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Contents lists available at SciVerse ScienceDirect

Accident Analysis and Prevention

journal homepage: www.elsevier.com/locate/aap

Pedestrian injuries due to mobile phone use in public places

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ARTICLE INFO

Article history:

Received 23 July 2012

Received in revised form 18 March 2013

Accepted 21 March 2013

Keywords:

Distraction

Cell phone

Safety

Situation awareness

Distracted drivers

Accidents

ABSTRACT

Research shows that pedestrians, similar to drivers, experience reduced situation awareness, distracted attention and unsafe behavior when talking or texting on their mobile phones. The present study centered on injuries related to mobile phone use among pedestrians. It used data from the US Consumer Product Safety Commission on injuries in hospital emergency rooms from 2004 through 2010. It found that mobile-phone related injuries among pedestrians increased relative to total pedestrian injuries, and paralleled the increase in injuries for drivers, and in 2010 exceeded those for drivers. Pedestrian injuries related to mobile-phone use were higher for males and for people under 31 years old. Using a mobile phone while walking puts pedestrians at risk of accident, injury or death.

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1. Introduction

1.1. Mobile phone use and distraction among drivers and pedestrians

“21 year old male was hit by a car while crossing a street and talking on his cell phone. Sprained elbow and lumbosacral sprain.” (U.S. Consumer Product Safety Commission, 2011)

Mobile phone subscriptions in the U.S. have increased from approximately 340,000 in 1985 to 302.9 million subscribers in 2010 (CTIA-The Wireless Association, 2011). The exponential increase in use combined with large numbers of people using mobile phones while driving – estimated at 745,000 drivers in the U.S. using handheld phones at any given daylight moment (Glassbrennen and Ye, 2007) – has stimulated concerns about safety. Studies show slowed reaction times, increased distraction and motor vehicle collisions associated with mobile phone use (Caird et al., 2008; Drews and Strayer, 2009; Strayer and Johnston, 2001). The studies also show that the decrement in driver performance stems more from the distraction from the driving task than to the medium – hands free or handheld (Drews et al., 2009; Hosking et al., 2009; Ishigami and Klein, 2009; Owens et al., 2011; Patten et al., 2004; Svenson and Patten, 2005). Although mobile phones have some positive effects on safety, allowing people to summon help (Nasar et al., 2007), now

with mobile phone use in excess of the critical mass of 100 million users, the life-taking effect dominates (Loeb and Clarke, 2009).

Research has also found reduced situation awareness and distracted attention among pedestrians using mobile phones (Hatfield and Murphy, 2007; Hyman et al., 2010; Nasar et al., 2008; Stavrinou et al., 2011). One study gave 30 pedestrians mobile phones to talk on and another 30 pedestrians mobile phones to hold while walking on a prescribed route, along which the research team planted five obtrusive objects (Nasar et al., 2008). Pedestrians conversing on the mobile phones recalled fewer of the objects than did those holding a phone but not conversing. A pair of observational studies of pedestrians confirmed a lack of situational awareness or inattention blindness; the cell phone users walked more slowly, changed directions more frequently, were less likely to acknowledge other people, and were less likely to notice a clown on a unicycle on their route (Hyman et al., 2010). Finally, a pair of studies of college pedestrians in immersive virtual environments found greater distraction among those in a mobile phone conversation than others (Stavrinou et al., 2011).

