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The Role of Socioeconomic and Cognitive Status in Determining Traffic Behaviour of Elderly Pedestrians in Iran: A Cross-Sectional Study

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Abstract

Elderly pedestrians are among the most vulnerable groups in terms of traffic-related injuries. This study aimed to investigate traffic behaviour and its determinants among elderly pedestrians in Iran. This cross-sectional study examined the traffic behaviour of 600 elderly pedestrians in Zanjan, Northwestern Iran. The participants were selected using the multistage random sampling method. Pedestrians' traffic behaviour, socioeconomic status (SES), and cognitive function were assessed using the Pedestrian Behaviour Questionnaire (PBQ), SES questionnaire, and Abbreviated Mental Test score (AMTS), respectively. Multiple linear regression was used to investigate the association of total score of pedestrian traffic behaviour with socioeconomic and cognitive status while adjusting for potential confounding roles of demographic variables. More than 90 percent of elderly pedestrians showed unsafe traffic behaviour. 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. A higher total score of PBQ was associated with a higher cognitive status, higher SES, higher levels of education, and walking more than 1 hour a day. The majority of the elders showed unsafe traffic behaviour and elderly pedestrians with high SES and normal cognitive function were more likely to exhibit safe behaviour than those with low SES and cognitive dysfunction. Interventions are needed to improve the traffic behaviour of elderly pedestrians especially those with low SES levels.

Introduction

According to the World Health Organization (WHO), the mortality caused by crashes resulting in road traffic injury (RTI) increased from about 999,000 in 1990 to more than 1 million in 2002 globally, and it was projected to reach 2 million a year by 2020 (Lord et al., 2018). In Iran, according to a national study, RTIs accounted for 2.5 percent of traffic injuries and RTIs were the leading cause of number of years of life lost due to premature death (Moradi & Rahmani, 2014).

Elderly people are among the most vulnerable groups in terms of RTIs, particularly when involved in a crash as a pedestrian (Homayoun Sadeghi-Bazargani et al., 2018). Increases in life expectancy worldwide have led to a rise in the number of elderly per 100,000 population and is expected to triple by 2025 in many developing countries (Mosenthal et al., 2004; World Health Organization, 2009, 2018). Research has shown that in general, elderly pedestrians have a greater risk of traffic-related injuries compared to other road users due to deterioration of physical and cognitive abilities (Naghavi et al., 2009; Nantulya & Reich, 2002). One study conducted in 49 countries showed that functional and cognitive impairment were prevalent among the elderly, especially in low-income countries (Lino et al., 2019). Another study confirmed that cognitive impairment exposed elders to various types of injuries, including RTIs (Meilianingsih & Husni, 2019). Research also pointed to a correlation between the traffic behaviour of elders and their perceptual abilities (Lord et al., 2018). For example, 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 this distance (Shi et al., 2020).

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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 (Papi et al., 2021). Due to decreased cognitive and perceptual functions, elders may find activities that require quick and accurate responses, such as crossing busy roads, a difficult task (Kim & Ulfarsson, 2018; Lord et al., 2018). Previous studies demonstrated a link between decreased cognitive ability and socioeconomic status (SES) among the elderly (Danielewicz et al., 2016; Shahar et al., 2019; Steptoe & Zaninotto, 2020). 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 (Cadar et al., 2018; Shahar et al., 2019).

There is an association between age-related issues and a high incidence of RTIs among the elderly. Various studies have indicated that unsafe behaviour by pedestrians increases the risk of collisions. Unsafe behaviours include pedestrians following other pedestrians blindly across the street instead of checking that it is safe to cross (Lino et al., 2019; Meilianingsih & Husni, 2019; Naghavi et al., 2009), using cell phones while crossing (Shi et al., 2020), or placing themselves in drivers' blind spots so that drivers are unable to see them (Cadar et al., 2018; Shahar et al., 2019). To the best of our knowledge, the behaviour of elderly pedestrians in Iran, which has the second highest mortality rate due to RTIs, has not been investigated before. Therefore, the present study was conducted to address this gap. The study investigated the association of elder people's total score as pedestrians among motor vehicle traffic with their socioeconomic and cognitive status while adjusting for potential confounding demographic factors (e.g., age, gender, marital status, educational level, etc.).

Methods

This was a descriptive, cross-sectional study among adult pedestrians in three districts in Iran. The study was conducted from February to August 2019. This project received ethical approval from the Ethics Committee of Tabriz University of Medical Sciences.

Setting and recruitment strategy

Zanjan city is located in Northwestern Iran and has three districts and 18 health centres. Since information about Iranian households is retained by health centres, samples were selected from health centres.

