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Gender differences in children's pedestrian behaviors: Developmental effects

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Abstract

Introduction—All child pedestrians are vulnerable to road traffic injuries, but there is evidence that boys may be at greater risk than girls, at least among some age groups.

Method—To create effective intervention programs, research on how boys and girls of particular ages behave as pedestrians, and whether there are gender differences that increase risk for particular genders at particular ages, is needed. In this study, 255 boys and 235 girls in grade 1 through 6 from two primary schools in Nantong city, China, were unobtrusively videotaped when walking to school in the morning. Videotapes were reviewed and coded for seven pedestrian safety behaviors, including activities related to crossing streets (walking instead of running/hopping, observing traffic, using the crosswalk instead of walking outside the crosswalk, and keeping close to an accompanying adult) and those related to walking alongside busy streets (walking instead of running/hopping on the sidewalk, not playing on the sidewalk, walking alone instead of walking side-by-side with a partner).

Results—Results revealed that as a whole, boys played on the sidewalk more often than girls ($p < 0.01$) and crossed with an accompanying adult more than girls ($p < 0.05$), while girls walked side-by-side with partners more often than boys ($p < 0.05$). With a few exceptions, boys and girls in the younger grades (1–2) as well as those in the older grades (5–6) behaved fairly similarly as pedestrians, but boys and girls in the middle grades (3–4) presented with several significant gender-based differences. In the middle grades, boys watched traffic more than girls while crossing ($p < 0.01$); ran, hopped and played on the sidewalk more often than girls ($p < 0.05$); and walked side-by-side less often with partners than girls ($p < 0.05$). We also detected different gender-based trends in the development of pedestrian skills. With increasing age, girls performed more safely in pedestrian tasks, but boys did not show a similar developmental trend.

Conclusions—We conclude that boys and girls exhibit different characteristics in their pedestrian behaviors and discuss implications for prevention.

Keywords

Pedestrian behavior; road-crossing behavior; children; gender; naturalistic observation

1. Introduction

Road traffic injury (RTI) constitutes a serious pediatric public health challenge worldwide. According to WHO estimates, there are around 186,300 child deaths from road traffic accidents each year around the world, and RTI has become one of the four leading causes of death globally among children over five years of age. Furthermore, about 38% of child RTI deaths are pedestrians (WHO, 2014).

The burden of RTIs is particularly pronounced in low-and middle-income countries (WHO, 2015). In China, according to data from the Global Burden of Disease project, 9,296 children ages 5–14 years died in traffic accidents in 2016, and 842,327 children were injured on the road (Institute for Health Metrics and Evaluation, 2018). Child pedestrians represented about 20.33% of the RTI deaths and injuries in China. As is the case in most countries (Santamariña-Rubio, Pérez, Olabarria, & Novoa, 2014), Chinese boys experience higher risk for road traffic injury than girls. Recent Chinese government data suggest 62.09% of the child pedestrian deaths and 61.38% of child pedestrian injuries were boys (Road Traffic Safety Research Centre of Ministry of Public Security in China, 2014).

Even though boys have higher injury rates than girls, there is no clear scholarly consensus concerning whether boys actually take more risks when they engage in traffic environments. In fact, some research suggests behavior across the genders is similar. For example, Morrongiello and Corbett (2015) used a virtual traffic environment to study pedestrian behavior among children ages 7–12 and found that boys and girls judged inter-vehicle gap thresholds similarly. Others report similar findings (Ampofo-Boateng & Thomson, 1991; Tabibi & Pfeffer, 2003; Barton & Schwebel, 2007a).

In other research, however, scholars have reported gender differences in child pedestrian behavior. Granié (2007) observed preschool children (age 5) in France, and found that boys were more compliant than girls in looking at the surrounding environment as they crossed. Underwood and colleagues (2007) reported sex differences in a study involving classification of risk in photographed road scenes, with the results suggesting boys focused on physical attributes of the pedestrian environment while girls were more likely to look at actors within the environment. They interpret this finding to suggest girls may be safer pedestrians because they attend to the dynamic attributes of a pedestrian environment.

