

Determinants of Elderly Pedestrian Traffic Behavior in Iran: The Role of Socio Economic and Cognition Status

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Abstract

Background: Elderly pedestrians are among the most vulnerable groups in terms of traffic-related injuries. This study aimed to investigate traffic behavior and its determinants among elderly pedestrians in Iran.

Methods: This cross-sectional study examined the traffic behavior of 600 elderly pedestrians in Zanjan, northwestern Iran. Pedestrian traffic behavior was evaluated in five domains (traffic violations, traffic distraction, adherence to traffic rules, aggressive behaviors, and positive behaviors) using the Pedestrian Behavior Questionnaire (PBQ). Participants' socioeconomic status (SES) was assessed by an SES questionnaire, and cognitive function was assessed by the Abbreviated Mental Test score (AMTS). The participants were selected using the multistage random sampling method.

Results: 50% of elders were man. 488 (81.3%) of them had 60-74 and 112 (18.7%) were 75 years old and above. More than 90% of elderly pedestrians showed unsafe traffic behavior. This included traffic violations and failure to adhere to traffic rules. Almost half the elders were aggressive and distracted when walking and crossing the street. Higher SES was associated with both higher cognitive status and safer traffic behavior. Higher SES, healthy cognitive function, male sex, walking more than 1 hour a day, higher levels of education, and being married were among the determinants of safe traffic behavior.

Conclusion: The majority of the elders showed unsafe traffic behavior. Elderly pedestrians with high SES and healthy cognitive function were more likely to exhibit safe behavior than those with low SES and cognitive dysfunction. Interventions are needed to improve the traffic behavior of elderly pedestrians special with low SES.

Background

According to the World Health Organization (WHO), the road traffic injury (RTI) mortality rate worldwide increased from about 999,000 in 1990 to more than 1 million in 2002 and was projected to reach 2 million a year by 2020 (1). According to a national study, RTIs in Iran accounted for 2.5% of traffic injuries worldwide, and RTIs ranked first in terms of the number of years of life lost in Iran due to premature death (2). Furthermore, RTIs were the second leading cause of death in Iran after cardiovascular diseases (2).

In Iran elderly people are among the most vulnerable groups in terms of RTIs, with most RTIs involving pedestrians, especially elderly pedestrians (3). Increases in life expectancy worldwide have led to a rise in the number of elderly per 100,000. The elderly population is expected to triple by 2025 in many developing countries (4–6). Research has shown that in general, elderly pedestrians have a greater risk of traffic-related injuries as compared with that of other road users due to deterioration of physical and cognitive abilities (7, 8). One study conducted in 49 countries showed that functional and cognitive impairment were prevalent among the elderly, especially in low-income countries (9). Another study confirmed that cognitive impairment exposed elders to various types of injuries, including RTIs (10). Research also pointed to a correlation between the traffic behavior of elders and their perceptual abilities (1). For examples, elders who could estimate the road crossing distance accurately were less likely to be exposed to traffic injuries than those who were unable to estimate the distance (11).

Age-related declines in cognitive ability in the elderly affect a range of brain functions, including attention, memory, vision, reaction times, perception, judgment, reasoning, and problem solving (12). Due to decreased cognitive and perceptual functions, elders may find activities that require quick and accurate responses, such as crossing busy roads, difficult (1, 13).

Previous studies demonstrated a link between decreased cognitive ability and socioeconomic status (SES) among the elderly (14–16). Elderly people with low SES were found to have poor cognitive function due to a low level of education, which was often accompanied by poor nutritional status and consequently mental health problems (16, 17).

Due to the aforementioned age-related issues, there is a high incidence of RTIs among the elderly. Various studies have indicated that unsafe behavior by pedestrians increases the risk of collisions. Unsafe behaviors include pedestrians following other pedestrians blindly across the street instead of checking that it is safe to cross (8–10), using cell phones while crossing (11), or placing themselves in drivers' blind spots, with the result that drivers are unable to see them (16, 17). To the best of our knowledge, the traffic behavior of elderly pedestrians in Iran, which has the second highest mortality rate due to RTIs, has not been investigated. Therefore, the present study aimed to examine the traffic behavior and its determinants among elderly pedestrians in Iran.

