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Contributors to pedestrian distraction and risky behaviours during road crossings in Romania

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Abstract

Objective—Pedestrian fatalities due to collisions with motor vehicles are a large public health problem in Romania, ranking them among the highest in Eastern Europe. The purpose of this study was to gain a better understanding of crash factors by examining how roadway and environmental characteristics contribute to pedestrian distraction and risky behaviours at pedestrian MVC (PMVC) locations in Cluj County, Romania.

Methods—A sample of PMVC locations was selected from the 2010 Cluj County police reported crash database for on-site examination. A total of 100 sites were visited to collect details on site characteristics and typical pedestrian and driver behaviours. Variable distributions were examined and rate ratios of pedestrian distraction and risky behaviours were calculated.

Results—Pedestrian distraction and risky behaviours were observed at rates of 6.3 and 24.3 per 100 observed pedestrians. The majority of distractions were related to electronic device use. Risky behaviours were evenly split between unpredictable, partial use of a crosswalk and midblock illegal crossings. Distractions and risky behaviours decreased as the number of pedestrians and average vehicle speeds at a site increased. RR of distraction was higher at intersections and locations with crosswalks.

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Conclusions—Pedestrian distraction was highly correlated with pedestrian risky behaviours at PMVC locations in Romania. Higher pedestrian volume was protective against pedestrian distraction and risky behaviours. Locations with painted crosswalks had increased distraction. Targeted distraction prevention, particularly at intersections and crosswalk locations, may contribute to the prevention of PMVCs.

INTRODUCTION

Pedestrian injuries and fatalities account for 22% of all road traffic deaths and >270 000 deaths per year, worldwide.[1] In Romania, a middle-income country, 39% of all traffic-related fatalities are pedestrians, which is the highest in the European Union.[23] The Romanian pedestrian fatality rate is 10-fold that of the best performing countries.[23] Road traffic fatalities in Romania have declined since 2008, but the proportion of pedestrians has increased from 37% in 2010 to 39% in 2013.[23]

As the number of vehicles increases on Romanian roads, so do pedestrian crashes[4] and the need to enhance the safe mobility of pedestrians.[5] The absence and poor maintenance of pedestrian facilities along with increasing traffic aggravate the issue, straining vehicle and pedestrian interactions.[6] Pedestrian and driver distractions, which are increasing worldwide, are also likely to contribute to this problem[178] and will likely continue to increase with the growth of electronic information and entertainment device use.[9]

Little is known about contributors to pedestrian MVCs (PMVCs), especially in Romania where studies are sparse and have relied on analysis of administrative data sets, including police or hospital records.[10–12] Worldwide, few studies of distraction and pedestrian safety have been conducted. These few studies have focused primarily on cell phone use and have relied on existing data sets or simulation-based studies. Even fewer have involved field observations,[13] which can be the most accurate reflections of population-level behaviour when observation protocols are stringent and interobserver reliability is high. Current pedestrian data sources (crash, hospital, surveys) often lack or have under-reported pedestrian distraction, making it difficult to estimate the burden and examine if distracted walking causes and/or contributes to pedestrian safety problems.[14] Observational studies may provide insights into natural behaviour of pedestrians and motorists and contribute to our knowledge of risk factors for PMVCs.[1516]

Romanian law does not prohibit pedestrian use of electronic devices, but does prohibit handheld mobile phone use for drivers (but allows hands-free phone use[15]). However, international evidence shows that legislation against drivers' use of mobile handheld phones does not always influence driver behaviour.[916] As the number of smartphone users grows annually, distraction continues to be a threat. It is estimated that by 2018 the percentage of the total population with smartphones in Eastern Europe will reach 62.4%[17] of which Romanian users are considered some of the most mobile device-oriented.[18] Other distractions, such as conversation with passengers; entertainment/navigation systems; and eating, drinking, smoking; degrade driving performance as well.[19] Physical environmental factors like absence of mid-block crosswalks, width of roads and poor timing of crossing

signals (eg, long delay between pedestrian light cycles) might encourage unsafe pedestrian behaviours.[20]