Other research also finds that boys take more risks in pedestrian environments than girls. Observational studies report boys are more likely to run near traffic (Fu & Zou, 2016), to play near traffic (Sullman, Thomas, & Stephens, 2012), and to choose riskier routes across intersections (Barton, Ulrich, & Lyday, 2011; Barton & Schwebel, 2007b). Similarly, in comparing knowledge and behavior, a few studies report that boys have more knowledge

about how to engage safely in traffic (Tabibi, Pfeffer, & Sharif, 2012; West, Sammons, & West, 1993) but that girls tend to behave more cautiously on the road, perhaps because they have less knowledge about how to act safely (O'Neal, Plumert, McClure, & Schwebel, 2016; Rosenbloom, Haviv, Peleg, & Nemrodov, 2008).

Finally, gender may influence how parents perceive and supervise children in pedestrian settings. Available evidence suggests parents may perceive boys as less responsive to learning about road safety and less careful when crossing the road than girls (Waylen & McKenna, 2002). Supporting this possibility, Morrongiello and Barton (2009) found that parents practiced (and therefore modeled) safer road-crossing practices when accompanying their sons than with their daughters.

Several factors might explain the range of gender-based differences reported in existing studies. Most prominent, the age range of the child may be a factor. For example, Morrongiello and Corbett (2015) studied 7–12-year old children's pedestrian behaviors in a virtual environment and reported no significant gender differences, while O'Neal et al. (2016) found that 7- and 8-year old girls were more cautious than boys when crossing a virtual roadway. Second, the task of engaging on streets as a pedestrian encompasses a wide range of perceptions, decisions, and behaviors, and gender-related patterns may vary across those pedestrian safety sub-tasks. For example, the field consistently suggests boys are riskier when crossing (Barton & Schwebel, 2007b; Fu & Zou, 2016), but boys' performance in some other pedestrian tasks, such as pedestrian route selection, is similar to girls (Ampofo-Boateng & Thomson, 1991; Barton & Schwebel, 2007a).

This study was designed to address further the topic of gender differences in children's pedestrian skills and behaviors. We observed real-world child pedestrian behavior outside a school to examine both overall gender-related differences and gender-related differences across development (grades 1–2 vs. 3–4 vs 5–6). We hypothesized we would not discover significant gender effects across the full sample, but that we might discover gender-based differences related to child development in analyses of narrower age groups. We also hypothesized that boys and girls might demonstrate different trends in their development of pedestrian skills and behaviors.

2. Method

2.1 Participants

We unobtrusively observed 491 children outside two primary schools in Nantong city, China while they walked to school in the morning. Observations occurred in two types of locations: while children crossed the road and while children walked on sidewalks adjacent to the road. Specifically, 201 children were observed during road-crossing, including 96 boys and 105 girls, and 290 children were observed walking on sidewalks, including 159 boys and 131 girls.

Observed children ranged in age from 6 years, 1 month to 14 years, 0 months. They all attended the schools, which served children from grades 1–6, and represented all 6 grade

levels. Following observations, we worked with teachers at the school to identify observed children's ages and grades.

Approval for the research was obtained from the Nantong University Academic Ethics Committee and the Primary Education Office of both participating schools. Written parental consent was secured prior to each child's participation.

2.2 Sites

Two observational sites were selected near each of the two primary schools, both at unsignalized mid-block locations. Vehicle traffic density on the roads where the research was conducted averaged 27 motor vehicles/minute and 24.5 electric bicycles/minute, and the child pedestrian density was 6.4 child pedestrians/minute during observational periods.

Figures 1 and 2 illustrate the research sites. In both cases, we stationed a camera across the street from where children were walking and filmed children as they crossed the street toward the camera (and their school). Pedestrian crosswalks were marked on the road and were 10.5 m (site 1) or 8 m (site 2) wide; dashed lines in the figure indicate where police officers were stationed to halt traffic while children crossed.