Methods

Setting and participants

This descriptive, cross-sectional study recruited 600 elderly pedestrians aged 60 years and older in Zanjan from February to August 2019.

Loading [MathJax]/jax/output/CommonHTML/jax.js ee districts and 18 health centers. The subjects were selected using a multistage sampling method.

First, each of the three districts was considered a cluster. According to the number of centers in each cluster, health centers were selected by stratified random sampling (four health centers from cluster 1, three health centers from cluster 2, and four health centers from cluster 3). Elders older than 60 years were randomly selected from each center and entered into the study. Given that information about Iranian households is retained by health centers, samples were selected from health centers. Thus, the study population was representative of the general population.

The inclusion criteria were as follows: aged 60 years or older, having the ability to walk without assistance, and being a resident of Zanjan City. The exclusion criteria were having a history of severe mental illness, depression, Alzheimer's disease, dementia, musculoskeletal disorders, neurological deficits, Parkinson's disease, paralysis, acute heart failure (e.g., acute myocardial infarctions), uncontrolled hypertension, severe hearing loss, severe visual impairment, or unwillingness to take part in the study.

All the participants signed a consent form.

The sample size was estimated to be 600 subjects based on the mean and standard deviation reported in Jalilian et al.'s study (18), taking into account the effect size in cluster studies, as well as the attrition rate.

Measures

Data were collected using the Pedestrian Behavior Questionnaire (PBQ), SES questionnaire, and Abbreviated Mental Test score (AMTS). Demographic data were also collected. The PBQ developed by the Traffic Injury Prevention Research Center has 29 items. The validity and reliability of PBQ have been confirmed previously (19). This questionnaire evaluates traffic behavior in five domains: traffic violations, traffic distraction, adherence to traffic rules, aggressive behaviors, and positive behaviors on a 5-point Likert scale (1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = always). The domain of adherence to traffic rules includes 7 items, including "When I want to cross the street, I wait for the cars to stop completely and the traffic light to turn green for pedestrians, then I start to cross." The traffic violation domain consists of 10 items, such as "I follow other people who cross the street in an unsafe manner in dangerous situations". The positive behavior domain contains 6 items, such as "I walk on the right side of the sidewalk, so as not to bother oncoming pedestrians." The traffic distraction domain includes 4 items, such as "I cross the street while talking on my cell phone or listening to music on my Bluetooth headset." The aggressive behavior domain contains 2 items, one of which is: "I get angry with other road users (pedestrians, drivers, cyclists, etc.) and insult them." In the aggressive behavior, traffic violation, and distraction domains, the items were recoded and reverse scored. The total score of the PBQ was obtained by summing the scores of each domain, with a higher score in each domain indicative of safer behavior.

The 10-item AMTS was used to assess the cognitive status of the elderly. The validity and reliability of the AMTS in Iran have been confirmed previously (20). The psychometric properties of this questionnaire have been evaluated in Iran previously (21). A score lower than 6 points to major cognitive impairment, a score between 6 and 8 represents mild cognitive impairment, and a score higher than 8 denotes no cognitive impairment (21).

The participants' SES was assessed using a 6-item SES questionnaire. The validity and reliability of the questionnaire were confirmed by Sadeghi et al (22). The SES questionnaire includes the following items: the occupation of the head of the household (main source of income), the level of education of the head of the household, total monthly income of the household, net worth of the family home, net worth of the family car, and the ratio of health expenditure to total household expenditure. A score below 11.97 indicates low SES, a score between 11.98 and 16.96 represents moderate SES, and a score above 16.97 means high SES (22).