As with drivers, the distracted attention from cell phone use among pedestrians threatens their safety. Research points to the likelihood of injuries related to cell phone use among pedestrians. Observations of 270 women and 276 men crossing streets found that women talking on mobile phones crossed more slowly, and were less likely to wait for traffic while crossing than women not using mobile phones; and men talking on a mobile phone crossed more slowly at crossings without signals (Hatfield and Murphy, 2007). Observations of 127 pedestrians at crosswalks found that pedestrians talking on mobile phone were more likely to cross

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unsafely than pedestrians using i-pods or pedestrians with no mobile technology (Nasar et al., 2008). A study in virtual environments found that pedestrians distracted by music or texting were more likely than pedestrians talking or undistracted to be hit by a vehicle (Schwebel et al., 2012). Similar results apply for children in virtual environments. Those 10–11 year old children, who were distracted by mobile phones were less attentive to traffic, less safe in crossing, and had more collisions and close calls than did children without distractions (Stavrinos et al., 2009). Although walking may be more natural than driving, thousands of pedestrians are killed or injured in traffic accidents (National Highway Traffic Safety Administration, 2006). Crossing a street, which is where most such accidents occur (daSilva et al., 2004), still requires cognitive attention (Hatfield and Murphy, 2007). Thus some of the pedestrian deaths or injuries probably resulted from their distracted attention from mobile phone use. For pedestrians, as drivers, mobile phone use probably increases the risk of accidents and personal injury.

1.2. Study aims

Given the evidence of distracted attention and risky behavior among pedestrians using cell phones, the present study sought to discover whether mobile phone use among pedestrians translated into pedestrian injuries. As mobile phone subscriptions have increased 20 million per year since the year 2000 (CTIA-The Wireless Association, 2011), we would expect to find an increase in injuries among pedestrians using mobile phones over time.

2. Materials and methods

2.1. Design

The study used the National Electronic Injury Surveillance System (NEISS) database to find the number of reported injuries due to cell phone use among pedestrians and drivers. NEISS, maintained by the U.S. Consumer Products Safety Commission, collects data from emergency rooms across the U.S. on product-related injuries. It includes all hospitals in the U.S. having an emergency room and six or more beds, but excludes psychiatric and penal institutions and hospitals. It groups the hospitals into five strata, four based on total number of reported emergency room visits and one for children's hospitals. Then, it uses the Keyfitz (1951) procedure for stratified random samples. The databases are available at the NEISS Query Builder website (U.S. Consumer Product Safety Commission, 2011). For the years between 2004 and 2010 (the most recent one for which data is available), we obtained data on injury accidents related mobile telephone use for motorized (automobiles, motorcycles, all-terrain vehicles, and mopeds) and non-motorized (pedestrians and bicyclers).

2.2. Data and data handling

The Consumer Product Safety Commission (U.S. Consumer Product Safety Commission, 2011) describes the NEISS data as follow. The NEISS samples approximately 100 hospitals to estimate the occurrences at the 3800 hospitals nationwide. Each reporting emergency department collects the data independently. During regular hours, a staff member records the patient's description of how the injury occurred on the patient's medical record. They can record up to two product codes that has a category for every consumer product, a two-line narrative of additional details about the incident and the specific product involved, and codes for the incident location (home, farm/ranch, street or highway, other public property, industrial place, school, and place of recreation or sports) and type (motorized and non-motorized). After hours, a staff member enters that data, based on the NEISS Coding Manual,

into the database, and the hospital then provides it to the Consumer Product Safety Commission (CPSC). Based on the size and location of the hospital and the type of cases normally reported by the hospital, the CPSC calculates weights. The weight, calculated each month, reflects the universe of hospitals (total number in the U.S.) divided by the total sample size, with adjustments for non-response, merged hospitals, and changes in sampling frame as shown in Eq. (1).

$$NEISS_{wt} = \frac{(N_h * n_h^i) R_h}{n_h * r_h} \quad (1)$$

where N_h = number of hospitals in the 1995 sampling frame for stratum h ; n_h = number of hospitals selected for the NEISS sample from stratum h ; n_h^i = number of in-scope hospitals in the NEISS sample for stratum h ; r_h = number of NEISS hospitals participating in stratum h for the given month; R_h = ratio of adjustment for combined stratum h .