We also filmed children walking along the sidewalks outside their schools. Sidewalks were about 2m wide and closed to non-pedestrian traffic, although occasionally electric and non-electric bicycles travelled on the sidewalks.

2.3 Procedure

We recorded children's pedestrian behavior on five sunny and temperate mornings in May 2014. To observe behavior, research assistants placed HD video cameras in discrete locations (e.g., amidst shrubbery or inside shops) to avoid attention from the pupils, and filmed children walking or crossing until they passed the target areas (e.g., across the road or out of view on the sidewalk). All filming occurred between 7 a.m. to 7:40 a.m., which were the peak hours of morning child pedestrian traffic in the filming locations.

We assessed 370 children at site 1 and 121 children at site 2. We captured 201 children crossing the street and 290 pupils walking along sidewalks. Since pupils were occasionally observed more than once, there were 216 observations of crossing and 316 observations of sidewalk-walking in total.

All videotapes were coded using Observer XT11.5 software. Coding was performed by two trained research assistants, who established inter-rater reliability through independent viewing of the full sample ($\kappa > .85$ for all variables). Rare disagreements were resolved through discussion between the coders and a third senior researcher.

2.4 Measures

We measured four pedestrian safety behaviors for children crossing the roadway and three for children walking along sidewalks. Measures were developed to be objective in nature; several were adopted from previous research (Fu & Zou, 2016; Granié, 2007; Miller, Austin,

& Rohn, 2004; Rosenbloom et al., 2008; Tom & Granié, 2011; Yeaton & Bailey, 1978; Zeedyk, Wallace, & Spry, 2002; Zeedyk & Kelly, 2003).

The following behaviors were coded dichotomously for children crossing roads:

- (1) Not walking outside the crosswalk. The child stays inside the crosswalk lines while crossing, rather than walking outside the crosswalk lines.
- (2) Not running or hopping. The child walks across the road to the opposite curb without running or hopping.
- (3) Observing while crossing. The child continues observing traffic in both directions while crossing instead of crossing inattentively.
- (4) Crossing with an accompanying adult. If the child walks with an adult companion, then the child remains close to the adult (hold hands or within 1 m).

The following behaviors were coded dichotomously for children walking on sidewalks:

- (1) Not running or hopping on the sidewalk. The child walks on the sidewalk instead of running or hopping.
- (2) No playing. The child is not playing ball or other games, or chasing another child/children, while walking on the sidewalk.
- (3) Not walking side-by-side with partner(s). In China, pedestrians are discouraged from walking side-by-side with one or more partners because it could affect traffic from the rear and may cause risks. We coded this variable if the child was walking side-by-side with one or more partners.

2.5 Data Analysis Plan

Data were analyzed in several steps. First, we examined descriptive data by computing the percentage of each behavior, both for the full sample as well as for each gender and for each gender within each grade group. Second, chi-square tests were used to evaluate gender differences, both overall and within each grade level. Finally, we examined the developmental trend of pedestrian skill in each gender. Post-hoc analyses were conducted if overall chi-square tests were significant, and the Bonferroni correction was used to correct for multiple post-hoc comparisons (in most cases, three comparisons were required to compare differences across the three grade groups, so the alpha boundary was adjusted to $0.05/3=0.017$). SPSS 22.0 was used for all analyses.

3. Results

The second column of Table 1 shows the percentage of safe and unsafe behaviors by the full sample. As shown, children tended to engage safely during the crossing, although nearly 30% of children were observed running/hopping while crossing and only 34% observed traffic while crossing the street. Similarly, almost 16% ran or hopped on the sidewalk and about a quarter of children walked side-by-side with a partner or partners on the sidewalk, a behavior that is discouraged in China.

