Headphone use and pedestrian injury and death in the United States: 2004–2011

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► An additional appendix is published online only. To view this file please visit the journal online (http://injuryprevention.bmj.com/content/early/recent).

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Accepted 28 November 2011

ABSTRACT

Background The association between distraction caused by cell phone use while driving and driver/passenger fatalities has been documented, but the safety risks associated with headphone use by pedestrians remains unknown.

Objective To identify and describe pedestrian–vehicle crashes in which the pedestrian was using headphones.

Methods A retrospective case series was conducted by searching the National Electronic Injury Surveillance System, US Consumer Product Safety Commission, Google News Archives and Westlaw Campus Research databases for reports published between 2004 and 2011 of pedestrian injuries or fatalities from crashes involving trains or motor vehicles. Cases involving headphones were extracted and summarised. The likelihood of headphone involvement was graded on a three-tier scale based on the information found in the article or report.

Results There were 116 reports of death or injury of pedestrians wearing headphones. The majority of victims were male (68%) and under the age of 30 (67%). The majority of vehicles involved in the crashes were trains (55%), and 89% of cases occurred in urban counties. 74% of case reports stated that the victim was wearing headphones at the time of the crash. Many cases (29%) mentioned that a warning was sounded before the crash.

Conclusions The use of headphones with handheld devices may pose a safety risk to pedestrians, especially in environments with moving vehicles. Further research is needed to determine if and how headphone use compromises pedestrian safety.

INTRODUCTION

According to the National Highway Traffic Safety Administration, 4000–5000 pedestrian deaths result from vehicle crashes every year, constituting 10–12% of total traffic fatalities.[1] According to the Federal Railway Administration, approximately 50 pedestrian deaths are caused by trains each year.[2] Pedestrian fatalities are associated with environmental (night time, urban environment) and human factors (alcohol use, male gender, distractible personality).[1 3] Devices such as MP3 players and cell phones may be risk factors in pedestrian injuries and fatalities near roadways and railways because they diminish the user's ability to appreciate environmental cues.

The Pew Research Center has documented increasing popularity of auditory technologies with headphones.[4] The most recent report highlights widespread ownership of these devices among young adults (figure 1). Seventy-four per cent of teens reported owning an MP3 player in 2008.[4] Another Pew Study found cell phone use increased from 45% in 2004 to 71% in 2008 for teens aged 12–17 years.[5]

A number of studies have called for more research into distraction and pedestrian safety.[1 6–9] These studies and local media coverage of a train–pedestrian crash involving headphones prompted us to investigate the role of headphone use in the injury and death of pedestrians.[10] We summarise 116 incidents of headphone-related pedestrian injuries and deaths. Although causal relationships cannot be proven, we speculate on implications for pedestrian safety.

METHODS

We searched the National Electronic Injury Surveillance System (NEISS), the United States Consumer Product Safety Commission, Google News Archives and Westlaw Campus Research Database from 1 January 2004 to 1 June 2011. Boolean combinations (operative algorithm using conjunctive, disjunctive and negative modifiers 'or', 'and' and 'not') of the terms 'headphones', 'earphone', 'earbud', 'mp3 player', 'iPod', 'pedestrian', 'hit', 'struck', 'killed', 'dead', 'hurt' and 'injured' were used to search for cases. Variation in the tenses of each of the aforementioned verbs was used as well to maximise results. For the purposes of this article, headphones will refer to either traditional or earphone-style (earbud) devices, both of which insulate from outside auditory stimuli.

Cases involving cell phones, including hands-free devices, were not included. Reports were reviewed to determine whether the victim was wearing headphones at the time of the injury/death and if any auditory alarms were sounded prior to the crash. Cases were excluded if the incident occurred outside the United States or the case's mention of headphones had nothing to do with the crash. In the remaining cases, we rated the implicating role of headphones by a specified subjective grading system on strength of association of headphone use to the injury (table 1). Each grade was agreed on by all three authors reviewing the cases (RL, DS, JA).

Unique cases were analysed by date, location, vehicle, victim age, victim gender and non-fatal injury description (when available). The location of each incident was classified according to the 2006 County Urban–Rural Classification Scheme of the CDC National Center for Health Statistics.[11] This system grades counties on a six-point scale, with scores of 1–4 considered urban/metropolitan and scores of 5–6 considered rural.