For 2004 through 2010, the weights varied as follows for each stratum: small hospitals (67.64–72.21), medium hospitals (63.33–78.76), large hospitals (54.08–61.03), very large hospitals (14.97–16.43), and children's hospitals (5.45–6.53). Multiplying the numbers from the sampled hospitals by the weight yields an estimate of the number of cases in each hospital for each month. Using the weighting, the CPSC produces from the NEISS data an estimate of the total number of injuries in the entire country for each month. Annual estimates of injuries reflect the sum of those monthly estimates for the months of the year.

For data from seven years (2004–2010), we tallied and compared the CPSC national estimates of injuries related to mobile phone use for non-motorized (pedestrians and bicycles) users and motorized (automobiles, motorcycles, all-terrain vehicles, and mopeds) users. The product codes allowed us to search the database to find injuries related to telephone or telephone accessories (product code 550). The two-line narrative allowed us to select injuries related to mobile phone use and to find out how the injury occurred. The location code allowed us to eliminate injuries that occurred in the home, and focus on injuries in public places. Finally, the codes allowed us to select injuries for the motorized (automobiles, motorcycles, ATVs, moped) and non-motorized (pedestrians, bicycle, horse, skateboard, shopping cart, skiing). Most motorized injuries involved automobiles (98.2%); and most non-motorized injuries involved pedestrians (79%) and to lesser extent bicyclists (19%). In each case 2% or less related to non-automobile or non-pedestrian or non-bicycle injuries. We henceforth refer to the motorized category as drivers and the non-motorized category as pedestrians. We also report injuries by age and gender. We did not adjust the figures for differences in the exposure base. Doing so would require information on the number of drivers and pedestrians, the amount of time each spends walking or driving, and percentage of that time spent using a mobile phone.

3. Results

For 2010, the estimated the number of injuries due to mobile phone use among pedestrian in the United States was 1506. Consider some examples for pedestrians: "23 year old male walking on the middle line of the road talking on a cell phone and was struck by a car, contusion hip." "28 year old male walked into pole talking on phone and lacerated brow" "14 year old male walking down road talking on cell phone, fell 6–8 ft. off bridge into ditch with rocks and water, landed on chest/shoulder, chest wall contusion." The injuries ranged from serious to less serious and included concussions, seizures, fractures, contusions, lacerations, dislocations, abrasions, sprains, strains, and pains throughout the body (including injuries to the head, face, nose, neck, lower back, shoulder, humerus, arm,

Table 1
Percentage of total pedestrian and driver injuries related to mobile phones.

		National estimates						
		2004	2005	2006	2007	2008	2009	2010
Pedestrian injuries								
Year								
Total		97,000	69,000	60,000	54,000	53,000	54,000	41,000
With mobile phone		559	256	396	597	1055	1113	1506
Percentage of total		0.58%	0.37%	0.66%	1.11%	1.99%	2.06%	3.67%
Driver injuries								
Year								
Total		64,000	56,000	50,000	46,000	47,000	43,000	50,000
With mobile phone		314	585	567	819	1099	1336	1162
Percentage of total		0.49%	1.04%	1.13%	1.78%	2.34%	3.11%	2.32%