3.1 Overall gender differences

Table 1 also shows crossing behavior among boys and girls separately. Chi-square tests suggest gender differences across all grades were not significant for any of the pedestrian behaviors while crossing the street [$\chi^2_{\text{walking outside the crosswalk}}(1, N=30) = 0.01, ns$; $\chi^2_{\text{running/hopping}}(1, N=78) = 1.47, ns$; $\chi^2_{\text{observing while crossing}}(1, N=90) = 2.26, ns$], except crossing with an accompanying adult, for which boys crossed more often with an accompanying adult than girls [$\chi^2(1, N=22) = 4.41, p<0.05$].

For children's behavior on the sidewalks, chi-square tests showed that the difference between boys and girls for running or hopping on the sidewalk was marginally significant [$\chi^2(1, N=50) = 3.60, p=0.058$]. Boys played more often than girls on the sidewalk [$\chi^2(1, N=19) = 9.62, p<0.01$] and girls walked side-by-side with partner(s) more often than boys [$\chi^2(1, N=80) = 8.31, p<0.01$].

3.2 Gender differences within grade groups

To analyze development differences between the genders, we divided children into 3 groups – younger grades (grades 1 and 2), middle grades (grades 3 and 4), and older grades (grades 5 and 6) – and computed chi-squares across genders within each developmental stage (Table 2).

Children in the younger grades displayed minimal gender differences; in fact, the only statistically significant difference between boys and girls in the younger grades was for running or hopping on the sidewalk (boys ran/hopped more than girls, $\chi^2(1, N=31) = 4.25, p<0.05$). We also detected few gender differences in the older grades. Girls in grades 5–6 walked outside the crosswalk more often than boys [$\chi^2(1, N=16) = 4.33, p<0.05$] and boys ran or hopped when crossing more than girls [$\chi^2(1, N=17) = 4.67, p<0.05$], but no other gender differences emerged in the older age group.

Among children in the middle grades, several gender differences emerged. Boys in grades 3–4 watched traffic more carefully than girls when crossing [$\chi^2(1, N=23) = 9.62, p<0.01$], crossed with an accompanying adult more often than girls [$\chi^2(1, N=4) = 5.33, p<0.05$], and kept close to the accompanying adult less often than girls when they were crossing with an adult [$\chi^2(1, N=3) = 6.52, p<0.05$]. We also observed that boys in grades 3–4 ran or hopped on the sidewalk more often than girls [$\chi^2(1, N=10) = 5.00, p<0.05$], played on the sidewalk more often than girls [$\chi^2(1, N=14) = 11.57, p<0.01$], and walked side-by-side with partner(s) less often than girls [$\chi^2(1, N=19) = 3.93, p<0.05$].

3.3 Developmental change of each gender

Our final analytic step was to analyze developmental change for boys and girls in each pedestrian behavior. We conducted a series of chi-square tests examining development change within each gender, using post-hoc chi-square tests when significant change across the three groups was detected.

Four differences emerged across development for girls. Specifically, girls' incidence rate for walking outside the crosswalk was significantly different among the three grade groups [$\chi^2(1, N=16) = 6.08, p<0.05$], with girls walking outside the crosswalk more often as they grew

older. Significant differences were observed also for girls across grade groups in running/hopping when crossing [$\chi^2(2, N=36) = 17.03, p < 0.001$], and while walking on the sidewalks [$\chi^2(1, N=18) = 8.17, p < 0.05$]. Post-hoc chi-squares indicated girls in grades 1–2 ran and hopped more often than girls in grades 3–4 [$\chi^2_{\text{while crossing}}(1, N=30) = 6.79, p = 0.017$; $\chi^2_{\text{while walking}}(1, N=12) = 8.17, p = 0.017$] and in grades 5–6 [$\chi^2_{\text{while crossing}}(1, N=26) = 14.75, p = 0.017$], and we found an overall trend for less running/hopping as girls grew older. Finally, a significant difference was observed across the grade groups for girls in observing traffic while crossing [$\chi^2(1, N=42) = 15.75, p < 0.001$]. Post-hoc chi-squares indicated girls in grade 5–6 observed traffic more often than girls in grades 1–2 [$\chi^2(1, N=33) = 7.58, p = 0.017$] or grades 3–4 [$\chi^2(1, N=30) = 12.86, p = 0.017$], and we note an overall trend for more observation of traffic as girls grew older.