Like drivers, when distracted by mobile phones, music devices, food, other people or environmental factors, pedestrians tend to act less cautiously.[9] Talking on a mobile phone or listening to music while crossing the road may result in unsafe behaviours, like reduced attention to traffic, reduced situational awareness, increased crossing time or failure to notice salient objects in the environment.[9141921–24] A 10-country survey on distracted pedestrians showed that Romanian pedestrians were the most likely to cross while using mobile devices or phones (83%), continue a phone call (79%) or while listening to music (46%) compared with the other nine European countries surveyed.[25]

The aim of this study was to use administrative data and on-site observations to examine environmental factors and pedestrian and driver behaviour at PMVC locations in Cluj County, Romania, with a focus on pedestrian distraction and risky behaviours while interacting with the roadway. The chosen environmental, pedestrian and driver factors examined in this study represent variables that have been shown in a priori transportation literature to be related to crash risk, in general. This study supplements our previous epidemiological study[26] of PMVCs in Cluj County by adding on-site observations of the PMVC locations. Specifically, we examine how traffic safety features and environmental factors impacted the rate of pedestrian distraction and pedestrian risky behaviours.

METHODS

In 2010, there were 318 reported PMVCs included in the Cluj County, Romania, police crash database. Of those, 204 (65.4%) had location data available. Details on these crash data have been presented elsewhere.[27] For the current study, a convenience sample of 100 sites was selected for on-site observation of environmental, driver and pedestrian behaviour characteristics. We were not able to observe all 204 sites that had location data available due to time and budget constraints. The 100 sites chosen were crashes that occurred during a weekday, between the hours of 07:00 and 19:00 and were equally distributed between local and national roads that were geographically representative of the county. Weekdays and daylight hours were chosen primarily for convenience and safety of our observers. Sites that had major infrastructure changes between the time the crash occurred and the time our study team completed the on-site evaluation were excluded. On-site observations were conducted during the summer of 2013.

Environmental variables collected on-site included crash site configuration (intersection, non-intersection, roundabout), number of lanes of index street where crash occurred, traffic controls (light, stop sign, yield sign), surface condition, land uses in area, parking, bicycle facilities (bike lanes or bike warning signs), paved multiuse trails and pedestrian facilities (pedestrian signs/signals, sidewalks, crosswalks, refuge islands and flashing warning lights). For locations where the crash occurred at an intersection, the index street where the crash occurred was identified based on information available in the police crash reports.

Pedestrian behaviours observed on site included illegal crossings (against red light, no crosswalk–midblock or did not use available crosswalk), unpredictable crossings (partial use of crosswalk) and distraction (by child, other pedestrian, electronic devices held to head, headphones, manipulation of an electronic device or reading). Distraction was specifically measured during the time the pedestrian entered the roadway to the time they completed their crossing (exited the roadway).

Unpredictable crossings, or partial use of crosswalk, were defined as crossings where the pedestrian starts crossing outside of a crosswalk and veers into the crosswalk before reaching the other side of the road, starts in a crosswalk then veers outside of it before reaching the other side of the road or cuts through crossing veering outside of it at both the beginning and end (see figure 1). These are considered risky behaviours because the pedestrian deviates from the intended path, marked by the crosswalk, and becomes unpredictable to other road users.

For motorist behaviours, we captured the average motor vehicle speed of five consecutive vehicles using a radar gun. Semitrailer trucks and motorcycles were excluded from these consecutive vehicles due to potential for large variations in speed compared with other passenger vehicles. We also coded any apparent motor vehicle moving violations that had a direct impact on pedestrians (ie, evasive action required).

Ten-minute motor vehicle and pedestrian traffic volumes were manually captured at each site using the TurnCount[28] traffic counting application. These counts were verified using video recordings taken during the on-site counts.

Still photographs were taken at each location (legs of intersection, direction of travel at non-intersections, pedestrian facilities and traffic controls and signage). A diagram of each location was also sketched, indicating the site configuration, camera and observer locations, pedestrian and bicycle facilities, sidewalks, traffic controls, traffic lanes, street names and cardinal directions. The photographs and sketches were used as references during data coding and cleaning.

Analysis

Frequencies, rates, rate ratios and corresponding 95% CIs of pedestrian distraction and risky behaviours were computed and stratified by site environment, driver and traffic safety characteristics. The unadjusted rate ratios and 95% CIs were computed using a negative binomial distribution and log link. The log-transformed count of pedestrians (number at risk) was used as an offset. Rate ratios were not calculated for variables with cell counts fewer than five.