Subjects were selected using a multistage sampling method. First, each of the three districts was considered a cluster. According to the number of centres in each cluster, health centres were selected by stratified random sampling (four health centres from cluster 1, three health centres from cluster 2, and four health centres from cluster 3). Individuals older than 60 years were randomly selected from each centre and entered into the study. Thus, the study population was representative of the general population.

Participants

The sample size was estimated to be 600 subjects based on the similar studies (Jalilian et al., 2015). The inclusion criteria were as follows: aged 60 years or older, is able to walk without assistance, and being a resident of Zanjan City. The exclusion criteria were: 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, and severe visual impairment.

Measures

Data were collected using the Pedestrian Behaviour Questionnaire (PBQ), SES questionnaire, and Abbreviated Mental Test score (AMTS). Demographic data were also collected by a separate questionnaire.

Pedestrian Behaviour Questionnaire (PBQ)

The PBQ developed by the Traffic Injury Prevention Research Centre has 29 items. The validity and reliability of PBQ have been confirmed previously (Bazargan et al., 2020). This questionnaire evaluates pedestrian behaviour in five domains: violations, distraction, adherence to road rules, aggressive behaviours, and positive behaviours on a 5-point Likert scale (1= never, 2= rarely, 3= sometimes, 4= often, and 5= always) (Table 1). In the aggressive behaviour, 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 behaviour.

Abbreviated Mental Test score (AMTS)

The 10-item AMTS was used to assess the cognitive status of the elderly. The psychometric properties of this questionnaire have been evaluated (Bakhtiyari et al., 2014). Scores: <6 major cognitive impairment; 6-8 mild cognitive impairment, and, >8 no cognitive impairment (Bakhtiyari et al., 2014).

Socioeconomic status questionnaire

The participants' SES was assessed using a 6-item SES questionnaire. The validity and reliability of the questionnaire have been confirmed (Sadeghi et al., 2015). The SES questionnaire included the following items: 1) the occupation of the head of the household (main source of income), 2) the level of education of the head of the household, 3) total monthly income of the household, 4) net worth of the family home, 5) net worth of the family car, 6) and the ratio of health expenditure to total household expenditure. Scores: <11.97 low SES; 11.98-16.96 moderate SES, and; >16.97 high SES (H. Sadeghi-Bazargani et al., 2015).

Table 1. Pedestrian Behaviour Questionnaire (PBQ) domains and example statements

Domain	Number of statements	Example statement
Adherence to road rules	7	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
Violations	10	I follow other people who cross the street in an unsafe manner in dangerous situations
Positive behaviour	6	I walk on the right side of the sidewalk, so not to bother oncoming pedestrians
Distraction	4	I cross the street while talking on my cell phone or listening to music on my Bluetooth headset
Aggressive behaviour	2	I get angry with other road users (pedestrians, drivers, cyclists, etc.) and insult them

Data analysis

Data were analysed using Stata version 16 statistical software package. 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 Shapiro-Wilk test. An analysis of variance was employed to assess the association of various traffic behaviours with SES and cognitive status. In this study, total score of PBQ was considered as the dependent variable. Participant characteristics (i.e. socio economic and cognitive status, age, gender, educational level, marital status, walking minutes/day, and transportation status) were regarded as independent variables. Multiple linear regression was used to investigate the relationship between independent and dependent variables. In this study, p-value of lower than 0.05 was considered significant for all tests.

Results

Participants were equally divided by gender (female: 50%; male: 50%). Regarding their age, 488 (81.3%) of them were 60-74 years old, and 112 (18.7%) were 75 years old and above. The majority of participants were married (77.5%), with limited education (illiterate: 36.2%; primary education: 36.5%). Most of the participants walked less than half an hour a day (32.3%), and one third were current drivers (33%).

Self-reported behaviour as pedestrians showed only 7 percent of the participants were safe. More than 90 percent of participants reported engaging in traffic violations and failing to adhere to road rules. A third (33.5%) reported aggressive behaviour and being easily distracted. Among the pedestrian behaviour domains, the highest and lowest scores were obtained in the “no aggressive behaviour” and “adherence to traffic rules” domains, respectively (Table 2).

More than half the elders in the study population had low SES. The majority of the participants (63%) had no impairment of cognitive function. Those with higher SES obtained significantly higher scores in all the domains of the PBQ except Distraction than those with lower SES (Table 3). Lower SES scores were associated with unsafe pedestrian behaviour while a higher SES was associated with improved pedestrian behaviour, except in the Distraction domain. Participants who had no cognitive impairment exhibited the safest behaviour in all the domains of the PBQ, except Distraction.