Only two significant developmental differences across grade groups emerged for boys. First, like girls, boys' incidence rate of running or hopping on the sidewalk differed significantly across grades [$\chi^2(1, N=32) = 24.11, p < 0.001$]. Boys in grades 1–2 ran and hopped much more often than boys in grades 3–4 [$\chi^2(1, N=41) = 7.37, p = 0.017$] or grades 5–6 [$\chi^2(1, N=40) = 21.56, p = 0.017$]. Second, boys' incidence rate for playing differed across the grade groups [$\chi^2(1, N=22) = 12.92, p < 0.01$]. Post-hoc analyses revealed that boys in grades 3–4 played on the sidewalk more often than boys in grades 5–6 [$\chi^2(1, N=15) = 15.57, p = 0.017$].

4. Discussion

By observing schoolchildren walking to school, we gained a number of insights into how boys and girls behave as pedestrians across development, and how children's pedestrian skills may develop differently in boys versus girls. Across the full sample, few gender differences emerged, a finding that concords with findings from a sample of 7–12 year old children in a virtual environment (Morrongiello & Corbett, 2015) and 5- and 7-year-old children in real-world simulations to recognize and select safe traffic routes (Ampofo-Boateng & Thomson, 1991); but contradicts other findings (e.g., ages 5–9, Barton et al., 2011; grades 5–7, Rosenbloom et al., 2008). We did replicate previous findings that boys across all age groups may engage in riskier play, running, and hopping while walking across streets (Fu & Zou, 2016; Sullman et al., 2012), including an extension of that finding to pedestrian behavior on the somewhat-safer environment of sidewalks near busy streets in our study.

Our consideration of gender differences within each age group yielded some unexpected findings. We detected relatively few gender-based differences in the younger children (grades 1–2) or the older children (grades 5–6). In fact, the only differences among the younger children were for boys to run and hop more than girls, which represents a developmentally-expected gender-based difference that may be tied to higher levels of activity, impulsivity, and an undercontrolled behavioral style among boys (Schwebel & Barton, 2006; Whitebread & Neilson, 1998). Among the older children, we also detected developmentally-expected differences across the genders. Boys continued to run and hop more often on the sidewalk than girls, and girls tended to walk outside the crosswalk lines more than boys. The gender difference in walking outside the crosswalk lines may reflect socializing among girls (e.g., walking in large groups that led them outside the lines) or a

perception or reality of mastered pedestrian skill that permitted greater risk-taking to achieve efficiency in walking (Meir, Parmet, & Oron-Gilad, 2013; Tabibi & Pfeffer, 2003).

Among the pupils in the middle grades 3 and 4, we detected many more pedestrian behavior differences across the genders. Specifically, boys in this age group observed traffic more carefully than girls when crossing; crossed with an accompanying adult more often than girls; ran or hopped and played on the sidewalk more often than girls; and walked side-by-side with partner(s) less often than girls. We suspect one or more aspects of child development could explain the pattern of results we detected.

First, the finding that boys in grades 3–4 observed traffic while crossing more often than girls may be tied to active or impulsive behavior patterns, which are more common among boys than girls (McDaniel & Zuckerman, 2003), and may emerge especially as children are actively learning to be safe pedestrians rather than when they are less safe and unaware, relying on adult supervision (grades 1–2) or when they are more confident and skilled in their pedestrian behavior (grades 5–6). Another possibility is that boys have greater knowledge about pedestrian safety than girls (Tabibi et al., 2012; West et al., 1993), and demonstrate compliance to those rules in looking at the surrounding environment as they cross streets even if they are not processing and acting upon the perceived information from the traffic environment any differently than girls (Granié, 2007).