Data analysis

Data were analyzed using Stata/MP16 software. Mean and standard deviation were used to describe quantitative data, and frequency and percentage were used to describe qualitative data. Before the analyses, the normality of the data was confirmed by the Kolmogorov-Smirnov test. A *P*-value of 0.05 was considered statistically significant in all the tests. A chi-square test was used to evaluate the correlation between SES, cognitive status, and demographic characteristics. An analysis of variance was employed to assess the association of various traffic behaviors with SES and cognitive status. In cases of a significant difference, the groups were compared in pairs using the Sidak test. Finally, multivariate regression was used to investigate the combined effect of the dependent variables. .

Results

The majority of participants were married (77.5%), illiterate (36.2%) and primary education (36.5%). Most of the participants walked less than half an hour a day (32.3%), and most (33%) were current drivers. More than half the elders in the study population had low SES. The majority of the participants (63%) had good cognitive status. Those with higher SES obtained significantly higher scores in all the domains of the PBQ than

those with lower SES (Table 1). Lower SES scores were associated with unsafe traffic behavior, with the lower the score the more unsafe the behavior. Higher SES was associated with improved pedestrian traffic behavior, except in the distraction domain.

Table 1
Traffic behaviors and their domains in pedestrians with respect on SES and cognitive function

	N	Adhering to traffic rules Mean ± SD	Traffic violation^a Mean ± SD	Positive behavior Mean ± SD	Traffic distraction^a Mean ± SD	Aggressive behavior^a Mean ± SD	Total score Mean ± SD
SES							
High	48(8.0)	23.93(4.31)	41.56(4.89)	23.65(4.29)	17.70(2.75)	9.37(1.21)	116.23(12.56)
Middle	250(41.7)	22.87(3.79)	39.64(3.91)	22.23(4.33)	17.74(2.63)	8.91(1.53)	111.40(9.96)
Low	302(50.3)	22.28(3.60)	38.53(4.31)	21.57(3.96)	18.12(2.62)	8.63(1.48)	109.14(8.98)
P-value		0.009	0.000	0.003	0.203	0.002	0.000
Cognitive function							
No cognitive impairment	378(63.0)	23.07(3.82)	40.00(4.11)	22.34(4.21)	18.02(2.53)	8.99(1.46)	112.42(9.65)
Suspected mild cognitive impairment	157(26.2)	22.03(3.34)	37.85(4.36)	21.67(4.05)	17.85(2.76)	8.52(1.44)	107.94(9.51)
Suspected of serious cognitive impairment	65(10.8)	21.78(4.12)	38.15(4.05)	20.89(4.12)	17.60(2.89)	8.41(1.66)	106.84(9.86)
P-value		0.002	0.000	0.018	0.462	0.000	0.000
^a Items are reverse scored, so that the total score could be calculated. Higher scores indicate more safe pedestrian behaviors.							

Married elderly males, with a university education and without cognitive impairment, exhibited the safest traffic behavior. The distance walked daily played a role in pedestrian traffic behavior, with longer daily walking distances associated with safer traffic behavior. Elders who no longer drove but walked instead behaved more safely than those who used cars or other means of transportation (Table 2).

Table 2
Traffic behaviors and their domains in pedestrians with respect on demographic variables

