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An analysis of pedestrian accidents in Kuwait

PARVIZ A. KOUSHKI AND MOHAMMED A. ALI

Department of Civil Engineering, Kuwait University,
P.O.Box 5969 Safat Kuwait 13060, Fax: (965) 481-7524,
E-mail: Parviz@kuc01.kuniv.edu.kw

ABSTRACT

In spite of the optimum sustainability, environmental compatibility, and numerous health and other socio-economic benefits of walking as a mode of urban travel, the safety of pedestrians receives insufficient attention from both drivers and policy makers, especially in non-industrialized nations, and pedestrians remain the most vulnerable road users. This research paper begins by highlighting the plight of pedestrians in a number of industrialized and non-industrialized nations. Next, the result of the analysis of a systematic-random sample of 443 pedestrian injury/fatality accident records occurring over the 3-year period, 1996-98, in metropolitan Kuwait is presented. The characteristics of the injurious and fatal pedestrian accidents with regards to cause, result, time of day, vehicle type, location, pedestrian age, nationality, and gender, are compared and discussed. A number of recommendations for safety improvements for pedestrians conclude the paper.

Keywords: Kuwait; pedestrians; pedestrian accidents; pedestrian safety.

INTRODUCTION

Walking is the most common mode of daily travel in urban areas worldwide. In addition to trips made solely by walking, journeys involving motorized modes of travel often include walking links as well. Physically unprotected, pedestrians represent the most vulnerable group of urban travelers, however. When involved in traffic accidents, they suffer the most severe levels of trauma.

Compared to motorized modes of urban travel, walking is characterized by optimum sustainability, environmental compatibility and numerous health and other socio-economic advantages. Yet, pedestrians remain the most vulnerable road users and their safety receives insufficient attention from policy-makers, especially in non-industrialized nations.

This paper reports the findings of a research project undertaken to highlight the unsafe plight of urban pedestrians in the Persian Gulf region. General trends in pedestrian safety are examined, and a profile of recent pedestrian accidents in the State of Kuwait is presented.

Unsafe pedestrian environments

Unsafe environments for the walking mode of urban travel can be found in all urban areas around the globe. A research study in Sweden, for example, has indicated that while pedestrians accounted for only 2% of the total exposure (person-kilometers) in traffic, they constituted 15% of traffic accident fatalities - the risk of being killed while walking was found to be seven times greater for pedestrians than for motorized travelers there (Thulin 1995). During the 1980s, pedestrian fatalities in the United States averaged nearly 9,500 per year, and while pedestrians were involved in less than 1% of all traffic accidents, they accounted for 18% of highway fatalities during this ten year period (Hall 1983). In 1995, however, the number of pedestrian fatalities recorded in the US dropped to 5,585 (USDOT 1997). This represents an encouraging 18% reduction from the 1985 figure.

In European countries, the percentages of fatal accidents involving pedestrians in road accidents reported for the year 1993 were as follows: 16.6 in West Germany, 14 in Ireland, 32.5 in Great Britain, 12.5 in France, 12 in the Netherlands, 12.2 in Belgium, 14.8 in Austria, and 16.9% in Switzerland (Bruhning 1997).

Available data collected during the 1980s and 1990s in a number of non-industrialized countries indicate that the proportion of pedestrians killed in road accidents is much higher than that experienced in industrialized nations. In Ethiopia, for example, pedestrians constituted a dramatic 84% of road traffic fatalities. In Hong Kong, 70% of road accident victims were pedestrians (Mohan 1992). 42% in India; 46% in Saudi Arabia; 57% in Kuwait; 47% in Thailand; 66% in Libya, and 60% in Bangladesh (Mohan 1992). In Indonesia, 4,000 pedestrians (40% of traffic accident fatalities) are killed in road accidents every year (Poerwo & Idris 2000). Unfortunately, due to lack of data on walking distances (exposure) of travel (even in the industrialized nations), no exposure-related measures for pedestrian accidents could be computed.

These disturbing data clearly disclose the disproportionate presence of pedestrians among the fatal victims of road traffic accidents throughout the world, even in the industrialized nations of the West.

The contributing factors

In non-industrialized nations, the pedestrian mode of travel does not receive the level of attention and recognition of responsible decision-makers which it warrants (Poerwo & Idris 2000, Koushki & Bener 1988). However, the greatest threat to the safety of pedestrians in the non-industrialized nations originates with the serious disrespect by the aggressive driving public (Hussein 1988).

Consequently, the safety risks of the pedestrian mode of travel in these nations is by far more serious than those in industrialized countries.