elbow, wrist, hand, finger, groin, hip, knee, foot, ankle, and toe). As expected, between 2004 and 2010, the number of estimated injuries for both pedestrians and drivers increased (Fig. 1). Estimated injuries for pedestrians and drivers each had a statistically significant upward trend (pedestrians: Kendall Tau = .81, $p < .01$; Drivers: Kendall Tau = .81, $p < .01$). Furthermore, while over time the estimates of total pedestrian injuries have decreased, estimates of the percentage of mobile-phone related pedestrian injuries have increased (Table 1). The increases each year relate in part to exposure (the number of people, the amount of time they spent walking and driving, and the percent of that time spent using a mobile phone while walking or driving). U.S. population has increased, cell phone use has increased yearly (Brenner, 2013), the number of drivers and amount of time spent driving has increased yearly (Federal Highway Administration, Office of Policy Information, 2010), more people walk than drive, and spend more time walking than driving each day (Bassett et al., 2010; Federal Highway Administration, Office of Policy Information, 2010). For pedestrians, the increased injuries averaged 186 cases per year (in spite of a drop of 303 injuries from 2004 to 2005). For drivers, between 2004 and 2010, the increases injuries averaged 163 injuries per year (in spite of a drop of 175 injuries from 2009 to 2010). The upward trends for pedestrians and drivers did not differ from one another. The trend for the driver minus pedestrian injuries revealed no statistically significant difference for a downward trend (Kendall Tau = -0.47 , $p = .12$), a two-sided trend (Kendall Tau = $-.14$, $p = .14$), or an upward trend (Kendall Tau = $.14$, $p = .65$). However, while total driver injuries exceeded total pedestrian injuries ($\chi^2(1) > 14.08$, $p < .001$), and in most years (2005, 2006, 2007, and 2008), driver injuries exceeded pedestrian injuries ($\chi^2(1) > 30.35$, $p < .001$), in 2009 driver and pedestrian injuries did not differ at a statistically significant level ($p = .34$), and in 2010, pedestrian injuries exceeded driver injuries ($\chi^2(1) = 44.63$, $p < .001$). Pedestrian injuries also exceeded driver injuries in 2004 ($\chi^2(1) = 50.45$, $p < .001$).

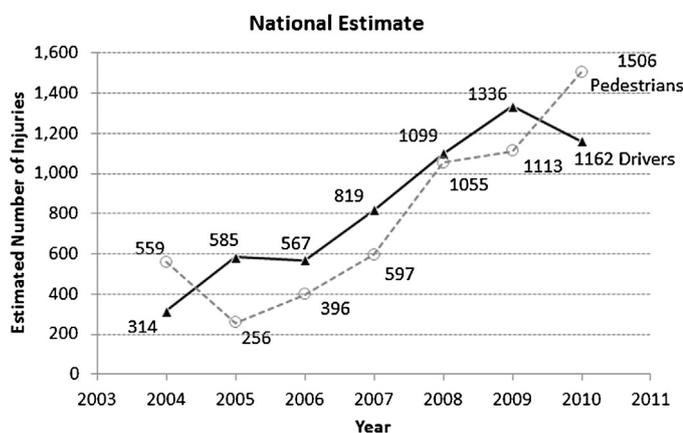


Fig. 1. CPSC national estimate of injuries related to cell phone use among pedestrians and drivers.

For 2009 and 2010, we examined what people were doing at the time of the accident. For pedestrians and drivers, more injuries related to talking than texting, though for drivers, reaching for the phone accounted for the most injuries. For pedestrians, talking on the phone accounted for 69.5% of estimated injuries, while texting accounted for 9.1%. For drivers, reaching for the phone accounted for 46.6% of the estimated injuries, talking accounted for 37.8% and texting accounted for 12.6%. The numbers do not mean that texting is less distracting. They probably reflect a lower amount of texting while driving or walking.

Reported injuries differed for gender and age. Pedestrian injuries occurred most often among men (52.9%) than women, while driver injuries occurred most often among women (58.7%) than men, and this interaction was statistically significant ($\chi^2(1) = 4.59$, $p < .05$). As for age, the national estimates show that of the 5482 pedestrian injuries and 5879 driver injuries, most occurred for people under the age of 31 (54.7% for pedestrians, 52.1% for drivers). Fig. 2 shows the CPSC estimated injuries (summed for 2004 through 2010) for each category by age.