Participants who were male, married, or had academic education revealed the safest pedestrian behaviour. The distance walked daily played a role in pedestrian behaviour, with longer daily walking distances associated with safer behaviour. Elders who did not drive and walked instead, behaved more safely than those who used cars (driver or passenger) or other means of transportation (Table 4).

Table 5 reports the association of PBQ total score with cognitive function, socio economic status, and demographic variables. The results of multiple linear regression analyses have shown that the total score of PBQ among elders with no cognitive impairment was 3.85 points higher than elders with major cognitive impairment (P=0.007, β= 3.85). Elders with high SES behaved more safely than those with medium SES (P=0.008, β= 2.66). Having an academic education compared to elementary education, increased the score of PBQ among elderly by 4.67 points (P= 0.005, β= 4.67). Elders who walked for more hours per day exhibited safer behaviour compared to those who walked fewer hours per day. For instance, elders who walked more than 2 hours a day behaved 5.11 times more safely than those who walked less than half an hour a day (P<0.001, β= 5.11). The PBQ score of elders who generally used bicycles or motorcycles was 5.87 points lower than the PBQ score of those who usually used their own car for transportation, controlling for the effect of other variables. In other words, cyclists and motorcyclists behaved more dangerously than those who used only cars, walked or used other means of transportation. Additionally, PBQ score had no significant relationship with gender, age or marital status (Table 5).

Discussion

This study investigated the potential roles of SES and cognitive status in the behaviour of elderly pedestrians. The results of the present study showed that more than 90 percent of the elders behaved in an unsafe manner. Unsafe behaviours are defined as engaging in traffic violations and not adhering to road rules. The highest scores were obtained for the “no aggressive behaviour” domain, and the

Table 2. Scores of Pedestrian Behaviour Questionnaire (PBQ) and its domains among elderly pedestrians (n=600)

Domains	Score range	Mean (SD)	Poor range	Moderate range	Good range	Poor N (%)	Moderate N (%)	Good N (%)
Adherence to road rules	12-32	22.66 (3.76)	≥18	19-28	≤29	75 (12.5)	483 (80.5)	42 (7)
Violation[a]	26-50	39.23 (4.28)	≥32	32-45	≤46	33 (5.5)	527 (87.8)	40 (6.7)
Positive behaviour	11-30	22.01 (18.4)	≥17	18-24	≤ 25	95 (15.8)	332 (55.3)	173 (28.8)
Distraction[a]	7-20	17.92 (2.63)	≤13	14-18	≤19	50 (8.3)	209 (34.8)	341 (56.8)
Aggressive behaviour[a]	2-10	8.81 (1.49)	≥6	7-9	≥9	56 (9.3)	145 (24.2)	399 (66.5)
Total PBQ	81-141	110.64 (9.90)	≥95	96-124	≤125	39 (6.5)	520 (86.7)	41 (6.8)

[a] Items are reverse scored, so that the total score could be calculated. Higher scores indicate more safe pedestrian behaviours.

lowest scores were obtained for the "adherence to road rules" domain compared to those obtained for the other domains. About a third of the participants exhibited aggressive behaviours and 43 percent reported distracted behaviours. Other studies also showed that pedestrians exhibited lower aggressive behaviour and higher positive behaviour than other domains of PBQ (Deb et al., 2017; Granié et al., 2013; Harisinghani et al., 2004).

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 (McIlroy et al., 2019). The lowest aggressive behaviour scores were reported in Vietnam and highest aggressive behaviours were reported in Kenya. In the same study, the lowest and highest lapse scores were found in Thailand and Bangladesh, respectively. These findings indicate that the behaviour domains vary in different countries. This might be attributed to the culture, built environment, and infrastructure of different geographical locations. The same study found that people were more likely to show safe pedestrian behaviour in countries, such as the United Kingdom, that offer pedestrian safety training courses and have particular agencies in charge of roads, sidewalks, and pedestrian crossings (McIlroy et al., 2019). Therefore, as suggested previously (Aghdam et al., 2020), pedestrian safety training courses targeting the elderly population may have a promising role in increasing safe pedestrian behaviour in Iran. The findings in this study show the majority of elders reported unsafe pedestrian behaviour. Therefore, developing community public health programs to increase knowledge about the importance of safe traffic behaviours among older people is required.