A major factor contributing to the disproportionate number of pedestrians among road accidents fatalities is that most pedestrian accident victims are either young or elderly, each with an age-related trait deficiency. There is a lack of fully developed faculties for the young, and loss of optimum faculty performance due to aging for the elderly. In England and Wales, for example, a quarter of all deaths in the age group 10-14 years were due to road accidents, and 57% of these were pedestrians (Preston 1995). Young pedestrians (in the same age range) killed in road accidents in Kuwait and Jeddah, Saudi Arabia, were 40% and 56%, respectively (Jadaan & Bener 1993).

Although traffic engineers attempt to accommodate pedestrians by providing special facilities such as sidewalks and crosswalks and other features such as lighting and islands, walkers are often not provided for in a totally satisfactory manner (Moses 1990). This is particularly true in the urban areas of non-industrialized nations. In these countries, the ineffectiveness or lack of comprehensive safety system policies combined with other factors such as shortcomings on the part of planners and designers, very poor driver behavior, lack of effective enforcement of traffic rules and regulations, and limited road-user education programs, often result in a disproportionately high number of pedestrian injuries and fatalities.

In addition, common features of walkways in urban areas of the non-industrialized world are often characterized by poor geometric design, lack of continuity, and the existence of a variety of construction materials and other safety hazard objects on the sidewalk. These factors frequently force pedestrians off of the sidewalk and into the mix of high-speed and unregulated motorized traffic (Koushki 1988). Even in newly developed urban infrastructures with intensive capital expenditures, pedestrian facility requirements are often ignored. The paths of pedestrians and motorized traffic frequently overlap dangerously and walkways are not fully related to existing buildings and public transit stations. Crossing structures are often designed without regard to socio-cultural peculiarities which can be important enough to discourage their use, especially by female pedestrians, thereby defeating their purpose (Al-Anezi 1986, Koushki & Ali 1993).

A profile of recent pedestrian accidents in Kuwait

Traffic accident records of the safety officials in Kuwait's Ministry of Interior, General Traffic Department, served as the source of data on road accidents involving pedestrians during the three-year period, 1996-1998. Due to

limitations in resources (time, manpower and money), a systematic random sampling technique was employed to select samples of pedestrian accident data from the 3-year study period, with a higher emphasis given to those from more recent years. The sampling result included three months of data from 1996, four months from 1997, and the remaining five months of June, July and August, due to the departure of most of the driving expatriates, vacationing Kuwaitis and extreme temperatures, the volumes of both the vehicular and the pedestrian traffic is significantly reduced from its normal working-month level (Koushki *et al*. 1998).

A total of 443 pedestrian injury/fatality road accident records were examined for data. Selected information included pedestrian age, gender, and nationality, and accident time-of-day, location, vehicle type, cause, and results. The data were coded and compiled in the VAX computing system of the College of Engineering and Petroleum. Statistical Analysis Softwares (SAS) were utilized to process and analyze the data.

The sample pedestrian accident victims included 310 non-Kuwaitis and 132 Kuwaitis (1 sample missing nationality). These numbers are in close conformity with the actual proportion of expatriates and Kuwaitis in the total population of Kuwait. More than 80% of the victims were male, reflecting the much higher mobility (and, therefore, exposure) of the male population in Islamic societies. Of the sample pedestrians, 45% were 25 years of age or less. Another 8% were more than 50 years old.

Nights and mornings witnessed higher percentages (28% each) of pedestrian accidents-nights, mainly due to darkness and reduced enforcement of speed/driver violations, and mornings due to the peak hour concentration of daily activity and movement on the roads.

By far the largest percentage of the total accidents involving pedestrians occurred in street sections (70.8%). However, a significant 12.4% of the sample pedestrians were hit in parking lots, clearly pointing to the careless, aggressive and reckless driving behavior (even inside parking lots) commonly observed in the Middle East region. It should also be noted, however, that in more than 21% of the pedestrian-involved accidents, the pedestrians' inappropriate crossing/carelessness was the main cause for the occurrence of pedestrian accidents. Of the total pedestrian accidents, 10.2% took place at intersections. Private autos and pick-ups were involved in nearly 85% of all pedestrian accidents.

An analysis of the sample pedestrian accidents by cause indicated that reckless/careless driving was responsible for nearly one half of all accidents. High speed, which caused nearly 16% of pedestrian accidents, was next in

importance. Mobile telephone use (drivers and pedestrians), was responsible for 6.5% of the sample pedestrian accidents, while darkness was cited in another 4.1% (Table 1).

