Prevalence of distracted walking with mobile technology: an observational study of Calgary and Edmonton high school students

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Abstract

Objectives Distracted walking poses a safety concern while crossing roads. A 2014 Canadian survey showed that 51% of teenagers were hit or almost hit while crossing the street, many of whom were distracted by mobile technology. An American study demonstrated that 1 in 5 high school students engaged in distracted walking; however, prevalence estimates in Canada have not been described. This study aimed to obtain a prevalence estimate of distracted walking in high school students in Calgary and Edmonton, Alberta, Canada.

Methods Students were observed crossing the street at 20 high schools following afternoon school dismissal times during September to November 2017. Behaviours included talking on mobile phone, using earbuds, looking down at phone, and engaging in more than one of these behaviours. Also recorded were median household income of surrounding neighbourhood, outside temperature, gender, and crosswalk type.

Results A total of 3553 students were observed, with 666 engaged in distracted walking (18.7%). Females engaged in distracted walking more than males (19.9% vs. 17.6%, respectively). The most prevalent behaviour was using earbuds (66.5%). Males had a lower prevalence of distracted walking compared with females. Distracted walking was more prevalent when the temperature was above 10 °C compared with less than 0 °C and less prevalent at signaled compared with non-signaled intersections.

Conclusion This study demonstrates that approximately 1 in 5 high school students in Calgary and Edmonton, Alberta, Canada, engage in distracted walking behaviours while crossing the street. These results may help raise awareness and inform policy to decrease risk of pedestrian injury.

Résumé

Objectifs La distraction des piétons pose un danger pour leur sécurité quand ils traversent la rue. Selon une enquête canadienne menée en 2014, plus de la moitié (51%) des adolescents s'étaient fait frapper ou presque frapper en traversant, et beaucoup d'entre eux étaient distraits par un appareil mobile. Une étude américaine a montré qu'un élève du secondaire sur cinq est distrait en marchant, mais il n'existe pas d'estimations de prévalence pour le Canada. Notre étude visait à obtenir une estimation de prévalence de la distraction des piétons parmi les élèves du secondaire de Calgary et d'Edmonton (Alberta), au Canada.

Méthode De septembre à novembre 2017, nous avons observé les élèves de 20 écoles secondaires en train de traverser la rue à la fin des classes de l'après-midi. Nous les avons vus parler sur un téléphone mobile, porter des mini-écouteurs, regarder leur téléphone et avoir plusieurs de ces comportements à la fois. Nous avons aussi enregistré : le revenu médian des ménages du quartier environnant, la température extérieure, le sexe et le type d'intersection.

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Résultats Sur les 3553 élèves observés, 666 (18,7 %) étaient distraits en marchant. Les filles étaient plus distraites que les garçons (19,9 % contre 17,6 %). Le comportement le plus prévalent était le port de mini-écouteurs (66,5 %). La distraction en marchant était moins prévalente chez les garçons que chez les filles. Elle était plus prévalente quand la température était supérieure à 10 °C que lorsqu'elle était inférieure à 0 °C, et moins prévalente aux intersections avec feux qu'aux intersections sans feux.

Conclusion Notre étude montre qu'environ un élève du secondaire sur cinq de Calgary et d'Edmonton (Alberta) au Canada présente un ou plusieurs comportements de distraction en traversant la rue. Les résultats obtenus peuvent contribuer à sensibiliser le public et à éclairer les politiques visant à réduire les risques de blessures chez les piétons.

Keywords Public health · Urban population

Mots-clés Santé publique · Population urbaine

Introduction

With the increasing need to stay connected through technology, many youth today possess and use mobile phones. In 2013, MediaSmarts conducted a national survey among Canadian students and found that one quarter (24%) of grade 4 students, half (52%) of grade 7 students, and 85% of grade 11 students have their own mobile phone (Steeves 2014). Keeping connected with friends and family through text and social media seems to be a priority for youth (Ferguson et al. 2014). However, the convenience of ubiquitous mobile technology use poses risks as well. These hazards include sleep disturbance (Hysing et al. 2015), distracted driving (Yannis et al. 2014), and distracted walking (described below).

In 2001, Transport Canada reported that pedestrian-related events resulted in 27 deaths and 1628 injuries among 15–19 year-olds (Traffic Accident Injury Database (TRAID) Transport Canada n.d.). A 2014 Canadian survey showed 51% of teenagers reported being struck, or nearly struck, by a vehicle while crossing the street (Parachute Canada 2014). Of the 8% of 13–18 year-olds who were distracted by mobile technology, 42% reported listening to music, 21% reported talking on the phone, and 15% reported texting (Parachute Canada 2014).