Zero-inflated negative binomial models for distraction and risky behaviours were also built to examine adjusted rate ratios. Following the assumptions for a negative binomial model, both our outcomes (distraction and risky behaviours) had variances that were greater than their means. Zero-inflated models were used due to the large number of sites that had zero pedestrians observed, thus had an inflated number of zero counts of distraction and risky behaviours. A zero-inflated model is appropriate for this situation, given that it models two

separate distributions, one for the excess zeros (count of pedestrians) and one for the regular count distribution.

SAS V.9.4 (SAS Institute, Cary, NC) was used to perform all analyses. The HPGENSELECT procedure was used for model building, with the backward selection option and Akaike Information Criterion (AIC) as the chosen criterion. Two models were built: one with the count of pedestrian risky behaviours as the outcome and one with the count of distracted pedestrians. For the risky behaviour model, main predictors considered included all the site environment, driver and traffic safety feature characteristics that were significant ($p<0.05$) in unadjusted analyses. These same variables were entered into the pedestrian distraction model, given the lack of significant variables at the $p<0.05$ level in unadjusted analyses and the high correlation between distraction and risky behaviours.

RESULTS

A total of 1711 pedestrians were observed during 10-min traffic counts at 100 PMVC sites in Cluj County, Romania (table 1). Pedestrian distraction was observed at a rate of 6.3 per 100, while pedestrian risky behaviours were much higher at 24.3 per 100. The most common type of pedestrian distraction was using an electronic device, held hand to head, followed by manipulating an electronic device (eg, texting). Pedestrian risky behaviours consisted primarily of unpredictable, partial crosswalk use or illegal crossings midblock with no crosswalk. Only three pedestrians were observed crossing against the pedestrian signal light, but per site ranged from 0% to 100%. Although the rates of risky behaviours were much higher compared with distraction, risky behaviours and distraction were highly correlated (table 1).

Rates by environmental factors, traffic safety features and driver behaviours

Distraction—Pedestrian distraction rates were slightly higher within the city of Cluj-Napoca than outside (table 2). Residential areas had lower rates of pedestrian distraction compared with non-residential areas. Wider roadways, flat locations (vs slight hill) and locations with no designated parking had higher pedestrian distraction rates. Distraction rates were also higher when traffic lights were present. No distraction was observed at locations without sidewalks, paved trails or paved shoulders and distraction rates were lower at locations with no painted crosswalk compared with a painted crosswalk and crossing sign or a crossing sign alone. Distraction rates were also higher when pedestrian crossing aids (signal, push button, refuge island and/or flashing light) were present.

Risky behaviours—Rates of pedestrian risky behaviour were higher outside the city of Cluj-Napoca and on narrower streets (table 2). Pedestrian risky behaviour rates were lower at intersections compared with non-intersections and places where motor vehicle moving violations involving pedestrians were observed and decreased with each mile per hour increase in average motor vehicle speed.

Lower pedestrian risky behaviour rates were found at locations with stop signs and bicycle lanes or bike warning signs compared with those without stop signs or bike facilities (table 3). Locations with both crosswalks and crossing signs had lower pedestrian risky behaviour

rates compared with locations with no crosswalk and no crossing sign. Locations with sidewalks, paved trails or paved shoulders had lower pedestrian risky behaviour rates compared with those absent of such facilities.

Multivariable results

Distraction—In adjusted models, residential areas did not remain protective, while intersections and locations with painted crosswalks and crossing signs had increased risk of pedestrian distraction compared with non-intersections and locations without crosswalks and crossing signs (table 3). Conversely, pedestrian distraction decreased with increased pedestrian volume and increased average motor vehicle speeds.

Risky behaviours—Increased average motor vehicle speeds, increased pedestrian volume and locations with bike lanes or bike warning signs were protective against pedestrian risky crossing behaviours (table 3). Conversely, pedestrian risky behaviours increased as the volume of distracted pedestrians increased.

DISCUSSION

The current study investigated contributors to pedestrian risky behaviours and distraction in Cluj County, Romania using observational data collected at PMVC sites. This is the first observational study of pedestrians conducted in Romania and one of few, worldwide, making comparisons to other observational findings limited.