Moreover, improvement is needed in the quality of pedestrian sidewalks to support elderly pedestrians. Given that the physical environment plays an important role in pedestrian behaviour, developing crosswalks especially for those with special needs, such as the elderly or disabled individuals, can facilitate safer behaviours including safe crossing behaviour (McIlroy et al., 2019). However, it is important to note that in general, behavioural change may be difficult in older ages. Therefore, training programs on safe traffic behaviour should start in younger ages and presented to all ages to stabilise the desired behaviour in old age and reduce the risk of RTIs in the elderly in the longer term (Aghdam et al., 2020).

In the present study, the cognitive function analysis showed that 37 percent 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 (Chen & Cao, 2019; Danielewicz et al., 2016; Khanna & Metgud, 2020; Papi & Cheraghi, 2021). These differences may be explained by the use of different measurement tools. In the present study, elders without cognitive impairment had high scores in all the domains of the PBQ except Distraction. Previous studies demonstrated that elders without cognitive impairment performed better on the PBQ than elders with cognitive impairment (Eggenberger et al., 2017; Tournier et al., 2016). Based on the literature, it can be concluded that impaired cognitive function adversely affects pedestrian behaviour by making it difficult for elders to estimate distance and crossing times. However, it is a limitation of this study that the ability of the participants in estimating the distance and crossing time was not measured. Therefore, it is suggested that activities should be taken before old age to maintain and improve cognitive function and quality of life. Various activities such as group reminiscence (Ghanbarpanah et al., 2014) and memory rehabilitation (Zare & Siahjani, 2018) have shown to improve the cognitive function and could be beneficial for increasing safe pedestrian behaviour among older adults.

Previous studies found a correlation between cognitive function and SES (Danielewicz et al., 2016; Mani et al., 2013; Marden et al., 2017), similar to results of this study. Thus, high SES might be associated with improved cognitive status, which, in turn, enhances safe pedestrian behaviour among the elderly. The results of the present study showed that elders with higher SES had safer pedestrian behaviour than those who had low and middle SES. Access to information and programs provided at a population level (e.g. government training) may contribute to the safe behaviour.

Table 3. Scores of Pedestrian Behaviour Questionnaire (PBQ) and its domains by SES and cognitive function among elderly pedestrians (n=600)

Variables		N (%)	Adherence to road rules Mean (SD)	Violation[a] Mean (SD)	Positive behaviour Mean (SD)	Distraction[a] Mean (SD)	Aggressive behaviour[a] Mean (SD)	Total PBQ score (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)
F-Value			4.74	12.76	5.77	1.6	6.27	12.31
P-value[b]			0.009	0.000	0.003	0.203	0.002	0.000
Cognitive function	No 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)
	Mild 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)
	Major 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)
F-Value			6.31	17.01	4.04	0.77	8.08	17.6
P-value[b]			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 behaviours, [b] Analysis of variance (ANOVA)

Table 4. Scores of Pedestrian Behaviour Questionnaire (PBQ) and its domains by demographic variables among elderly pedestrians (n=600)

Demographic variables		N (%)	Adherence to road rules Mean (SD)	Violation[a] Mean (SD)	Positive behaviour Mean (SD)	Distraction[a] Mean (SD)	Aggressive Behaviour[a] Mean (SD)	Total PBQ score (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)
	t-value		2.11	1.32	0.86	-0.14	1.63	1.95
	P-value[b]		0.035	0.185	0.391	0.889	0.102	0.052
Marital 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)
	t-value		-2.45	-1.9	1.32	-0.61	-0.15	-2.5
	P-value[b]		0.014	0.058	0.188	0.546	0.878	0.013
Education level	Illiterate	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 (4.13)	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)
	F-Value		10.87	12.38	7.01	3.81	6.01	14.11
	P-value[c]		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Walking minutes/ day	Less than 30	194 (32.3)	21.30 (3.58)	39.03 (4.11)	21.42 (4.42)	17.38 (2.94)	8.79 (1.40)	107.92 (10.09)
	30-60	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)
	60-120	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)
	120 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)
	F-Value		18.80	1.64	5.24	7.14	0.79	13.57
	P-value[c]		<0.001	0.179	<0.001	<0.001	0.501	<0.001

Demographic variables		**N (%)**	**Adherence to road rules Mean (SD)**	**Violation[a] Mean (SD)**	**Positive behaviour Mean (SD)**	**Distraction[a] Mean (SD)**	**Aggressive Behaviour[a] Mean (SD)**	**Total PBQ score (SD)**
Transportation Status	Personal	182 (0.33)	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)
	F-Value		7.02	3.62	3.12	5.54	4.21	8.48
	P-value[c]		<0.001	0.011	0.004	<0.001	<0.001	<0.001

[a] Items are reverse scored, so that the total score could be calculated. Higher scores indicate more safe pedestrian behaviours, [b] Independent t-test, [c] Analysis of variance (ANOVA)