	N	Adhering to traffic rules Mean ± SD	Traffic violation^a Mean ± SD	Positive behavior Mean ± SD	Traffic distraction^a Mean ± SD	Aggressive behavior^a Mean ± SD	Total score Mean ± SD
Gender							
Male	300(50)	22.98(3.60)	39.47(4.28)	22.16(4.10)	17.91(2.59)	8.91(1.48)	111(9.37)
Female	300(50)	22.33(3.89)	39.00(4.28)	21.86(4.27)	17.94(2.68)	8.71(1.50)	109.86(10.35)
P-value		0.035	0.185	0.391	0.889	0.102	0.052
Marriage status							
Single	135(22.5)	21.96(3.70)	38.62(4.50)	21.59(3.94)	17.80(2.81)	8.79(1.63)	108.77(9.81)
Married	465(77.5)	22.86(3.76)	39.41(4.20)	22.13(4.24)	17.96(2.58)	8.81(1.45)	111.18(9.87)
P-value		0.014	0.058	0.188	0.546	0.878	0.013
Educational level							
illiteracy	217(36.2)	21.81(3.75)	38.30(4.15)	21.05(4.26)	18.27(2.63)	8.55(1.49)	107.98(9.54)
Elementary (1 to 6 classes)	218(36.3)	22.57(3.57)	39.08(4.18)	22.28(3.95)	17.82(2.55)	8.78(1.57)	110.54(9.34)
Secondary (7 to 12 classes)	114(19)	23.55(3.56)	40.16(3.70)	22.83(3.94)	17.90(2.56)	9.14(1.32)	113.58 (8.79)
Academic	51(8.5)	24.61(4.05)	41.86(5.05)	23.14(4.27)	16.94(2.95)	9.29(1.34)	115.84(12.26)
P-value		0.000	0.000	0.000	0.010	0.000	0.000
Walking minutes/day							
Less than 30	194(32.3)	21.30(3.58)	39.03(4.11)	21.40(4.42)	17.38(2.94)	8.79(1.40)	107.92(10.09)
31–60	140(23.3)	23.14(3.73)	39.40(4.45)	21.92(3.75)	17.72(2.67)	8.97(1.31)	111.17(8.79)
61–120	176(29.3)	22.77(3.56)	38.92(4.27)	21.98(4.14)	18.25(2.36)	8.72(1.53)	110.65(9.97)
121 or more	90(15)	24.61(3.52)	40.05(4.31)	23.48(4.06)	18.76(2.05)	8.75(1.83)	115.67(8.95)
P-value		0.000	0.179	0.001	0.000	0.501	0.000
Transportation Status							
Personal	182(33.3)	22.82(3.70)	39.91(4.46)	22.60(4.21)	18.14(2.37)	9.15(1.26)	112.64(9.66)
Taxi	123(20.5)	21.82(3.33)	38.85(3.89)	21.00(3.81)	17.61(2.91)	8.79(1.52)	108.09(8.39)
Public	171(28.5)	22.19(3.97)	38.81(4.11)	21.65(4.40)	17.77(2.79)	8.70(1.39)	109.14(10.38)
Bicycle or motorcycle	51(8.5)	22.54(3.95)	38.09(4.42)	22.39(4.56)	16.78(2.88)	8.31(1.67)	108.13(10.94)
Walking	73(12.2)	24.80(3.17)	39.97(4.46)	22.79(3.54)	19.06(1.58)	8.57(1.91)	115.21(8.46)
P-value		0.000	0.011	0.004	0.000	0.001	0.000

^aItems are reverse scored, so that the total score could be calculated. Higher scores indicate more safe pedestrian behaviors.

insert Tables 1 and 2 about here

The results showed that pedestrian traffic behavior of approximately 7% of the elders was safe. More than 90% of the elders engaged in traffic violations and failed to adhere to traffic rules. In the study, 33.5% exhibited aggressive behavior and were easily distracted. Among the traffic behavior domains, the highest and lowest scores were obtained in the “no aggressive behavior” and “adherence to traffic rules” domains, respectively (Table 3).

