Original Article

Road Traffic Injuries and Associated Factors among Older Adults Using Motorcycles with Sidecars in Chachoengsao Province

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Abstract

OBJECTIVES: This research aimed to study the factors related to the occurrence of accidents from using motorcycles with sidecars among Older Adults in Chachoengsao Province.

MATERIALS AND METHODS: This cross-sectional study collected data from older adults using motorcycles with sidecars (MwS) in Chachoengsao province. Eligible participants were 60 or older, lived in Chachoengsao, and used MwS. This study includes participants' demographic characteristics, traffic knowledge, perceptions towards environmental safety and vehicle safety conditions. A multivariate logistic regression analysis was used to examine factors associated with a road traffic injuries (RTIs).

RESULTS: Of 600 participants, 53.3% reported RTIs in the past year. Factors associated with RTIs included primary education level (aOR 1.96, 95%CI 1.05-3.64), monthly incomes below 10,000 baht (aOR 2. 23, 95%CI 1.25-3.99), presence of at least one chronic disease (aOR 2.48, 95%CI 1. 53-4.02), not wearing a helmet (aOR 4.12, 95%CI 2.21-7.69), and inadequate knowledge of traffic signs and sidecar driving (aOR 18.19, 95%CI 11. 23-29.48).

CONCLUSION: Key findings indicate that lower education levels, lower monthly incomes, chronic diseases, and inadequate knowledge of road safety significantly increase the risk of RTIs. Moreover, despite self-reported safety checks, a substantial number of MwS did not meet safety standards during official inspections. These results underscore the need for targeted interventions to improve road safety knowledge and vehicle safety among older adults.

Keywords: older adults, road traffic injuries, motorcycles with sidecars

Road traffic injuries (RTIs) involve a vehicle that crashes with another vehicle, pedestrian, cyclist, animal, road debris, or stationary obstruction on a public road or street. RTIs cause significant economic losses for individuals, families, and countries.[1] These losses include the cost of treatment, lost productivity, and the impact on family members of the injured. Each year, approximately 1.3 million people are involved in road accidents globally. Deaths from RTIs will become the seventh leading cause of death by 2030, with around 90% of fatalities occurring in low- and middle-income countries.[2] Older adults with RTIs are a special population requiring increased attention and care. The high incidence and mortality rates from RTIs among older adults highlight the need for a specific triage system tailored to this age group. This need is particularly evident in low and middle-income countries.[3]

Thailand had about 42 million vehicles in 2022.[4] The top three vehicles were: personal motorcycles (about 22 million or 52.7%), personal automobiles (about 11.3 million or 27%), and personal trucks (about 7 million or 16.9%). About 1.5 million injuries and 2.5 thousand deaths occurred in the same year.[5] Older adults accounted for 10% and 18% of the injuries and deaths, respectively. Most of these road traffic injuries occurred in motorcyclists. One study reported that motorcyclists'

risk of dying from RTIs was 34 times higher than among occupants of other vehicles.[3] The Decade of Action for Road Safety 2021-2030 aims to reduce road traffic fatalities and injuries by at least 50% over the next decade.[6] This ambitious goal is congruent with the five global plan pillars established during the previous Decade of Action (2011-2020), which include management, safe user practices, safe vehicles, safe road infrastructure, and effective post-crash response measures. The Haddon Matrix, a critical framework in injury prevention research and interventions, has been employed for over two decades.[7] This matrix delineates various stages of an injury (pre-event, event, and post-event) and contributing elements (host, agent/vehicle, physical environment, social environment, and overall environment). Personal variables, vehicle performance factors, and environmental factors are the three categories of factors associated with traffic accidents among the elderly, which for personal factors include congenital disease and physical performance. Vehicle performance factors include vehicle readiness and safety. Environmental factors include road conditions, warning signs, advisory signs, mandatory signs, and traffic lights.[8]