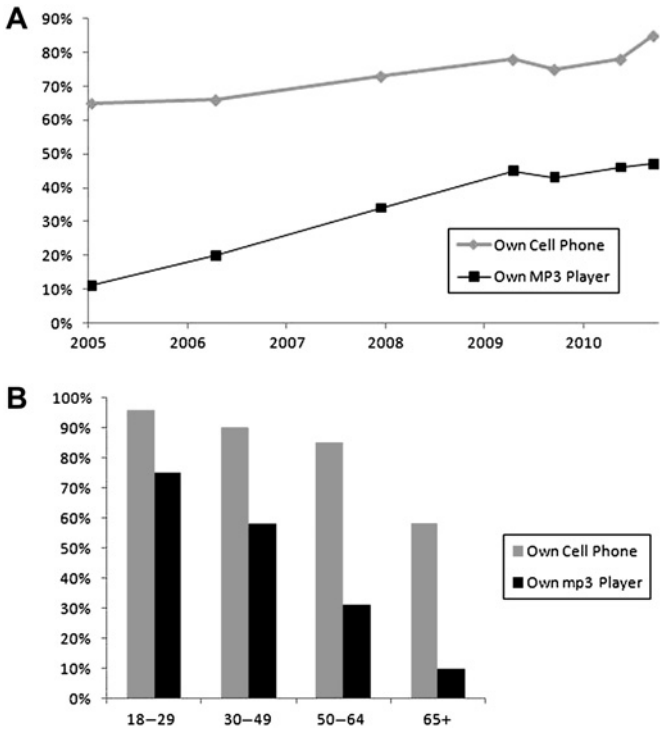

Figure 1 Ownership of auditory devices: (A) overall; (B) by age (adapted from Smith[5]).

The study was reviewed and exempted by the University of Maryland Institutional Review Board.

RESULTS

The Google News Archive, Westlaw Campus, Consumer Product Safety Commission and NEISS database searches returned 631, 38, 6, and 1396 results, respectively. The final series included 4 cases from NEISS, 10 from Westlaw Campus and 102 from Google News Archive database cases.

A total of 116 unique cases of pedestrian injuries or deaths involving headphone use were identified and are summarised in table 2 (based on the reports listed in online appendix 1).

The median age of victims was 21 years; 68% were male and 67% were under 30 years of age. Sixty-four of the 116 victims (55%) were hit by a train. Eighty-one of the 116 collisions (70%) resulted in death.

Crashes were distributed across all four regions of the United States. The majority of crashes (59%) occurred in counties that were classified as 1–2 on the National Center for Health Statistics urban scale, indicating large metropolitan populations of 1 million or more residents. Only 12% of cases occurred in counties classified as 'rural' (score 5–6).

Eighty-six of the 116 cases (74%) had an 'A' evidence grade, meaning that the police and/or eyewitnesses reported the victim was wearing headphones at the time of the crash. Thirty-four of the 116 (29%) reports specifically mention horns or sirens being sounded prior to the victim being hit.

Table 1 Description of evidence grading criteria in reviewing articles

Evidence grade	Description
A	Police report or witnesses indicated the victim was wearing headphones* at the time of the incident
B	One or more of the following criteria were met: ► The police report indicated the victim *may* have been wearing headphones or using an MP3 player ► The article stated the victim was wearing headphones, but the source of this information was not specified ► Headphones were found in the victim's ears
C	Headphones were found on or near the victim's body but not covering his/her ears
+	Added to above grades if an alarm (yelling, horn, siren) was reported to be sounded prior to the crash

*Or earphones or earbuds. Hands-free cell phones not included.

Table 2 Headphones-related pedestrian crashes: summary (n=116)

Category	No.
Year	
2004–2005	16
2006–2007	19
2008–2009	34
2010–2011	47
Season	
Spring (Mar–May)	30
Summer (Jun–Aug)	16
Fall (Sep–Nov)	30
Winter (Dec–Feb)	40
Age	
<15	5
15–24	62
25–34	18
35–44	6
≥45	13
Unknown	12
Gender	
Male	79
Female	37
Outcome	
Serious injury*	24
Mild injury†	7
Death	81
Unknown	4
Evidence grade	
A+	28
A	58
B+	6
B	11
C+	0
C	13
Region‡	
Northeast	24
South	32
Midwest	17
West	41
Urban score‡	
1	30
2	39
3	21
4	13
5	9
6	5
Vehicle	
Train	64
Car	32
Other§	20

*Serious injuries include those described as serious condition, critical condition or life-threatening injuries.
†Mild injuries include those described as mild injuries, lacerations or good condition.
‡Two case locations were unavailable.
§Other vehicles include trucks, buses, tractor trailers, bikes, SUVs.

DISCUSSION

We present 116 cases of pedestrian–vehicle crashes with evidence of headphone use. This series presents some important observations. First, the pedestrians tended to be young: more than a third were younger than 18 years and two-thirds were younger than 30. This predominance of younger victims may be explained by increased media reporting of incidents involving youth as well as this group's lower access to motor vehicles, higher rates of headphone use, and/or less experience in traffic navigation.

The percentage of incidents that occurred during the summer months in school-aged pedestrians was small: 9% of cases involving victims ≤18 years of age (4 of 43) occurred during June, July or August. In older victims, 20% (12 of 61) of crashes occurred during the summer. This may suggest that daily travel to school increases young pedestrian risk.