In the 2012–2013 school year, Safe Kids Worldwide observed that, in the United States, one in five high school students and one in eight middle school students cross the street distracted (Ferguson et al. 2013). In laboratory studies, college students were shown to engage in riskier behaviour while crossing a virtual street when distracted by web browsing on their mobile phones (Byington and Schwebel 2013). Similarly, another study revealed that 10–11 year-olds were at increased risk of injury while talking on a cell phone as they crossed a virtual street (Stavrinos et al. 2009). To date, however, there are no studies of distracted walking while crossing the street among Canadian high school students.

Evidence suggests that cell phone use among Canadian high school students is increasing with time, and also increases as students progress into higher grades in school

(Steeves 2014). Research is needed to determine whether trends in cell phone use are associated with distracted walking behaviours for adolescents who are crossing the street, as this may be a safety concern. Therefore, the purpose of this study was to obtain a prevalence estimate of Calgary and Edmonton high school students who engage in distracted walking while crossing the street. Determining the prevalence of distracted walking in this population may contribute to the development of new policies to prevent pedestrian injuries among adolescents.

Objectives

1. To determine the prevalence of distracted walking in Calgary and Edmonton public high school students.
2. To determine the types of distracted walking behaviour in high school students.
3. To determine whether city, median household income of surrounding neighbourhood, outside temperature, type of crosswalk, and/or gender are predictors of distracted walking.

Methods

The Conjoint Health Research Ethics Board deemed our study not needing ethics approval as it relied on the observation of people in public places with no direct interaction with the researchers or identification of specific individuals.

Setting

The study was conducted as a prospective observational study in Calgary and Edmonton, Alberta, Canada. Ten out of 18 Calgary public high schools were included. In Edmonton, 10 out of the 21 public high schools were included. These schools were selected as a non-random convenience sample. In each city, an equal number of “low socio-economic” and

“high socio-economic” schools were selected (described later). In Edmonton, one school had only one student observed and therefore, it was replaced with a different school of similar socio-economic status. This may have been due to an incorrect dismissal time listed online or a professional development day on the date of data collection.

Population

High school students, presumably ages 14–18 years old, from Calgary and Edmonton public high schools were observed for distracted walking with mobile technology. Mobile technology was limited to smartphones and music-listening devices. While talking or texting on the phone is more active than the passive nature of listening to music through earbuds, simply having something in one’s ears impairs one’s sense of hearing. This could impact one’s ability to hear oncoming cars or alerts such as horns. In 2012, Lichenstein et al. performed a retrospective case series in which they analyzed headphone-use-related pedestrian-vehicle injury and deaths in the US (Lichenstein et al. 2012). They found that, of the 116 cases, 74% stated the victim was wearing headphones at the time of the crash and 29% mentioned that a warning sound occurred before the crash. Therefore, our study included the categories of distracted walking behaviour used by Basch et al. (2014):

1. Talking on mobile phone or smartphone
2. Using earbuds or headphones
3. Looking down and/or interacting with a mobile phone or smart phone (which may include texting, web browsing, and/or using other functions of the mobile device)
4. Engaging in more than one of these behaviours simultaneously

Inclusion criteria were (1) high school student (as best judged by observers), (2) walking across street in direction away from school, and (3) using most populous crosswalk as determined by preliminary observations by research team (who visited schools and observed pedestrian traffic at an earlier date).

Exclusion criteria were (1) adult or non-high school student, (2) running (jogging), or use of mobility aids, such as wheelchairs, crutches, etc., (3) use of other forms of transportation, such as bicycles, skateboards, etc., and (4) other non-technological distractions such as walking while reading a book or talking with peers.

Data collection

Development and pilot testing of the recording tool was completed prior to data collection. There was one team, consisting of two data collectors, in each city. The data collectors were

trained on behaviours of interest and recording methods with a training module prepared by the authors. The trained observers then recorded high school students who crossed the street at the predetermined designated crosswalk near each school. Only individuals using the crosswalk in the direction moving away from the school were counted. “Using the crosswalk” was defined as being in the crosswalk for at least half of the crossing. Students were also counted if there was physically not enough room in the designated crosswalk for them to fit due to large crowds. The observers recorded the gender of the pedestrians and the distracted walking behaviours exhibited. The outside temperature at the time of observation was also recorded using the Environment Canada website (Environment Canada n.d.). Median household annual incomes (rounded to nearest \$10,000) of the dissemination area near the schools were recorded from 2016 Calgary and Edmonton census data (Census Profile 2017). These data were used to estimate low and high socio-economic status of high schools, using \$80,000 as the division.