In Thailand, many riders have MwS modified by attaching sidecars by uncertified mechanics. These MwS, therefore, may not meet the required safety standard for MwS and may put users at risk of RTIs. Recent research data in Nongjik District, Pattani Province, Thailand, show that the number of motorcycle crashes remains unchanged over the past three years.[9] Chachoengsao Province, between 2019 and 2023, had a total of 10,563, 7,646, 12,070, 9,808, and 9,593 injuries from accidents, respectively. And the total number of deaths was 170, 168, 237, 170 and 212 respectively. Of these, 581, 427, 683, 569 and 701 older adults were injured while riding motorcycles, respectively. The number of older adults who died while riding motorcycles was 9, 12, 17, 16 and 38 respectively. The number of elderly men who were injured while riding motorcycles was higher than that of older elderly women.[10] Older adults are a high-risk group for death from RTIs, particularly crashes related to motorcycles.11 However, these reports do not include data on RTIs from MwS, particularly in older adults.

Materials and Methods

This study was a descriptive correlation research. Factors affecting road injuries in motorcycles with sidecars in Chachoengsao Province. Factors affecting the occurrence of road injuries in this study included personal factors, vehicle factors, and environmental factors.

The variables collected in this research study were divided into independent variables: personal factors (gender, age, education level, occupation, income, chronic diseases, alcohol consumption, wearing a helmet, reasons for driving, and knowledge about traffic signs and riding a sidecar motorcycle), readiness of a sidecar motorcycle, and the environment. The dependent variable was the occurrence of accidents while riding a sidecar motorcycle in the past 2 years.

Road traffic injuries refer to injuries sustained while driving a motorcycle with a sidecar, which may result from collisions, overturns, or other related incidents occurring during the operation of the motorcycle with a sidecar. Injuries sustained while driving a motorcycle with a sidecar can be categorized based on severity as follows:

1. Severe Injuries: Non-fatal injuries that require hospitalization, such as fractures, internal injuries, large wounds, or brain injuries.
2. Minor Injuries: Injuries that do not require hospitalization but still need medical attention, such as bruises, minor cuts, or sprains.

Although injuries from driving a motorcycle with a sidecar can be categorized by severity, this study classified the history of accidents involving sidecar motorcycles over the past two years using a binary "Yes" or "No" approach. "Yes" indicates having experienced an accident that resulted in injuries (without distinguishing levels of severity), while "No" indicates having never experienced an accident while driving a sidecar motorcycle.

Study design

This cross-sectional study investigated the prevalence of RTIs among older adults using MsW and its associated factors in Chachoengsao, Thailand, in 2023. The Human Research Ethics Committee at Thammasat University Department of Medicine (Approval Number: MTU-EC-CF-0-031/65]) granted ethical approval for this study. This study received permission from the Chachoengsao Provincial Public Health Office and local government organizations, including the Chachoengsao Provincial Police.

Population and sample

Eligible participants were 60 or older, resided in Chachoengsao Province, and used MsW in the past year. A stratified random sampling technique was used to select the participants from every district in Chachoengsao. (Table 1).

Table 1: Number of older adults by district Chachoengsao Province

Characteristics	Numbers of older adults	sample sizes
Mueang Chachoengsao	69,816	140
Bangkla	23,577	45
Bang Nam Priao	37,870	76
Bang Pakong	36,352	73
Ban Pho	25,303	52
Phanom Sarakham	36,131	73
Ratchasan	5,874	13
Sanam Chai Khet	24,471	50
Plaeng Yao	16,543	33
Tha Takiap	14,297	29
Khlong Khuean	7,469	16
Total	297,703	600