Our gender-based findings in grades 3–4 concerning walking on the sidewalk tend to concord with behavior patterns in other age groups and likely reflect social development influences. Boys tended to run, hop, and play on the sidewalk more than girls, and girls tended to walk side-by-side with partners more than boys. We also detected gender differences in adult supervision among children in grades 3–4 that were not detected in younger or older children: boys were supervised more often than girls. This may reflect adult perception – in fact, an accurate perception – that boys have greater risk in pedestrian settings and therefore need to be supervised more carefully (Morrongiello & Barton, 2009; Waylen & McKenna, 2002). Of course, the presence of supervising adults also complicates interpretation of the findings from our study and other observational research. If boys take more risks on the road – or if adults perceive or assume that they may take more risks – then adults may be more likely to supervise boys in pedestrian settings. Adult supervision may impact both children's learning of safe pedestrian behavior (explicitly and through modelling) as well as their actual behavior (e.g., relying on adults to keep them safe rather than engaging in pedestrian behaviors themselves).

The final objective of our study was to consider developmental trends in pedestrian behavior within each gender. With increasing age, we found that girls became safer in most pedestrian behaviors but boys did not. Empirical research does not support gender-based differences in relevant cognitive skills, suggesting other gender-based factors might affect boys' development of pedestrian behaviors more than girls. Temperament and personality seem a plausible influence to consider (Barton & Schwebel, 2007b; Hoffrage, Weber, Hertwig, & Chase, 2003). Both impulsive temperament (Briem & Bengtsson, 2000) and sensation-seeking personality traits (Rosenbloom, 2006) have been linked to traffic behavior, and high

levels of both impulsivity and sensation-seeking are more common among boys than girls (McDaniel & Zuckerman, 2003; Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993).

More broadly, our research speaks to the interacting roles of cognitive, perceptual, and social development on child pedestrian safety. The field of pedestrian research appropriately tends to focus on cognitive and perceptual development factors that influence children's behavior in traffic, but our observations of children in grades 3–4 remind us of the possibility that social developmental factors may also play a significant role on children's pedestrian safety. As children grow from middle to late childhood, they increase peer contacts and activities, they begin to develop friendships and affiliations outside of school (Cicchetti & Cohen, 2006), and socialization to sex roles begins to differentiate more distinctly the peer interaction style of boys versus girls (Adler, Kless, & Adler, 1992; Rose & Rudolph, 2006). Girls in middle childhood typically prefer social conversation and interaction, creating a pattern of increased friendships and social behavior that may be reflected in our finding that girls walked together in pairs more often than boys in grades 3–4. Boys embody more active and inattentive behavior patterns that persist into early adolescence, play more in physical “tussles” with friends, and have less strong affiliations with large friendship groups. This pattern of social development may be reflected in our findings that boys in grades 3–4 were looking toward traffic more than girls, but that boys took more risks, including playful and running behavior in traffic.

Our findings have implications for pedestrian injury prevention and training efforts. In particular, they suggest prevention and training programs might be tailored somewhat differently for boys and girls at different age groups. Boys seem to behave actively in pedestrian settings, so even boys in middle and older grades who have cognitive capacity to walk safely in pedestrian settings may have risk due to their active, impulsive, and playful behaviors. Use of prevention strategies like crossing guards might be extended to older male students, and training should target boys with education about the risks present, teaching them to recognize the potential hazards on the road and seek adult supervision to cross streets.

Girls may prefer to walk with partners, which could lead girls to danger either because they are busy socializing and neglect traffic or because they rely on each other to watch for dangers, and no one in the group of girls notices a hazard. Prevention might encourage girls to focus on the crossing task. Training could target social development and peer relations among girls, encouraging them to understand potential hazards and focus on pedestrian risks when they are near traffic. Our insight that social development may be relevant to child pedestrian safety along with cognitive and perceptual development is critical to creation of prevention programs.

Our study was limited by the lack of information about potential covariates, such as children's road experience, temperament/personality, or cognitive skills. Also, we analyzed gender differences in children's pedestrian skills by observing behaviors at two primary schools but failed to expand the samples to pre-school or secondary-school children, who might display different developmentally-mediated behavior patterns between boys and girls.