Inter-rater reliability was addressed by comparing the counts of two independent observers at two Catholic schools prior to data collection. The total number of high school students crossing the street was recorded for the first 10 minutes after the afternoon bell followed by an additional 10 minutes recording the number of high school students who engaged in any of the four behaviours previously mentioned. The counts were within 5% of each other; thus, subsequent counts for the study had one observer record the total number of high school students while the second observer recorded the high school students engaging in distracted walking. The observer recording total number of high school students had two click counters—one for each gender.

Data collection occurred during September to November of 2017 as a previous study showed no difference in prevalence of distracted walking between spring and fall periods (Ferguson et al. 2013). The same study also showed that 29% more students walk home after school compared with walking to school. Additionally, children are at increased risk of pedestrian injuries between 3 pm and 5 pm (Wazana et al. 1997). Therefore, data were gathered 10 minutes following the afternoon school dismissal times, which fell between 3 pm and 5 pm.

Data analysis

Data were analyzed using Stata 15 (StataCorp 2017). The percentage of high school students who engaged in distracted walking was calculated by dividing the number of students engaged in distracted walking by the total number of students crossing the street. The proportion of students engaged in each distracted walking category was also calculated. Poisson regression was used to model the prevalence of distracted walking to account for clustering by school site (Zou 2004).

Poisson regression was also used to determine the association between distracted walking and city, surrounding median household income, outside temperature, type of crosswalk, and gender of pedestrians. Results are presented as prevalence rates and prevalence rate ratios with 95% confidence limits. We chose to use the term “prevalence” as the most appropriate outcome of our study as much of the literature about distracted walking based on a similar design uses the same term (Ferguson et al. 2013; Basch et al. 2014; Mohd Syazwan et al. 2017). We recognize that our population is based on several assumptions, and that our data is a snapshot in time based on a cross-sectional approach.

Results

Total

In total, there were 3553 students observed walking near 20 different high schools in both Calgary and Edmonton. Six hundred sixty-six students were engaged in distracted walking (18.7%). Of those, using headphones/earbuds was the most prevalent type of distracted walking (66.5%).

Table 1 provides estimates of the prevalence of distracted walking over covariate categories, and prevalence ratios comparing categories. The estimated prevalence of distracted walking ranged from 17.23% (95% CI 14.30–20.75) when the temperature was less than

0 °C to 25.5% (95% CI 19.80–32.9) when the temperature was > 10 °C. Other covariate categories had an estimated prevalence between these extremes. Males were estimated to have 12% (prevalence ratio [PR] 0.88; 95% CI 0.78–0.99) lower prevalence of distracted walking when adjusting for all other covariates in the model. The prevalence of distracted walking was greater when the temperature was over 10 °C compared with < 0 °C (PR 2.08; 95% CI 1.30–3.34). There was a lower prevalence of distracted walking at signaled compared with non-signaled intersections (PR 0.76; 95% CI 0.60–0.95). City and median income did not have a statistically significant effect on the prevalence of distracted walking.

Calgary

Observations were made of 1552 students walking near high schools in Calgary. Of those, 302 demonstrated distracted walking behaviour for an overall prevalence of 19.4%. The prevalence estimates ranged from 14% to 31%.

Females engaged in distracted walking just slightly more than males (20.1% vs. 18.4%, respectively). Figure 1 shows the proportion of males and females engaged in each distracted walking behaviour. Females outnumbered males in the specific categories of talking on mobile phones and looking down at mobile phones. Males tended to use earbuds or headphones more than females.

Table 1 Prevalence by covariate category and prevalence ratios of distracted walking in Calgary and Edmonton, Alberta, high schools

	Distracted walkers	Total walkers	Prevalence % (95% CI)*	Adjusted prevalence ratio (95% CI)* ⁺
City				
Calgary	302	1552	19.46 (17.06–22.20)	0.77 (0.51–1.15)
Edmonton	364	2001	18.19 (14.23–23.25)	Reference
Gender				
Males	308	1750	17.60 (14.62–21.19)	0.88 (0.78–0.99)
Females	358	1803	19.86 (17.49–22.55)	Reference
Median household income				
≥ \$80,000	328	1771	18.52 (15.76–21.77)	0.86 (0.65–1.14)
< \$80,000	338	1782	18.97 (14.76–24.37)	Reference
Temperature				
< 0 °C	287	1666	17.23 (14.30–20.75)	Reference
0 °C–10 °C	303	1589	19.1 (15.0–24.3)	1.22 (0.76–1.95)
> 10 °C	76	298	25.5 (19.8–32.9)	2.08 (1.30–3.34)
Signaled intersection				
Yes	438	2402	18.24 (14.75–22.54)	0.76 (0.60–0.95)
No	228	1151	19.81 (17.73–22.13)	Reference