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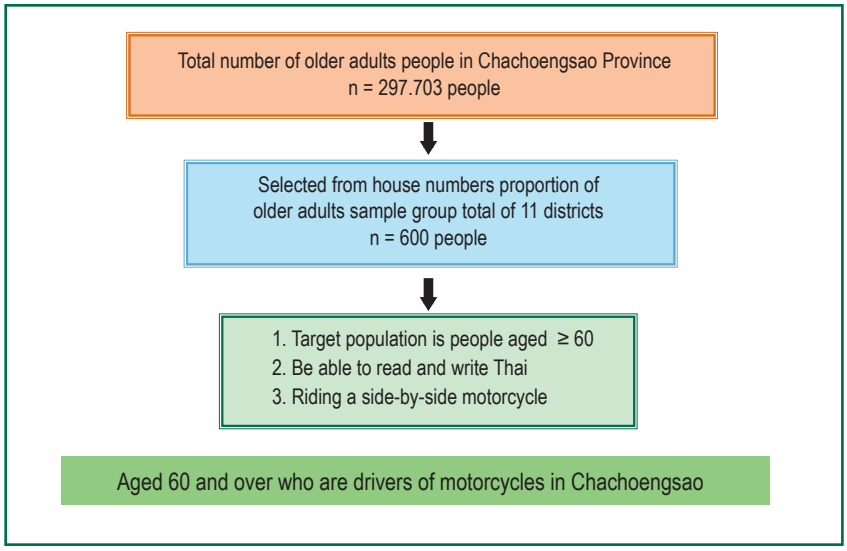

Figure 1: Systematic selection of older adults

Interview development

The first author wrote the initial version of an interview with three key sections. The first section comprised demographic information about the individuals as well as RTI-related behaviors like alcohol consumption. The second part asked about road traffic knowledge and perception of environmental safety. The third part was for certified vehicle inspectors to check vehicle safety conditions. Two experts in Mueang Provincial Police Station and two experts in Provincial Transportation Studies validated the contents of this version. The interview was revised according to the result of content validity (supplement 1). The second version comprised three parts (45 questions) with Cronbach's alpha coefficient of 0.83 (supplement 2). After the reliability test, the final version comprised 35 questions (supplement 3).

Knowledge and understanding of riding a sidecar motorcycle, 16 items, closed-ended questions with answers of yes or no. The knowledge level of riding a sidecar motorcycle was divided using the Bloom's criterion-referenced scoring criteria.12 The scoring was divided as follows: correct answer was given a score of 1 and incorrect answer was given a score of 0.

≥ 60 % (9-16 points) had good knowledge of riding a sidecar motorcycle.

< 60 % (0-8 points) had poor knowledge of riding a sidecar motorcycle.

Vehicle readiness survey: readiness of the condition of the motorcycle sidecar's equipment, including various vehicle lights, side mirrors, horn, brakes, gears, tires, and sidecar shock absorbers, totaling 11 closed-ended questions as follows:

Average score 1.34-2.00 sidecar safety is very good

Average score 0.0-1.33 sidecar safety is low

Environmental perception interview form, consisting of 10 items includes: unsuitable road conditions, roadside light locations, traffic sign locations, and failure of warning devices. The questions are both positive and negative.

Average score 2.68-4.00 High level of environmental safety in the community

Average score 1.34-2.67 Moderate level of environmental safety in the community

Average score 0.0-1.33 Low level of environmental safety in the community

Data collection

The researchers explained and requested help from the Subdistrict Health Promoting Hospital and the District Public Health Office in gathering data from older adult's motorbike riders with sidecars. Select and train data collectors based on interview principles and study objectives and go to the data collection location with an interview form and a survey about the condition of bikes with sidecars.

Data analysis

The participant's characteristics and other variables were presented using proportions, means, and standard deviations. Bivariate analysis was used to explore the association between RTIs and other variables. Associations demonstrating a significance level of $p < 0.05$ were subsequently selected for inclusion in the multiple logistic regression analysis.

Result

This study included a total of 600 samples, 53.7% of whom were male, with a mean age of 67.2 ± 5.4 years. Most of them had completed primary school (85.2%), were farmers (85.2%), had a monthly income of less than 10,000 baht (71.8%), and had at least one chronic disease (72.5%). They had unregistered motorcycles with sidecars (50.3%). With regards to the

behavior of the sample group, it was found that 68.2% did not drink alcohol and 80.5% surveyed the readiness of the sidecar motorcycle before use, as shown in Table 2.