4. Discussion

The results confirm risk of injury to pedestrians using mobile phones. Although the national estimated appear small (for example, 1506 pedestrian injuries in 2010), the actual number of injuries are probably much higher. Many people who suffer an injury may

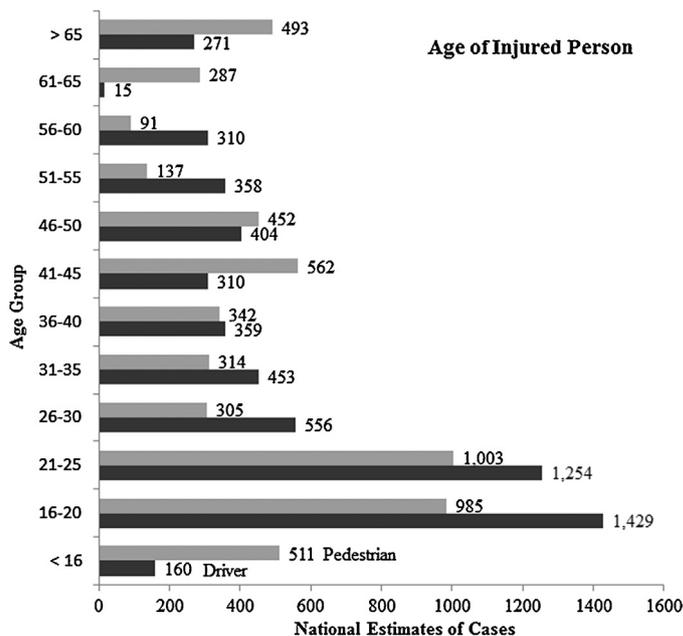


Fig. 2. CPSC national estimates (total from 2004 to 2010) of injuries related to cell phone use by age for pedestrians ($n = 5482$) and drivers ($n = 5879$).

not go to the emergency room; they may go to their primary care doctor, not go to a doctor, may not report the cell phone as the cause, or may die (newspapers report incidents of pedestrian mobile phone users getting hit and killed by cars, buses, and trains). Regarding the possible underreported injuries, consider an estimate that in 2008, for which NEISS estimated 1099 driver injuries related to mobile phone use: 515,000 people were injured and 5870 people died in traffic accidents in the United States related to driver distraction (Madden and Rainey, 2010). Of course, mobile phone use is only one aspect of driver distraction, but according to the National Highway Traffic Safety Administration, cell phone use is the most common distractor among drivers and the most common cause of vehicle crashes (Klauer et al., 2006). The National Safety Council (2010) estimated that 24.1% of motor-vehicle crashes each year involved mobile phone use. A similar percentage emerged from an examination of the phone records of 699 people involved in motor vehicle crashes: One fourth of those people had used their phones in 10 min before the crash (Drews and Strayer, 2009). Other research estimates a four- to nine-fold increase of accidents for drivers related to cell phones (Drews and Strayer, 2009). In 2010, the U.S. had 1.54 million police-reported motor vehicle crashes that resulted in an injury and 30,196 such crashes that resulted in death (National Highway Traffic Safety Administration, 2011). Thus, for drivers using mobile phones, the number of crash-related injuries are about 1300 times higher than the CPSC national estimates of emergency room injuries. If similar numbers apply to pedestrians, then the 2010 national estimate from emergency rooms may reflect about 2 million pedestrian injuries relate to mobile phone use.

As expected the number of injuries to pedestrians increased with time. The increasing trend probably relates more to the increase in mobile phone use than to increases in texting. Yes, texting has increased faster than mobile phone use. While the number of wireless connections has grown by approximately 20 million connections per year since the year 2000, with 302.9 million connections in 2010 (CTIA-The Wireless Association, 2011), text messaging has increased from 2.85 billion text messages sent during June in 2004 by more than 26 times to 75 billion in June 2008 (Cell Signs, 2011). There were 258 billion cell phone minutes used and 14.4 million text messages sent in 2000 and 2.2 trillion phone minutes used and 2.1 trillion annualized text messages sent in 2010 (CTIA-The Wireless Association, 2011). In spite of the dramatic increase in texting, most of the reported injuries among pedestrians and drivers related to talking or reaching for the phone, not texting. This is consistent with findings from 2005 and 2006 that approximately twelve times more drivers talk than text on the phone while driving (Glassbrennen and Ye, 2007), and with a 2010 estimate that of the mobile-phone related crashes each year, most (92.3%) related to talking while less than 1% related to texting (National Safety Council, 2010).