Table 3
Descriptive statistics for Pedestrian Traffic Behavior (PTB) and domain

	Number of items	Range	Cronbach's alpha	Total score Mean (SD)	Poor range scores	Moderate range scores	Good range scores	Poor N(%)	Moderate N(%)	Good N(%)
Adherence to traffic rules	7	12–32	0.68	(3.76)22.66	≥ 18	19–28	≤ 29	(12.5)75	(80.5)483	(7)42
Traffic violation ^a	10	26–50	0.67	(4.28)39.23	≥ 32	32–45	≤ 46	(5.5)33	(87.8)527	(6.7)40
Positive behavior	6	11–30	0.65	(18.4)01.22	≥ 17	18–24	≤ 25	(15.8)95	(55.3)332	(28.8)173
Traffic distraction ^a	4	7–20	0.72	(2.63)17.92	≤ 13	14–18	≤ 19	(8.3)50	(34.8)209	(56.8)341
Aggressive behavior ^a	2	2–10	0.73	(1.49) 8.81	≥ 6	7–9	≥ 9	56(9.3)	145(24.2)	399(66.5)
PTB	29	81–141	0.50	(9.90) .64110	≥ 95	96–124	≤ 125	(6.5)39	(86.7)520	(6.8)41

^aItems are reverse scored, so that the total score could be calculated. Higher scores indicate more safe pedestrian behaviors.

The results of the multivariate regression analysis predicted the pedestrian traffic behavior of elders in three SES groups. In the moderate to high SES group, elders who walked for more hours per day exhibited safer behavior than those who walked fewer hours per day. For example, in the high SES group, elders who walked more than 2 hours a day behaved 13.59 times more safely than those who walked less than half an hour a day. In the low SES group, the safety behavior score of elders who generally used bicycles or motorcycles for transportation was 4.47 points lower than the safety behavior score of those who usually used their own car for transportation, controlling for the effect of other variables ($P=0.044$, $\beta = -4.47$). In other words, cyclists and motorcyclists behaved more dangerously than those who used cars, walked or other means of transportation. Elders Who had better cognitive function and high SES behaved more safely than those who had cognitive impairment and with low SES (Table 4).

Table 4

Results of multivariate regression analysis Login style to predict the score of pedestrian behavior between variables In groups of weak, moderate and good socio-economic status

Variable	Variable levels	β	low income		P-value	β	CI middle income		P-value	β	CI high income		P-value				
			Upper	Lower			Upper	Lower			Upper	Lower					
Age	Young elder																
	Elder	0.09	2.49	-2.31	0.941	1.14	4.85	-2.57	0.546	4.15	16.46	-8.16	0.498				
Gender	Male																
	Female	0.24	2.41	-1.92	0.825	-0.24	2.02	-2.69	0.846	1.87	9.20	-5.46	0.607				
marital status	Single																
	Married	1.59	3.84	-0.66	0.166	1.28	4.80	-2.22	0.470	0.18	13.37	-13.01	0.978				
Walking minutes/day	< 30																
	31–60	0.68	3.48	-2.12	0.631	5.73	9.00	2.46	0.001	10.06	24.31	-4.17	0.160				
	61–120	-1.04	1.58	-3.66	0.437	6.09	9.39	2.80	0.000	4.45	16.51	-7.61	0.458				
	121 or more	1.13	5.38	-3.12	0.601	6.51	10.43	2.58	0.001	13.59	25.78	1.39	0.030				
Transportation status	personal vehicle																
	Taxi	-3.48	-0.58	-6.39	0.019	-0.93	2.40	-4.27	0.583	-4.23	8.52	-16.98	0.504				
	Large vehicle	-0.48	2.22	-3.17	0.729	-3.03	0.12	-6.18	0.060	2.76	15.61	-10.07	0.664				
	Bicycle or motorcycle	-4.47	-0.13	-8.81	0.044	0.22	4.60	-4.16	0.921	-8.36	5.57	-22.31	0.231				
	walking	2.36	6.11	-1.39	0.216	3.06	7.82	-1.71	0.208	3.80	21.79	-14.17	0.669				
Educational level	illiteracy																
	Elementary	0.94	3.26	-1.38	0.426	2.70	6.54	-1.13	0.166	-10.58	14.51	-35.67	0.397				
	Secondary	3.92	9.78	-1.94	0.189	5.47	9.56	1.38	0.009	-5.76	18.80	-30.33	0.636				
	Academic	1.45	3.71	10.79	0.815	5.14	10.41	-0.12	0.056	-2.77	21.83	-27.38	0.820				
Cognitive status	Mild disorder																
	Moderate disorder	0.91	3.69	-1.88	0.52	-3.64	3.99	-11.28	0.34	*	*	*	*				
	Healthy cognitive	3.99	7.05	0.92	0.011	-1.81	5.44	-9.06	0.629	26.12	54.97	-2.71	0.07				
Adj.R ² = 0.08			R ² = 0.13			Adj.R ² = 0.16			R ² = 0.21			Adj.R ² = 0.29			R ² = 0.50		
CI: Confidence interval (95%)																	
*The sample size is insufficient																	