In terms of **knowledge of the sample group,** it was found that 58.8 % had a poor level of knowledge about driving a motorcycle with a sidecar. The questions that the sample group answered most incorrectly were: 1) When you come to an intersection, what should you do? 2) The important purpose of wearing a helmet when driving a motorcycle with a sidecar? and 3) The signs prohibiting motorcycles and cars. In the **Sidecar motorcycle safety of the sample group**, it was found that 63.5% had a high level of safety. The three most frequently found unavailable equipment were sidecar tail lights, side mirrors, and horns. In the **environmental conditions in the community from the perspective of the sample group,** it was found that 80.3% believed that the environment in the community was at a moderate level of traffic safety. The three most common environmental problems in the community were potholes in the road, slippery roads during the rainy season, and trees or branches blocking traffic signs, as shown in Table 2

In the past 2 years, 53.3 % of the sample had experienced a motorcycle sidecar accident. Of these, 33.2 % were male 22.8 %, 42.2% did not wear a helmet, 22.4 % did not survey the readiness of the sidecar, 35.9 % drank alcohol, and 11.4 % viewed the environment as having low safety.

Associated factors to among older adults using motorcycles with sidecars results of the study found that 53.3% of the sample had experienced at least one traffic accident involving a motorcycle with a sidecar in the two years prior to the interview date. Factors associated with accident occurrence from multivariate analysis were: those with higher education level than primary school level aOR (1.96 95%CI 1.05,3.64), had monthly income of 10,000 baht or more (aOR2. 23, 95%CI 1.25,3.99), had at least 1 underlying disease (aOR 2.48, 95%CI 1.53,4.02), did not wear a helmet (aOR 4.12, 95%CI 2.21,7.69), and had poor knowledge of traffic signs and riding a sidecar motorcycle (aOR 18.19, 95%CI 11.23,29.48). Meanwhile, the readiness of the motorcycle with a sidecar and perception of the environment were not associated with traffic accident occurrence, as shown in Table 3.

Table 1: The participants' characteristics, behaviors, traffic knowledge, perception of environmental safety, and vehicle safety conditions (n = 600)

Variables	n (%)
Sex	
Men	322 (53.7)
Female	278 (46.3)
Age (years)	
60-69	394 (65.7)
≥70	206 (34.3)
Mean ± SD	67.2 ± 5.4)
Education levels	
Primary	511 (85.2)
Other educational	89 (14.8)
Occupations	
Farmers	511 (85.2)
Non-farmer	89 (14.8)
Monthly income (Baht)	
< 10,000	431 (71.8)
≥10,000	169 (28.2)
Underlying disease	
Yes	435 (72.5)
No	165 (27.5)
Vehicle registration	
Yes	298 (49.7)
No	302 (50.3)
History of accidents in the past 2 years	
Yes	326 (53.3)
No	274 (45.7)
Alcohol drinking	
Yes	191 (31.8)
No	409 (68.2)
Helmet wearing	
Yes	405 (67.5)
No	195 (32.5)
Regular vehicle safety check	
Yes	483 (80.5)
No	117 (19.5)
Road traffic knowledge	
Adequate (9-16 points)	247 (41.2)
Inadequate (0-8 points)	353 (58.8)
Mean ± SD	7.20 ± 0.16
Safety of motorcycles with sidecars	
Meet standard	381 (63.5)
Did not meet standard	219 (36.5)
Mean ± SD	1.45 ± 0.38
Perception of the environmental safety	
High	32 (5.4)
Moderate	482 (80.3)
Low	86 (14.3)
Mean ± SD	1.91 ± 0.43

Discussion

This study revealed that more than half of older adults driving sidecar motorcycles had experienced at least one accident in the past two years. However, the severity of injuries in this study was mostly minor, differing from other research findings that suggest older adults are more likely to sustain severe injuries or fatalities. For instance, a study on the severity of injuries among motorcycle riders involved in traffic accidents in Hunan, China, found that riders aged over 60 years had a statistically significant association with severe injuries and fatalities at intersections. [13] Additionally, data from the Global Burden of Road Traffic Accidents in older adults indicated that over 90% of all road fatalities occur in low- and middle-income countries.[3] The reason why most older adults in our study sustained minor injuries from accidents is that these incidents typically occurred within community areas, where older adults tend to drive sidecar motorcycles at low speeds. The severity of traffic injuries depends on the type of collision, the location of the accident, and the vehicle's speed.[14]