*Adjusted for clustering by school

⁺ Adjusted for all other variables in table

Fig. 1 Number of students by type of distraction

Edmonton

There were 2001 students observed walking near Edmonton high schools. A total of 364 demonstrated distracted walking behaviour (18.2%), with one school over 30%. The prevalence estimates ranged from 8% to 31%.

Figure 1 shows the proportion of males and females engaged in each distracted walking behaviour. Females engaged in distracted walking slightly more than males (19.1% vs. 17.2%, respectively). Females outnumbered males in the specific categories of talking on mobile phone, using earbuds/headphones, and looking down at mobile phones.

Discussion

Our results indicate that approximately one fifth of Calgary and Edmonton high school students engage in distracted walking activities. The results of our study are similar to the Safe Kids study reporting a distracted walking prevalence of one in five high school students (Ferguson et al. 2013). This is concerning as the prevalence of distracted walking may increase over time given the increasing prevalence of mobile phone ownership among youth (Steeves 2014).

We have shown that the most common types of distracted walking involve the use of earbuds and looking down at a phone. The prevalence estimates were higher for females, outside temperature of $> 10^{\circ}\text{C}$, and signaled crosswalks, but there was little correlation with city and socio-economic status of schools.

We hypothesized prior to data collection that crosswalks that are marked or signaled might induce a false sense of security and influence students to engage in more distracted walking behaviours. However, our results indicate the opposite—there were higher rates of distracted walking in non-signaled crosswalks compared with signaled crosswalks. Perhaps students pay more attention when there are lights and they have to follow instructions and therefore, they are less inclined to engage in distracted walking. We also predicted that higher socio-economic status schools would have a higher prevalence of distracted walking as these students may be more likely to own mobile phones. Yet, median annual income did not influence the results. Additionally, we hypothesized that more distracted walking behaviours would be observed during warmer temperatures, which was supported by our results showing higher prevalence estimates when temperatures were above 10°C .

In October 2017, Honolulu became the first major US city to ban texting while walking in a crosswalk with their “Zombie Law” (A Bill for an Ordinance 2017). At the time of this study, no Canadian city had implemented a distracted walking bylaw. Some argue that it puts too much onus on the pedestrian rather than the driver and adopts a victim-blaming attitude. Therefore, the change may need to focus on not only education and legislation directed at pedestrians, but also driver attention and ideally the built environment. For example, in Germany, they have implemented ground-level traffic lights to alert distracted walkers who may be looking down at their phones to oncoming trains (Whitten 2016). Other possibilities include changing the texture of sidewalks to notify pedestrians of an upcoming road and LED-lit crosswalks that are synced

with traffic lights, which have been implemented and well received in the Netherlands (Wilson 2017).

A strength of this study was that data were collected from a sample of high schools from two major cities in Alberta, Canada. This ensured a more diverse spread of data within the province. Additionally, the comprehensive data collector training ensured a similar approach was used in each city.

There were several limitations to our study. The socio-economic status applied to each school was a gross estimate based on the mean annual household income in the surrounding neighbourhoods. This does not take into account that students may attend high schools outside of their home neighbourhood. However, although students may be from a neighbourhood of different socio-economic status, they may be less likely to be pedestrians since they need to travel a further distance to school. Therefore, the students who were observed walking may actually be more reflective of those neighbourhoods and corresponding socio-economic status. In terms of data collection, two out of the 20 schools observed were combined junior and senior high schools. Therefore, observations of students that fit the study's age criteria relied on best judgement from the data collectors. Similarly, gender was also judged on observation. In Calgary, 10 out of 18 schools were included, whereas, in Edmonton, 10 out of 21 schools were included. Ideally, all high schools would have been included but time and funding constraints were limiting factors.

Conclusions

Distracted walking is a relevant and increasingly common issue. This study estimates the prevalence of distracted walking among high school students in two major cities in Alberta, Canada. Similar rates of distracted walking in high school students were found in the United States. These data could aid in the education of youth regarding safer use of smartphones and inform policy makers around legislation for distracted walking, similar to distracted driving laws, that may be implemented in the future.

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