Our study observations revealed only 6% (range 0%–20% at each site) of active distraction among crossing pedestrians. However, a survey of smartphone users in 10 European countries (including Romania) found that 83% of Romanians admitted to having crossed streets while using a mobile device or phone and 79% had continued a phone call when crossing the street.[25] These results suggest a common acceptance among Romanian smartphone users for being distracted during walking and crossing streets. This discrepancy suggests that although the majority of Romanians having previously been distracted while crossing, they are not distracted each time they cross a roadway.

An observational pedestrian study at intersections in San Francisco, California, found average pedestrian mobile device use while crossing was 8%, but ranged from 2.5% to 18% at study sites, similar to our study's observed rates.[29] However, compared with two studies conducted in university towns in the USA the pedestrian distraction rates observed in our study were low, with those studies observing 29% and 44.1% distraction among pedestrians.[2430] Cluj-Napoca contains a university but is a larger and more diverse environment than these two studies. Our study also included areas in the county that did not lie within city limits.

In our study, only three observed pedestrians crossed against red, given red (0.5%, overall), but this ranged from 11.1% to 100% at the three sites where this behaviour was observed. The remaining observed signalised sites had zero crossing against red, given red. Compared with the San Francisco study, our overall crossing against a red light, given red was low (theirs was 29%, overall), but both our studies showed significant variation by site (San

Francisco ranged 3.6% to 69.7% per site).[29] However, the illegal crossings in our study primarily occurred at midblock locations, suggesting a need for additional environmental interventions (eg, additional marked crosswalks) to create safe and legal midblock crossings in Romania.

Intersections and painted crosswalks were particularly problematic for pedestrian distraction in our Romanian sample. Given that painted crosswalks are intended to increase pedestrian safety, it is possible that pedestrians perceive this as a safe zone to engage in a secondary task. The majority of intersection sites in our sample were in the most urban areas of Cluj County with high pedestrian volume. In these areas of high pedestrian density, pedestrians may have also been influenced by their pedestrian peers, relying on social information from the group on when to cross, thus freeing up their cognitive load, making room for secondary task engagement (eg, texting).[31]

The development and evaluation of targeted distraction prevention strategies is needed as there is a paucity of evidence-based interventions.[32] However, one potential avenue for safety benefits is intelligent transport system applications, including infrastructure to pedestrian technology and the use of dedicated short-range communications between infrastructure, vehicles, and vulnerable road users. Behavioural interventions may also be beneficial.[33]

Pedestrian distraction in our sample was positively correlated with pedestrian risky behaviours. This finding is supported by existing research that has shown that distracted pedestrians are less likely to be aware of their surroundings and have compromised safety behaviours.[13] Previous studies have shown pedestrian distraction contributes to inattentional blindness and can negatively impact safe walking behaviour.[2434] Greater risk of injury has also been found when crossing the street while talking on the phone, texting and listening to music,[2123] and this may be due to increased likelihood of making errors while distracted.

Finally, higher vehicle speeds and number of pedestrians were found to be protective against pedestrian risky behaviours. This may be attributed to the decreased likelihood of vehicles to stop for a pedestrian when travelling at higher approaching speeds[35] and use of social information from nearby pedestrians or collective decision-making, which in this study appeared beneficial, but has also been found to be detrimental if relied on over nonsocial information.[31]

Limitations

On-site observations were not matched exactly to the day of week, time of day or time of year that they occurred due to our limited budget and timeline for project completion. We selected crashes for observation that occurred on weekdays between 07:00 and 19:00 and also conducted our observations during these days and hours. Our results, therefore, should only be generalised to weekdays and daytime hours.

Motor vehicle violations were difficult to detect in the videos and were not possible to code on site due to the coders being occupied by other tasks, therefore are likely under-represented in our data set. We also did not assess the contribution of driver distraction. This

is likely to have contributed, in part, to some of the PMVCs that occurred at the sites we observed. Consequently, our findings cannot speak to the full contribution of motorist behaviour to pedestrian distraction and risky crossing behaviour.