Table 5. Multiple linear regression model of the association between total score of PBQ and its predictors

Variables	Regression Coefficient	95% Confidence Interval		P- value
		Lower limit	Upper limit	
Cognitive function (Major impairment)				
No impairment	3.85	1.05	6.65	0.007
Mild impairment	1.09	-1.57	3.77	0.420
Socioeconomic status (Medium)				
Low	0.55	-1.41	2.52	0.578
High	2.66	-0.49	5.82	0.008
Age	0.03	-0.75	0.14	0.533
Gender (Male)				
Female	0.12	-1.41	1.65	0.878
Marital status (Single)				
Married	1.39	-0.47	3.26	0.143
Education (Elementary)				
Illiterate	-0.91	-2.92	1.09	0.371
Secondary	2.54	0.31	4.78	0.026
Academic	4.67	1.43	7.91	0.005
Transportation Status (Walking)				
Personal vehicle	-1.84	-4.65	0.95	0.197
Taxi	-5.18	-8.26	-2.11	<0.001
Public	-3.97	-6.86	-1.08	0.007
Bicycle or motorcycle	-5.87	-9.42	-2.32	<0.001
Walking minutes per day (Less than 30)				
30-60	3.81	1.75	5.85	<0.001
60-120	2.65	0.71	4.59	0.008
120 or more	5.11	2.41	7.79	<0.001

According to previous studies, higher levels of education and income were among the factors that were effective in reducing RTIs (Kazemi et al., 2013; Ghafari Fam et al., 2014; Cadar et al., 2018). The SES may play both direct and indirect roles in traffic behaviour. 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 about the importance of healthy traffic behaviour. In terms of the direct effects, individuals with higher income levels tend to reside in high quality and safer environments which reduce the risk of injury compared to individuals with lower incomes.

In the present study, the longer the people walk each day, the safer their pedestrian behaviour across all domains. In addition, the more the experience of being in a traffic environment, the safer the person's traffic behaviour is. As mentioned above, it is more practical and beneficial for elderly pedestrians to be provided with a suitable and safe physical environment and then be encouraged to be active in the environment which in turn may have effect in preventing other age-related conditions such as social isolation and depression (Aghdam et al., 2015; Papi et al., 2021). Various studies using an ecological approach have indicated that a suitable physical environment and observing others when doing the right behaviour will encourage the person to do the same behaviour (Bakhtari et al., 2019). As RTIs are the second leading cause of death in Iran, traffic behaviour 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 behaviour of elderly pedestrians to reduce RTIs.

Strengths and limitations

Our study has a number of strengths and limitations. One of its strengths is the use of Iranian PBQ to examine the behaviour of elderly pedestrians. Another strength is the focus on the effect of reduced cognitive function, one of the most common aging-related problems that effects pedestrian behaviour. In addition, we examined the effects of SES, which may play an important role in traffic behaviour, simultaneously with those of cognitive function.

On the other hand, current study has several limitations. This study is limited by the cross-sectional design of the survey, which limits the ability to predict the possible causality between pedestrian behaviour and different variables. Also, since the questionnaire was self-reported; it is possible that some respondents might have misreported their answers due to either recall or reporting biases. We also did not determine the type of road, weather (e.g., rain, snow, etc.), time of the day (i.e., daylight, dawn, dusk, and darkness), colour of clothing used by participants in a dark environment; and whether the behaviours reported by the elderly pedestrians occurred in rural areas, urban areas, or motorway. These are all important factors that make elderly people vulnerable to the crashes. However, the focus of this study was on the health behaviour of pedestrians and not on their vulnerability to injury or crashes (Bakhtari et al., 2022). Future studies that explore the factors underpinning the behaviour of elderly pedestrians should take account locations and more details on violations. We also suggest that safe pedestrian behaviour training intervention programs should be designed and implemented for pedestrians at all ages, especially among those who are more vulnerable (Aghdam et al., 2020).

Conclusion

The majority of older pedestrians in this study reported unsafe behaviour. Unsafe pedestrian behaviour was associated with cognitive impairment, lower SES, lower levels of education, and shorter daily walk times. Effective interventions targeted to elderly pedestrians should be designed and implemented by policymakers at the national level to improve the safety of pedestrians.

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Author Contributions

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

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Human Research Ethics Review

The study protocol was approved by the Ethics Committee of the Tabriz University of Medical Sciences (Identifier: IR.TBZMED.REC.1397.785).

Data Availability Statement

Data used for this project are available with researcher ethics approval from the corresponding author.

Conflicts of interest

The Authors declare that there are no conflicts of interest.

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