The majority of cases occurred between 2008 and 2011, possibly reflecting an increasing awareness of the issue by the media. Moreover, as previously mentioned, the ownership of electronic devices using headphones has increased in recent years. Another observation that may be explained by media bias is the large proportion of fatal crashes and crashes involving trains. Media reports have been shown to emphasise emerging issues as well as 'hard news' that reports more abnormal events with severe outcomes.[12–15]

Finally, the majority of cases (89%) occurred in urban counties, which may be due to the increased population density necessitating more dangerous crossings. Such a correlation was noted by Lascala *et al* in their spatial analysis of pedestrian crashes in San Francisco.[16]

Distraction: inattentional blindness

Two phenomena are likely contributors to the possible association between headphone use and pedestrian injury: distraction and sensory deprivation. Distraction caused by the use of electronic devices has been coined *inattentional blindness*, essentially a divided cognitive workload that reduces mental resource allocation, or attention, to outside stimuli.[17] This phenomenon, which involves both the cognitive distraction of interpreting auditory input as well as the tactile distraction needed to manipulate electronic devices, has been highlighted as an important emerging cause of motor vehicle crashes.[18]

A number of pedestrian studies have examined inattentional blindness. Bungum *et al* conducted a large pedestrian observational study (n=866) that weakly correlated distraction (defined as wearing headphones, talking on a cell phone, eating, drinking, smoking or talking) with less cautious street-crossing behaviour.[19] Nasar *et al* observed pedestrians at three intersections (n=131), and found those conversing on a cell phone were more likely to engage in risky crossing behaviour, but failed to find this difference in those using MP3 players.[6] Hatfield and Murphy conducted a similar observational study (n=546), which found that pedestrians using cell phones crossed roads more slowly, increasing the time in which they were exposed to oncoming traffic.[20] Finally, Stavrinos *et al* used a simulated crosswalk environment to show that children on cell phones had similar inattentional blindness.[7]

Sensory deprivation: environmental isolation

The actual sensory deprivation that results from using headphones with electronic devices may be a unique problem in pedestrian incidents, where auditory cues can be more important than visual ones. This deprivation, which we call *environmental isolation*, is the inability to hear sounds emanating from the local surroundings.

Only one laboratory study has examined environmental isolation in pedestrians. Neider *et al* used a simulated crosswalk environment to examine the effect of the use of hands-free cell phones and MP3 players with headphones on adult pedestrians crossing a street.[21] They established that cell phones caused pedestrians to take longer to cross the street, but failed to find a similar difference in MP3 player use. However, the study size was small (n=36) and overall failure rate of crossing was about 15%, a rate the authors acknowledge may have compromised the real-world applicability of the simulated environment.

Limitations

This report has several major limitations. First, it relies on media reporting, which likely over-publishes tragic events but vastly under-publishes non-fatal cases. Moreover, there is no method of collecting information about 'near misses', in which the pedestrian who is wearing headphones suddenly becomes cognisant of danger in the environment and avoids an injury. Such misses may be captured by video cameras at specific places, but larger studies are only practical using pedestrian injury and death as outcomes. Our capture of the cases in this study required headphones to be mentioned, information that may or may not be available to reporters at the scene.

Also, since this is a retrospective case series, neither causation nor correlation can be established between headphone use and pedestrian risk. Such risk can be determined only in virtual environments or large-scale pedestrian observational studies. However, we believe our grading system shows strong circumstantial evidence that headphones may have played a role in most injuries and deaths in the case series. Moreover, although three authors agreed on each rating, it is possible that misclassification of cases still occurred.

Finally, factors other than the use of headphones, such as suicidal intentions, substance abuse or mental illness, may have had a role in some of the pedestrian injuries and fatalities. The most dramatic examples are the victims who were hit by trains despite the sounding of auditory alarms. The headphones may have had a significant role in these scenarios; but other factors, especially intoxication or suicidal ideation, must be considered. In cases involving vehicles other than trains, the operators may

What is already known on the subject

- Distraction caused by cell phone use while driving has been highlighted in driver and passenger fatalities.
- Headphone use (a distracting element) is becoming increasingly popular among teenagers and adults.
- Risks associated with pedestrian use of headphones are not well described.

What this study adds

- Reports of teens and young adult pedestrians using headphones with injuries and fatal outcomes are described and have increased over the last 3 years.
- Many cases describe vehicle or train warnings prior to the crash.

have been at fault. This factor was not mentioned in any of the articles, but its role cannot be ruled out. Fatality review teams or complete police reports may be more helpful in determining the combined contributions of these various factors in pedestrian injuries and deaths.

Summary and recommendations

The use of cell phones and MP3 players is increasing. The risks posed in use of these devices by drivers are well documented, but little is known about the association between headphone use and pedestrian injury. The danger in using headphones as a pedestrian may be explained by two phenomena: auditory masking of outside stimuli (environmental isolation) and distraction (inattentional blindness). This series presented 116 cases of pedestrian injury involving headphones. The majority of victims in this series were young and/or male, with more incidents occurring in urban counties, during the school year, and involving trains. These observations may be influenced by biases in media reporting; therefore, more complete capture rates are needed to delineate which populations are at particular risk.

Acknowledgements We would like to acknowledge Ms Jamie Friel Blanck for her assistance with the library search methodology. The manuscript was copyedited by Linda J Kesselring, the technical editor/writer in the Department of Emergency Medicine at the University of Maryland School of Medicine.

Competing interests None.

Contributors All authors provided substantial contributions to the conception and design of this report, data collection, and interpretation. Each author contributed to the draft of the article and its multiple revisions to develop the intellectual content that constitutes the final version.

Provenance and peer review Not commissioned; externally peer reviewed.

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