Although research indicates that hand-held texting and talking degrades driving performance more than does hands-free use of mobile phones (Drews et al., 2009; Hosking et al., 2009), and that both degrade driver performance (Ishigami and Klein, 2009; Owens et al., 2011; Svenson and Patten, 2005), the present findings indicate that driver injuries related most often to the driver reaching for the phone. However, talking or texting while driving is also unsafe. For drivers, talking accounted for 36.5% and texting accounted for 16.9% of driver injuries.

Perhaps laws restricting mobile phone use while driving account for the decrease in driver injuries in 2010, while pedestrian injuries continued to increase. Although no state bans all cell phone use while driving, ten states (plus DC, Guam and the Virgin Islands) prohibit handheld cell phone use while driving; 39 states (DS, Guam and the Virgin Islands) ban text messaging while driving and five more prohibit messaging for novice drivers. An additional 32 states and D.C. ban all cell phone use by new drivers (Governors Highway

Safety Association (GHSA), 2012). That said, the decrease for drivers may also relate to improved safety in newer cars, hands-free technology in newer autos, and less driving due economic conditions and higher gas costs in 2010. Many of the injury cases involved a motorist reaching for the cell phone and driving off the road or striking a stationary object. The hands free technology in newer automobiles, while still a risk, allows the driver to answer the phone without reaching for it. But the two year change in injuries for drivers using mobile phones is not adequate. We need longer term data. Also, to better understand the effectiveness of the legislation, research could look at accident or injury data by state in relation to when and what kind of legislation was passed and other control variables.

The higher rates of injuries among young people agrees with findings that more people under than over the age of 25 use mobile phones and hand-held devices while driving (Glassbrennen and Ye, 2007), and that teen-agers have less developed brains and the part of the brain that inhibits risky behavior, such as reckless driving, does not fully develop until people are in their twenties (Johnson et al., 2009). Perhaps, more young people also use mobile phones and hand-held devices while walking or do so for longer periods of time than other age groups. Regarding gender, the finding that more women than men had driving injuries agrees with findings that more women than men talk or text on mobile devices while driving (Glassbrennen and Ye, 2007), but other factors related to exposure rate may also account for the difference. As to why more men than women having pedestrian injuries, perhaps more men use the mobile phones or use them for more time while walking than do women, or perhaps the explanation results from the higher risk-taking among men (and particularly among young men) than among women (Byrnes et al., 1999). To better understand the age and gender differences, research would need to adjust for exposure rate (the amount of time spent using mobile phones while driving and while walking by each group).

As the number of cell phones in use increases as well as the time spent using them, the number of injuries is likely to increase as well. If current trends continue, the number of injuries due to cell phones may well double from 2010 to 2015. Legislation is useful. Even if it is difficult to enforce, it may make people aware of the dangers. But legislation alone may not be enough. Just as norms changed for smoking, it is essential that norms change for cell phone use. People will need to be made aware of the dangers, and just as parents teach their children to look both ways when crossing the street, they should teach their children to put their cell phone away while walking, particularly when crossing a street. And both drivers and pedestrians should stop when they must use their mobile technology. The technology may offer solutions as well. For example, mobile phones could have technology that locked features while moving, which the GPS feature can detect. Software will allow incoming text messages to be read aloud. This can also stop drivers from reaching for their phone and reduce distraction from the road ahead. Design of our public places may also help. For example, changes in the texture of the sidewalk along its edges may reduce the number of injuries involving people falling off the curb or walking unaware into the street. In sum, mobile technology continues to change rapidly. We must keep pace with changes to enhance the benefits and lessen the safety risks through environmental design, apps, public awareness, and, if necessary, legislation.

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