Although not all of the 2010 PMVCs were analysed for the purpose of our study, we believe the sample was representative of national, local, urban and rural roadways, which took into consideration, the local versus national road differences, which were found in a previous study (eg, more pedestrian risky behaviours on local roads and more driver errors on national roads).[26]

CONCLUSIONS

In this study of PMVC locations in Romania, pedestrian distraction was correlated with pedestrian risky behaviours. Higher pedestrian volume was protective against both distraction and risky behaviours at observed PMVC sites. Increased motor vehicle speeds were protective against distraction and risky behaviours. Conversely, intersections and painted crosswalks increased risk of distraction, relative to non-intersections and non-crosswalk locations. Based on these results, targeted distraction prevention, particularly at intersections and crosswalk locations, may contribute to the prevention of PMVCs. Further investigation is needed to reveal the causal pathway between painted crosswalks (a countermeasure) and the increased distraction and risky behaviours found in this study.

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What is already known on the subject?

- Pedestrian MVC (PMVC) rates in Romania are among the highest in Eastern Europe.
- PMVCs in Romania are more likely to occur on national roads.
- Pedestrian actions contribute to Romanian crashes more frequently on local roads.

What this study adds?

- Over 6% of all observed pedestrians were distracted.
- Over 24% of observed pedestrians crossed illegally or unpredictably.
- Intersections and locations with painted crosswalks had higher distraction rates.
- Pedestrian distraction was positively correlated with pedestrian risky behaviours.
- Higher vehicle speeds and number of pedestrians protected against risky behaviours.

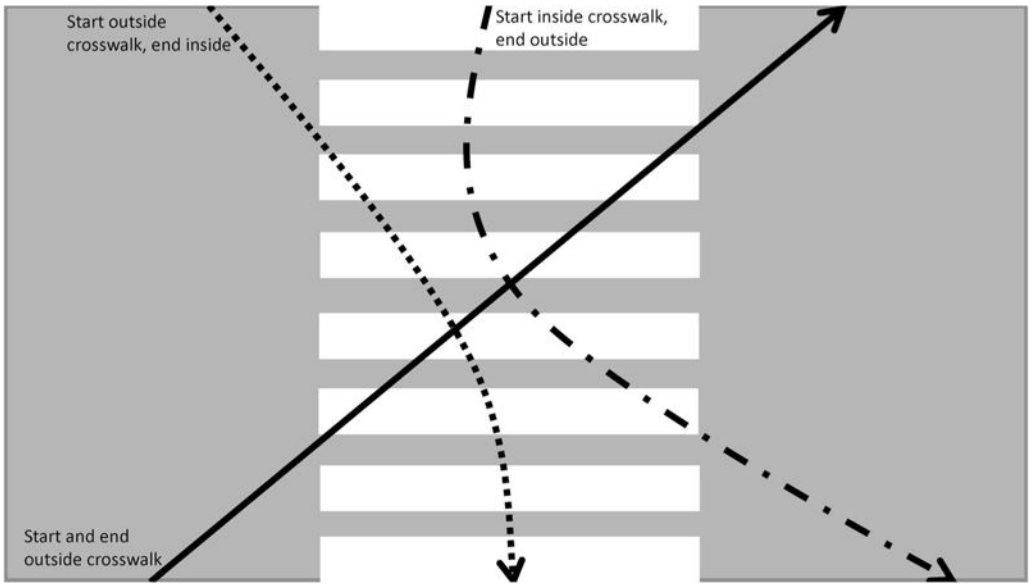

Figure 1.
Three types of unpredictable, partial use of crosswalk.

Table 1

Frequencies, rates and correlation of pedestrian distraction and risky behaviours at observed pedestrian MVC (PMVC) sites, Cluj County, Romania

Characteristics	n	Rate*
Total pedestrians observed	1711	–
Pedestrian distraction	107	6.3
Distracted by		
Child	2	0.1
Other pedestrian	6	0.4
Electronic—hand to head	79	4.6
Electronic—headphones	1	0.1
Electronic—manipulating device	18	1.1
Reading	1	0.1
Pedestrian risky behaviours	416	24.3
Unpredictable, partial use of crosswalk†	210	15.2
Illegal crossing—against red light, given red‡	3	0.5
Illegal crossing—no crosswalk, midblock or did not use available crosswalk	203	11.9

Correlations at PMVC sites	Pearson's r	p Value
Pedestrian distraction and risky behaviours	0.82	**<0.01**
Pedestrian distraction and average motor vehicle speed	−0.19	0.06
Pedestrian risky behaviours and average motor vehicle speed	−0.27	**0.01**
Pedestrian distraction and motor vehicle volume	0.16	0.10
Pedestrian risky behaviours and motor vehicle volume	0.01	0.90

Significant of bold values $p<0.05$.

