual total. Differences between predicted fatalities and actual fatalities also grew over time. Our findings showed road accidents caused by distracted driving to be a serious public health problem that is on the rise. The results from our study can be used to shape public policy on the use of handheld devices while driving. Effective policy interventions to reduce cell phone use and text messaging while driving may result in several thousand fewer vehicle fatalities each year.

Much discussion and media attention on the causes of distracted driving center on the use of cell phones and texting.[30] The Alliance of Automobile Manufacturers, which represents 11 of the largest international car companies, has called for a ban on handheld cell phone use while driving. Some car models use Bluetooth wireless technology, which allows hands-free cell phone use, but only 1 out of 3 US cars sold in 2009 had this feature.[31] Bluetooth technology is also limited to voice communication. New systems are currently being developed that will use Bluetooth and global positioning system technologies to allow parents to monitor their children while driving, and to prevent cell phone use, including texting, by their children while driving. Such technologies come at a time when several states and cities have passed bans or restrictions on the use of cell phones or texting while driving. For example, a driver in Utah who causes a fatal crash because of texting may now be charged with automobile homicide. A total prohibition of handheld cell phone use while driving exists in 8 states plus Washington, DC.[32] Total distracted driving fatalities decreased slightly from 2007 to 2008, perhaps because of more widespread and publicized prohibitions on cell phone use, but it is too early to conclude whether this is the start of a long-term trend.

Only 30 states currently have text messaging bans, however, and the effectiveness of using traffic citations to demotivate texting among drivers is unclear. For example, although New York was the first state to ban handheld cell phone use by drivers, 1 study showed that cell phone use there declined only temporarily. The authors attributed their findings to a lack of significant publicity and less than vigorous enforcement of the ban.[33] Unlike violations such as speeding or running a red light, for which there are numerous technological aids in traffic enforcement, catching drivers in the act of texting is difficult without close observation by police, or unless the person is observed to be driving erratically. Unlike a drunk driver, a texting driver may be observed to drive normally for long periods of time before exhibiting sudden, erratic driving because of texting. Drunk drivers may also be caught at police checkpoints, and intoxication can be objectively measured with breathalyzers, for example. By contrast with established methods of detecting drunk drivers, there are no proven protocols for the detection of texting drivers; this factor creates difficulties for law enforcement, and may potentially result in significant underreporting of distracted driving. Utah has attached severe criminal penalties for causing a fatal accident while texting and, in 1 case, police investigators there used cell phone records to demonstrate that a driver was texting at the time of a fatal crash.[34] Criminal charges for texting while driving and routine examination of cell phone records in accident investigations may act as effective deterrents to drivers with cell phones.

Limitations

Our results had several limitations. First, although we had national data on average monthly texting volumes, our state-level texting volumes were estimates based on average national texting volumes per cell phone subscriber and state-level cell phone

subscribership. We do not believe that the number of texts sent per cell phone subscriber varied systematically by state, and thus, our estimates of state-level texting volumes were likely to be fairly accurate. Furthermore, accurate data on state texting volumes would likely strengthen our multivariate findings by increasing the statistical significance of texting volume on fatalities if our measure of state texting volume had measurement error. A second limitation was that the FARS database does not specify whether a distracted driving fatality resulted from texting while driving or from other types of distraction. However, our findings suggest that increases in distracted driving fatalities are consistent with the rapid increase in texting volumes occurring in the United States in recent years. A third limitation was the absence of injuries in our analysis. Factors that increase the number of fatalities in car crashes are also likely to increase crash injuries by a proportional degree. Therefore, we believe our findings have strong implications for injury rates arising from distracted driving. A survey of police-reported road accidents suggested that injuries from distraction have decreased from 26% of all crash injuries in 2004 to 22% in 2008.[13] This decrease suggests, perhaps, that distracted driving crashes have become more likely to be fatal in recent years. Finally, we did not have data on texting volumes before 2002. However, the years following 2002 captured most of the growth in texting volumes that occurred in the United States, and thus, we do not believe this was a significant limitation.

Conclusions

Fatal crashes resulting from driver distraction have increased in recent years. Much attention from the media and policymakers has focused on the use of cell phones and texting while driving as serious public threats. Several states have already banned texting or cell phone use by drivers, and momentum for federal legislation seems to be increasing. We used data on all fatal vehicle accidents occurring on public roads in the United States to document the trends in fatalities and characteristics of distracted drivers involved in fatal crashes. Our results suggested that recent and rapid increases in texting volumes have resulted in thousands of additional road fatalities yearly in the United States. Legislation enacting texting bans should be paired with effective enforcement to deter drivers from the use of handheld devices while driving. Requiring standard new-car options such as Bluetooth or other automobile technologies that inhibit handheld cell phone use should also be considered. ■

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Contributors

F. A. Wilson originated the study, led the writing, and completed the analyses. J. P. Stimpson assisted with the study and the analyses.

Human Participant Protection

No protocol approval was needed for this study because data were obtained from secondary sources.

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