Discussion

This study investigated the potential roles of SES and cognitive status in the traffic behavior of elderly pedestrians. A review study showed that elderly pedestrians accounted for 48.1% of RTIs involving elders (23). Studies conducted in Iran (24, 25) and worldwide demonstrated that the highest rate of RTIs in the elderly population involved elderly pedestrians (26). Several factors, including physiological changes, reduced physical abilities and reaction times, and decreased vision, account for the increased risk of pedestrian collisions with vehicles among the elderly population. These factors increase the risk of RTIs in the elderly population 2.5 times as compared to that in other age groups (3). When considered, the risk may be even higher. Due to age-related changes affecting mobility, many elders

may avoid busy traffic junctions and environments. Thus, rather than cross at a place that they perceive to be dangerous, they may lengthen their route to cross at a place they perceive to be less dangerous (3). Elders may also go out less often than younger individuals do due to a fear. Thus, the risk of vehicle collisions involving elderly pedestrians may be higher than that reported.

The results of the present study showed that more than 90% of the elders behaved in an unsafe manner. Unsafe behaviors included engaging in traffic violations and not adhering to traffic rules. The highest scores were obtained for the “no aggressive behavior” domain, and the lowest scores were obtained for the “adherence to traffic rules” domain compared to those obtained for the other domains. 33.5% and 43% of the elders exhibited aggressive and distracted behaviors, respectively. Other studies showed that pedestrians exhibited lower aggressive behavior and higher positive behavior than other domains of PBQ(28–30).

A study conducted in six high-, middle-, and low-income countries indicated that the lowest and highest violation scores were observed in China and Bangladesh, respectively (31). The lowest and highest aggressive behavior scores were reported in Vietnam and Kenya, respectively. In the same study, the lowest and highest lapse scores were found in Thailand and Bangladesh, respectively. As can be seen, behavior domains vary in different countries. This can be attributed to the culture and infrastructure of different societies. The same study found that people were more likely to show safe traffic behavior in countries, such as the U.K., that offer pedestrian safety training courses and have particular agencies in charge of roads, sidewalks, and pedestrian crossings (31). Therefore, as suggested previously (27), pedestrian safety training courses targeting the elderly could be offered in Iran.

In the present study, as shown by the findings on traffic behavior, the traffic behavior of the majority of elders was unsafe. Therefore, arranging traffic knowledge development programs and safe behavior training seems to be required to develop safe passages for pedestrians. In respect of the above, the quality of sidewalks for pedestrians, especially elderly pedestrians, should be improved to enable pedestrians to utilize these sidewalks rather than having to walk on the street. Given that the physical environment plays an important role in pedestrian traffic behavior, places designated for pedestrians to cross, especially those with special needs, such as the elderly, should be designed to enable them to cross the road safely (31). However, it is important to note that training and behavioral change may be difficult in old age. Therefore, training programs of safe traffic behavior should start in childhood and continue to stabilize the desired behavior in old age and reduce the risk of RTIs in the elderly.