*Rate per 100 observed pedestrians.

†Partial use of crosswalk=veers outside of crosswalk at start and/or end of crossing; denominator only includes sites with crosswalks.

‡Denominator includes only pedestrians at sites with traffic lights.

Table 2

Pedestrian distraction and risky behaviour frequencies and unadjusted rate ratios during crossings at pedestrian MVC locations by environmental factors, driver behaviours and traffic safety features, Cluj County, Romania, 2013

	Number of site	Total pedestrians observed	Distracted pedestrians			Pedestrian risky behaviours		
Sites characteristics	**n**	**n**	**n**	**Rate**	**Unadjusted rate ratio (95% CI)**	**n**	**Rate**	**Unadjusted rate ratio (95% CI)**
Location–								
In Cluj-Napoca	64	1505	95	6.3	1.1 (0.6 to 2.0)	327	21.7	0.7 (0.3 to 1.5)
Outside Cluj-Napoca	36	206	12	5.8	Ref	89	43.2	Ref
Road type								
National road	54	1113	76	6.8	1.3 (0.9 to 2.0)	259	23.3	0.8 (0.4 to 1.6)
Local road	46	598	31	5.2	Ref	157	26.3	Ref
Location geometry								
Non-intersection	68	580	32	5.5	Ref	216	37.2	Ref
Intersection *	32	1131	75	6.6	1.2 (0.8 to 1.8)	200	18.3	**0.5 (0.2–0.99)**
Number of lanes, index street †								
≥4	27	713	50	7.0	1.2 (0.8 to 1.8)	140	19.6	0.5 (0.2 to 1.1)
≤3	73	998	57	5.7	Ref	276	27.7	Ref
Land use in area ‡								
Residential								
Yes	78	868	41	4.7	**0.6 (0.4 to 0.9)**	180	20.7	0.7 (0.3 to 1.6)
No	22	843	66	7.8	**Ref**	236	28.0	Ref
Business								
Yes	78	1451	93	6.4	1.2 (0.7 to 2.1)	333	23.0	0.6 (0.2 to 1.6)
No	22	260	14	5.4	Ref	83	31.9	Ref
Other (recreation, farm/agriculture, vacant)								
Yes	12	92	4	4.3	§	41	44.6	1.3 (0.4 to 3.9)
No	88	1619	103	6.4		375	23.2	Ref
Slope/grade								
Flat	78	1556	100	6.4	Ref	396	25.4	Ref
Slight hill	13	155	7	4.5	0.7 (0.3 to 1.5)	20	12.9	0.7 (0.2 to 1.9)

Sites characteristics	Number of site n	Total pedestrians observed n	Distracted pedestrians n	Distracted pedestrians Rate	Distracted pedestrians Unadjusted rate ratio (95% CI)	Pedestrian risky behaviours n	Pedestrian risky behaviours Rate	Pedestrian risky behaviours Unadjusted rate ratio (95% CI)
Parking‡								
Parallel parking								
Yes	71	816	47	5.8	0.9 (0.6 to 1.3)	233	28.6	1.7 (0.8 to 3.7)
No	29	895	60	6.7	Ref	183	20.4	Ref
Diagonal parking								
Yes	7	243	15	6.2	1.0 (0.6 to 1.7)	47	19.3	1.4 (0.4 to 4.8)
No	93	1468	92	6.3	Ref	369	25.1	Ref
Parking (parallel or diagonal)								
Yes	76	1017	57	5.6	Ref	259	25.5	Ref
No	24	694	50	7.2	1.3 (0.9 to 1.9)	157	22.6	0.7 (0.3 to 1.8)
Motor vehicle moving violation involving pedestrian								
Yes	4	123	8	6.5	1.0 (0.5 to 2.1)	16	13.0	0.5 (0.1 to 2.9)
No	95	1588	99	6.2	Ref	400	25.2	Ref
Traffic controls								
Traffic light								
Yes	12	855	63	7.4	1.4 (1.0 to 2.1)	196	22.9	0.9 (0.3 to 2.4)
No	88	856	44	5.1	Ref	220	25.7	Ref
Stop sign								
Yes	5	94	1	1.1	§	7	7.4	**0.2 (0.04 to 0.8)**
No	94	1617	106	6.6		409	25.3	**Ref**
Yield sign								
Yes	2	21	0	0	§	9	42.9	1.5 (0.2 to 13.0)
No	98	1690	107	6.3		407	24.1	ref
Unregulated								
Yes	82	744	43	5.8	0.9 (0.6 to 1.3)	204	27.4	1.3 (0.6 to 3.2)
No	18	967	64	6.6	Ref	212	21.9	ref
Pedestrian facilities‡								
Sidewalk, paved trail or paved shoulder								
Yes	92	1690	107	6.3	§	402	23.8	0.6 (0.1 to 3.0)