Sixty-four pedestrians died, and another 162 were severely injured over the 12 sample months. The remaining 217 pedestrians in the sample sustained moderate injuries (Table 1).

Table 1. Distribution of Pedestrian Accidents by Cause and Result

Variable Name	Freq.	Percent	Cum. Percent
Cause:			
High Speed	71	16.0	16.0
Reckless/Careless Driving	198	44.7	60.7
Use of Mobile (driver & ped.)	29	6.5	67.2
Illegal Crossing	39	8.8	76.0
Pedestrian Fault	56	12.6	88.6
Darkness	18	4.1	92.7
Other	11	2.6	95.3
Missing	21	4.7	100.0
Total:	443		
Result:			
Injury	217	49.1	49.1
Severe Injury	162	36.4	85.5
Fatality	64	14.5	100.0
Total:	443		

A category analysis of the data by time-of-day of the accident and the age of pedestrian involved showed that accidents involving younger pedestrians occurred throughout the day rather evenly. Accidents involving older pedestrians, however, were concentrated more in the mornings and evening/night hours (Table 2). This pattern is in conformity with expectations, given the traditional behavior of the young and the elderly in the cultures of the Persian Gulf nations. Most adult men in Kuwait are involved in daily work and other family activities in the morning and participate in "Diwaniyahs" - indoor social gatherings - in the evenings and late night hours. Young people, on the other hand, are active throughout the day and spend the evenings joy-riding and walking through shopping centers, or frequenting restaurants and movie theaters. The chi-square test indicated that these differences in pedestrian accident-involvement rates by age and time of day were statistically significant at the 95% significance level ($\chi^2 = 37.2$, df = 18, $p < 0.005$).

Table 2. Pedestrian Accidents by Time-of-Day and Pedestrian Age

Time of Day	Age (years)						
	≤20	21-25	26-30	31-40	41-50	51-60	> 60
Morning (6.00 - 12.00 pm)	21.7	14.3	36.5	27.9	32.6	42.9	58.3
Afternoon (12.00 - 6.00 pm)	25.7	35.7	19.2	31.7	16.3	33.3	00.0
Evening (6.00 pm - 12.00 am)	28.3	21.4	11.5	13.9	14.0	00.0	8.3
Night (12.00 - 6.00 am)	24.3	28.6	32.7	26.6	37.1	23.8	33.4
Total:	100	100	100	100	100	100	100
	($\chi^2 = 37.2$, df = 18, $p < 0.005$)						

Category analysis was also employed to analyze the sample pedestrian accidents by gender, vehicle type, and accident location. Results indicated that while the percentages of auto/pick-up involvement in pedestrian accidents were roughly the same for both genders, a larger percentage of the female pedestrian accidents involved medium-size vehicles and mini-buses. The opposite was true for male pedestrian accidents, which instead involved heavy vehicles and buses. The difference in pedestrian accidents by gender and vehicle type was also significant at the 95% significance level ($\chi^2 = 14.4$, df = 4, $p < 0.03$), as shown in Table 3. Mini-buses are used primarily for the transport of students to schools and colleges, the riders of which are mostly female students who do not have driver's licenses or who do not wish to drive. The largest percentage of public bus transit riders, on the other hand, consists of single expatriate male laborers working in the State of Kuwait.

The data in Table 3 also show that a disproportionate share of pedestrian accidents involving females occurred in parking lots (three times that of the sample males), and at "other" places (nearly twice that of the male sample). The fact that a rather large percentage of the total fatal and injurious pedestrian accidents occurred in parking lots and "other" off-road locations is disturbing. As presented in Figure 1, nearly 20% of the pedestrian accidents which took place in parking lots were fatal, and another 44% resulted in severe injuries - an astonishing indication of the high speed, carelessness, and disrespect for the rights of pedestrians which characterizes the Middle Eastern driving environment. As revealed by the data in Table 3, the majority of these fatal parking accident victims were female pedestrians.