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Table 3: Associated factors to among older adults using motorcycles with sidecars

Factors	Accidents n(%)		Crude OR (95% CI)	Adjusted OR (95% CI)	*p*-value
	Yes	NO			
Sex					
Female (ref)	127 (45.7)	151 (54.3)	1.92 (1.38,2.66)	1.59 (0.97,2.60)	0.06
Men	199 (61.8)	123 (38.2)			
Age (Years)					
60-69 (ref)	213 (54.1)	181(45.9)	0.96 (0.69,1.35)	0.96 (0.60,1.54)	0.87
≥70	113 (54.8)	93 (45.2)			
Education levels					
Primary (ref)	273 (53.4)	238 (46.6)	0.78 (0.49,1.23)	1.96 (1.05,3.64)	0.03*
Other educational	53 (60.0)	36 (40.0)			
Occupations					
Non-farmer (ref)	129 (46.4)	149 (53.6)	1.82 (1.31,2.52)	1.53 (0.99,2.36)	0.05*
Farmers	197 (61.2)	125 (38.8)			
Monthly income (Baht)					
< 10,000 (ref)	214 (49.7)	217 (50.3)	1.99 (1.37,2.88)	2.23 (1.25,3.99)	< 0.01*
10,000 or more	112 (66.3)	57 (33.7)			
Underlying disease					
No(ref)	63 (38.2)	102 (61.8)	2.47 (1.71,3.57)	2.56 (1.58,4.15)	< 0.01*
Yes	263 (60.5)	172 (39.5)			
Vehicle registration					
Yes (ref)	151 (50.7)	147 (49.3)	1.34 (0.97,1.85)	0.79 (0.49,1.28)	0.35
No	175 (57.9)	127 (42.1)			
Alcohol drinking					
No (ref)	209 (51.1)	200 (48.9)	1.51 (1.06,2.14)	0.91 (0.53,1.56)	0.75
Yes	117 (61.3)	74 (38.7)			
Helmet wearing					
Yes (ref)	189 (46.7)	216 (53.3)	2.70 (1.87,3.88)	4.12 (2.21,7.69)	< 0.01*
No	137 (70.3)	58 (29.7)			
Regular vehicle safety check					
Yes (ref)	253 (52.4)	230 (47.6)	0.66 (0.43,1.00)	0.50 (0.23,1.07)	0.70
No	73 (62.4)	44 (37.6)			
Knowledge of road safety					
Adequate (ref)	55 (22.3)	192 (77.7)	18.17 (10.38,31.81)	18.19 (11.23,29.48)	< 0.01*
Inadequate	271 (76.8)	82 (23.2)			
Safety of motorcycles with sidecars					
Meet standard (ref)	201 (33.5)	180 (30.0)	0.84 (0.60,1.17)	0.90 (0.56,1.46)	0.69
Did not meet standard	125 (20.8)	94 (15.7)			
Perception of the environmental safety					
High (ref)	19 (6.5)	14 (6.1)	0.93 (0.45,1.91)	0.06 (0.77,0.64)	0.85
Moderate	272 (93.5)	214 (93.9)			
Perception of the environmental safety					
High (ref)	19 (33.9)	14 (21.0)	1.75 (0.84,4.41)	0.66 (0.16,1.48)	0.11
Low	37 (66.1)	49 (79.0)			

Factors Associated with Traffic Accidents from Sidecar Motorcycle Riding in Older Adults

Personal factors

Personal factors associated with accidents among the sample group include educational level, monthly income, chronic diseases, helmet-wearing behavior, and the level of knowledge about traffic signs and sidecar motorcycle driving.