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	Number of site	Total pedestrians observed	Distracted pedestrians			Pedestrian risky behaviours		
Sites characteristics	**n**	**n**	**n**	**Rate**	**Unadjusted rate ratio (95% CI)**	**n**	**Rate**	**Unadjusted rate ratio (95% CI)**
No	8	21	0	0		14	66.7	ref
Painted crosswalk								
Yes, with crossing sign	43	1386	90	6.5	1.3 (0.7 to 2.4)	243	17.5	**0.3 (0.2 to 0.7)**
No, but has crossing sign	5	81	5	6.2	1.3 (0.4 to 3.6)	27	33.3	1.3 (0.2 to 7.5)
No, and no crossing sign	52	244	12	4.9	Ref	146	59.8	Ref
Pedestrian crossing aid(s)[¶]								
Yes	15	888	65	7.3	1.4 (1.0 to 2.1)	197	22.1	0.7 (0.3 to 1.8)
No	85	823	42	5.1	Ref	219	26.6	Ref
Surface condition								
Excellent/good	75	1449	94	6.5	Ref	316	21.8	Ref
Fair/poor	25	262	13	5.0	0.8 (0.4 to 1.4)	100	38.2	1.6 (0.7 to 3.6)
Bike lane or bike warning sign								
Yes	11	704	47	6.7	1.1 (0.8 to 1.6)	112	15.9	**0.3 (0.1 to 0.9)**
No	88	1007	60	6.0	Ref	304	30.2	Ref

	Mean per site	SD	Unadjusted rate ratio (95% CI)	Unadjusted rate ratio (95% CI)
Average motor vehicle speed (miles per hour)	28.9	10.8	0.98 (0.94 to 1.02)	**0.95 (0.90 to 0.99)**
Motor vehicle volume (per motor vehicle)	86.1	38.0	1.01 (1.0 to 1.02)	0.99 (0.99 to 1.00)
Distracted pedestrians (per pedestrian)	1.1	2.6	n/a	0.96 (0.86 to 1.08)
Risky crossing behaviours (per pedestrian)	4.2	8.7	1.01 (1.00 to 1.02)	n/a

[*] Includes three roundabouts.

[†] Based on index road where crash occurred, which was drawn from the crash data.

[‡] Not mutually exclusive.

Rate=per 100 observed pedestrians.

[§] Rate ratio not computed due to small cell sizes.

[¶] Pedestrian signal, push button, refuge island and/or flashing light.

Table 3

RR of pedestrian risky crossing behaviours and distraction at pedestrian MVC locations, Cluj County, Romania, 2010

	Distraction ZINB model		Risky behaviours ZINB model	
Site characteristic	**Adjusted RR**	**95% CI**	**Adjusted RR**	**95% CI**
Intersection (ref=no)	1.03 *	1.31 to 3.44		
Average motor vehicle speed (per mile per hour increase)	0.95	0.88 to 1.01	0.93 *	0.90 to 0.96
Distracted pedestrians (per pedestrian)			1.28 *	1.21 to 1.35
Painted crosswalk (ref=no crosswalk and no crossing sign)				
Yes, with crossing sign	2.48 *	1.21 to 5.07	0.72	0.47 to 1.11
No, but has crossing sign	1.87	0.60 to 5.84	1.42	0.74 to 2.71
Bike lane or bike warning sign (ref=no)			0.36 *	0.19 to 0.66
Pedestrians (per pedestrian)	0.88 *	0.82 to 0.95	0.95 *	0.92 to 0.99

* $p<0.05$.

ZINB, zero-inflated negative binomial.