In the present study, the cognitive function analysis showed that 37% of the elderly had mild to major cognitive impairment. The prevalence of cognitive impairment among the elderly population was reported to vary from 5–36% in different countries (15, 33, 34). The difference may be explained by the use of different measurement tools. In the present study, healthy elders without cognitive impairment had high scores in all the domains of the PBQ. Several previous studies demonstrated that elders without cognitive impairment performed better on the PBQ than elders with cognitive impairment (35, 36). Based on the literature and results of the present study, it can be concluded that impaired cognitive function adversely affects traffic behavior by making it difficult for elders to estimate distance and crossing times. Therefore, measures should be taken before old age to maintain and improve cognitive function in older adults and improve their quality of life, various measures, such as group reminiscence (37) and memory rehabilitation (38) should be implemented.

Previous studies found a correlation between cognitive function and SES (15, 39, 40), similar to that identified in the present study. Thus, high SES seems to be associated with improved cognitive status, which, in turn, enhances traffic behavior in the elderly. The results of the present study showed that elders with higher SES had safer traffic behavior than those who had low and middle SES.

According to previous studies, higher levels of education and income were among the factors that were effective in reducing RTIs (17, 41, 42). It can be said that these factors such as higher levels of education and income may be involved in improving traffic behavior and reducing the risk of injuries.

SES may play both direct and indirect roles in traffic behavior. In terms of indirect effects, someone with high SES usually has a high level of education, and higher education can indirectly affect people’s knowledge and behavior. In terms of the direct effects, individuals with higher income levels tend to reside in better quality and safer environments than individuals with lower incomes. Therefore, improving SES can help to improve traffic behavior.

In the present study, the longer the walk, the safer the traffic behavior and its domains. In addition, the more the experience of being in a traffic environment, the safer the person’s traffic behavior. As mentioned above, it may be a good idea to first provide a suitable and safe physical environment for pedestrians and then encourage the elderly to be more in the environment. This may also be useful in preventing other aging-related problems such as social isolation and depression (12, 43). Various studies using an ecological approach have indicated that a suitable physical environment and observing others when doing the right behavior will encourage the person to do the same behavior (44, 45). As RTIs are the second leading cause of death in Iran, traffic behavior and its determinants need to be examined in all target groups, especially vulnerable groups such as the elderly and to implement intervention programs aimed at improving the traffic behavior of elderly pedestrians and reducing RTIs.

Our study has a number of strengths and weaknesses. One of its strengths was the use of Iranian PBQ to examine the traffic behavior of elderly pedestrians and its determinants. Another strength was its focus on the effect of reduced cognitive function, one of the most common aging-related problems, on traffic behavior. In addition, we examined the effects of SES, which may play an important role in traffic behavior, simultaneously with those of cognitive function. In terms of the weaknesses of the study, we did not determine whether the behaviors reported by the elderly pedestrians occurred inside or outside of the city. Future studies aimed at shedding light on the factors underpinning the traffic behavior of elderly pedestrians should take account of the locations of traffic behavior and traffic behavior violations. We also suggest that safe traffic behavior training intervention programs should be designed and implemented for pedestrians.

Conclusion

The pedestrian traffic behavior of the majority of Iranian elders in the present study was unsafe. Unsafe traffic behavior was associated with cognitive impairment, single status, lower SES, and shorter daily walk times. Effective interventions should be implemented to maintain and improve elderly pedestrians' cognitive function, SES, and traffic behavior. Decision makers must design and implement specific programs to strengthen the cognitive of the elderly. To improve the socio-economic situation, policymakers at higher levels need to take activities.

Abbreviations

SES
Socio-economic status
AMTs
Abbreviated mental test score
PBQ
Pedestrian traffic questionnaire
PTB
Pedestrian traffic behavior
CI
confidence interval
RTI
Road traffic injury

Declarations

Ethics approval and consent to participate

Ethical approval was provided by the ethical committee of Tabriz University of Medical Sciences vide reference number IR.TBZMED.REC.1397.785. All participants provided informed consent.

Consent for publication

Not applicable

Availability of data and materials

The data collection tools and datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Author contributions statement:

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FBA and HSB wrote the first draft. MG, SP and ZR were involved in the data analyses. KP restructured and rewrote the first draft. All authors reviewed the final version of the manuscript.

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