Finally, our study was conducted in China. Cultural and socialized gender norms may differ across nations, and replication in other cultures would be valuable.

5. Conclusion

In summary, boys and girls of different ages display distinct characteristics on and near roadways. Across development, boys played and ran/hopped more often while girls preferred to walk with partners. Substantial gender differences emerged between boys and girls in grades 3 and 4, with boys behaving in riskier ways than girls at that age. With increasing age through grade 6, girls behaved more safely on roads but boys did not show increasing safety.

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Highlights

- Gender differences of pedestrian behaviours among children in grades one through six are studied by observing.
- Across the full sample, few gender differences emerged in crossing behaviours.
- Boys and girls in the younger grades (1–2) as well as those in the older grades (5–6) behaved fairly similarly as pedestrians.
- Boys and girls in the middle grades (3–4) presented with several significant gender-based differences.
- With increasing age, girls performed more safely in pedestrian tasks, but boys did not show a similar developmental trend.

Fig. 1.
Schematic depiction of road layout at site 1

Fig. 2.
Schematic depiction of road layout at site 2

Table 1

Percentage of children displaying each pedestrian behavior – full sample

Pedestrian behavior	Full sample	Boys	Girls	χ^2 gender
Crossing behavior (N=201, 96 boys and 105 girls)				
<i>Unsafe crossing</i>				
Walking outside the crosswalk	11.49	11.02	11.94	0.01
Running/hopping while crossing	29.88	33.07	26.87	1.47
<i>Safe crossing</i>				
Observing traffic while crossing	34.48	37.80	31.34	2.26
Crossing with accompanying adult	8.43	11.02	5.97	4.41 [*]
Behavior on sidewalks (N=290, 159 boys and 131 girls)				
Running/hopping on the sidewalk	15.82	18.60	12.50	3.60
Playing on the sidewalk	9.49	12.79	5.56	9.62 ^{**}
Walking side-by-side with partner(s)	25.32	20.35	31.25	8.31 ^{**}

*
p<0.05**
p<0.01

Table 2

Percentage of children displaying each pedestrian behavior by grade groups

Pedestrian behavior	Younger Grades (G1-2)		Middle Grades (G3-4)		Older grades (G5-6)		χ^2_{G1-2}	χ^2_{G3-4}	χ^2_{G5-6}	χ^2_{boy}	χ^2_{girl}
	Boys	Girls	Boys	Girls	Boys	Girls					
Crossing behavior											
<i>Unsafe crossing</i>											
Walking Outside the crosswalk	7.	0	16	11	12	26	—	0.93	4.3	3.50	6.08*
Running/hop	41	42	25	22	27	14	0.0	0.33	4.6	4.19	17.03
Ping while crossing	.07	.55	.81	.22	.5	.29	5		7*		***
Safe crossing											
Observing while crossing	30	25	45	20	42	50	0.2	9.62	0.5	3.37	15.75
Crossing with an accompanying adult	.36	.53	.16	.00	.5	.00	9	**	3		***
	12	8.	9.	2.	10	7.	0.7	5.33	0.5	0.55	4.33
Behaviors on Sidewalks											
Running/hopping on the sidewalk	33	18	15	5.	5.	11	4.25	5.00	2.8	24.11**	8.17*
Playing on the sidewalk	.87	.87	.09	.00	26	.76	*	*	8	*	
	11	11	22	5.	5.	0	0	11.5	—	12.92**	2.25
	.29	.32	.64	.00	26			7**			
Walking side-by-side with partner(s)	25	39	15	27	19	28	2.9	3.93	1.7	3.10	3.00
	.81	.62	.09	.5	.3	.26	7	*	2		

* p<0.05

** p<0.01

*** p<0.001.

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The sample of children crossing in younger grades is 76 (41 boys and 35 girls), in middle grades is 85 (49 boys and 36 girls), and in older grades is 64 (28 boys and 36 girls). The sample of children walking on the sidewalk in younger grades is 107 (58 boys and 49 girls), in middle grades is 98 (52 boys and 46 girls).