Our study found that older adults with an education level higher than primary school were more likely to experience traffic accidents from sidecar motorcycle driving compared to those with a primary school education or lower. This finding contrasts with other studies that reported traffic accidents were more common among individuals with lower education levels. For instance, a study in Iran found that older adults with a primary school education were at higher risk of sidecar motorcycle accidents compared to those with higher education levels.[15] Another study on traffic-related fatalities in West Azerbaijan Province, Iran, found that road traffic deaths were most frequent among individuals with less than a high school education, while those with university-level education had the

lowest occurrence of traffic accidents.[16] Therefore, further research into the factors contributing to the higher likelihood of accidents among individuals with education levels above primary school is essential. Such research could help stakeholders better understand these factors and develop effective strategies to prevent accidents in this group. Similarly, regarding education levels, the study also found that individuals with a monthly income exceeding 10,000 baht were more likely to experience traffic accidents than those earning 10,000 baht or less. This finding also warrants further investigation.

Having chronic diseases is a factor associated with traffic accidents. Data from the National Center for Injury Prevention and Control indicate that older adults with chronic diseases are at a higher risk of accidents from sidecar motorcycle driving compared to those without chronic diseases.[17] In addition to chronic diseases, the deterioration of various bodily functions is another factor linked to decreased driving ability,[17] leading to a higher likelihood of traffic accidents. Examples include vision problems 18 and slower reaction times.[19]

Vehicle factors

The safety of sidecar motorcycles was not found to be significantly associated with the occurrence of accidents. This may be because short-distance driving within communities and minor deficiencies in safety equipment did not result in a higher-than-expected rate of accidents. However, there appears to be a positive, albeit statistically insignificant, correlation between the safety of sidecar motorcycles and the occurrence of accidents. This finding aligns with a study on the severity of injuries among motorcycle riders involved in traffic accidents in Hunan, China, which reported that two-wheeled motorcycles (3,445 vehicles, 86.0%) were involved in more accidents than three-wheeled motorcycles (560 vehicles, 14.0%).[13] Our study is the first to report on the safety of sidecar motorcycles, revealing that only two-thirds of them were adequately safe for road use. The top three safety issues or missing equipment were sidecar tail lights, brakes, and sidecar shock absorbers. The primary reason for the lack of installation or repair of safety equipment was the high cost of installation. Relevant authorities need to implement measures to mitigate the risks for older adults using sidecar motorcycles.[20]

Environmental factors

Environmental safety was not statistically significant. Environmental safety was at a moderate level, which may be due to the habit of driving in the village or community. Drivers may not notice traffic signs or choose to drive against traffic, which results in a higher chance of accidents than those who perceive the environment as less safe. Road accident prevention guidelines for the elderly with driver's licenses should therefore focus on promoting safe driving discipline in the elderly and may include designing traffic signs and warning signs in the community.[21]

However, the guidelines for preventing traffic accidents from elderly people riding sidecar motorcycles from this study have issues that focus on the elderly group, which at the national level focuses on the elderly group who use the footpath, but the direction is the same, which is to make the elderly or road users have knowledge about traffic signs, the behavior of wearing helmets to reduce the severity of injuries. The survey of vehicle readiness before and after using the guidelines is different because the elderly have knowledge about traffic signs that should be improved or there must be continuous training activities to provide knowledge.[22]

Conclusion

This cross-sectional study highlights significant factors associated with road traffic injuries (RTIs) among older adults using MwS in Chachoengsao, Thailand. Key findings indicate that lower education levels, lower monthly incomes, chronic diseases, and inadequate knowledge of road safety significantly increase the risk of RTIs. Moreover, despite self-reported safety checks, a substantial number of MwS did not meet safety standards during official inspections. These results underscore the need for targeted interventions to improve road safety knowledge and vehicle safety among older adults.

Research limitations

This research is a study of road traffic injuries in older adults riding sidecar motorcycles, which has vehicle specificity that may affect the accident situation data that has not been collected enough for reference.

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Conflict of Interests:

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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