Table 3. Distribution of Pedestrian Accidents by Vehicle Type, Location and Gender

Variable Name	Pedestrian Gender	
	Male	**Female**
Vehicle Type:		
Auto	68.6	76.7
Pick-up	16.3	7.0
Med. Size / Minibus	4.4	11.6
Heavy Veh. / Bus	8.1	2.3
Other	2.6	2.4
Total (%):	100	100
(χ^2 = 14.4, df = 4, p 0.005)		
Location:		
Street	82.6	73.2
Intersection	10.1	10.5
Parking	3.1	9.3
Other	4.2	7.0
Total (%):	100	100
(χ^2 = 8.1, df = 3, p < 0.03)		

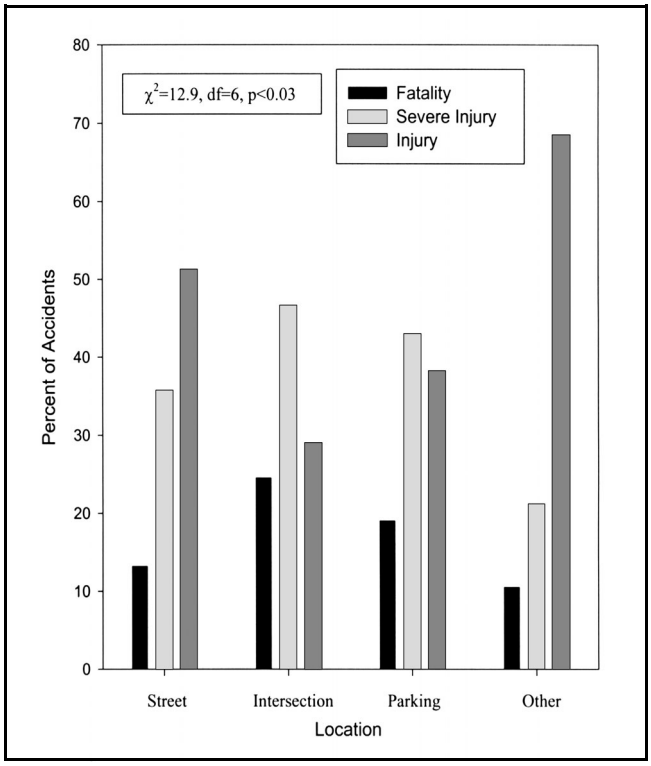

Fig.1 Pedestrian Accidents by Location and Injury Severity

As expected, most pedestrian accidents were with autos resulting in 71.4, 67.1, and 74.2% of injuries, severe injuries and fatalities, respectively (Table 4). However, the second highest percentage of pedestrian fatalities (14.5%), involved heavy vehicles. As is indicated by the chi-square test, the difference in the distribution of the severity of pedestrian injury by different vehicle types is not statistically significant at the 90% significance level. In general, any conflict between a pedestrian and a vehicle will result in pedestrian injuries, even at very low vehicle speeds.

Table 4. Pedestrian Accidents by Vehicle Type and Severity of Injury

Variable Name	Injury Severity (%)		
	Injury	Severe Injury	Fatality
Vehicle Type:			
Auto	7.4	67.1	74.2
Pick-up	15.5	16.1	6.5
Medium-Size Veh.	5.1	7.7	3.2
Heavy Vehicle	5.2	6.5	14.5
Other	2.8	2.6	1.6
Total:	100.0	100.0	100.0
	(χ^2 = 11.9, df = 8, p < 0.15)		

High speed and reckless driving were, by far, the causes for the largest percentage of injury, severe injury and fatal pedestrian accidents. Pedestrian mobile phone use was responsible for 3.9% of mild injuries, 1.3% of severe injuries, and 1.6% of fatalities. Darkness and the fault of the pedestrian were next in causing injuries and fatalities (Table 5). While 8.2% of fatalities were caused by darkness, 13.8% of pedestrian fatalities had "other" causes.

Table 5. Pedestrian Accidents by Cause and Severity of Injury

	Accident Cause							
	High speed	Reckless driving	Ped. use of mobiles	Illegal crossing	Ped. fault	Darkness	Other	Total
Severity of Injury (%):								
Injury	10.7	48.3	3.9	3.9	9.3	15.6	8.3	100
Severe Injury	18.1	47.1	1.3	5.2	11.0	12.3	5.1	100
Fatality	32.8	42.6	1.6	3.3	4.9	8.2	13.8	100
	(χ^2 = 22.6, df = 12, p < 0.03)							

A summary analysis of the data showed that the sample female pedestrians, when involved in a road accident, sustained a higher rate of both injury and severe injury compared to their male counterparts (Figure 2). Male pedestrians, on the other hand, suffered a higher rate of fatality. This finding is also in conformity with the general socio-cultural behavior of men and women/girls in public in the Middle East. This differences in the injury/fatality rates of the sample pedestrians by gender was statistically significant at the 95% significance level ($\chi^2 = 8.4$, df $= 2$, $p < 0.03$).

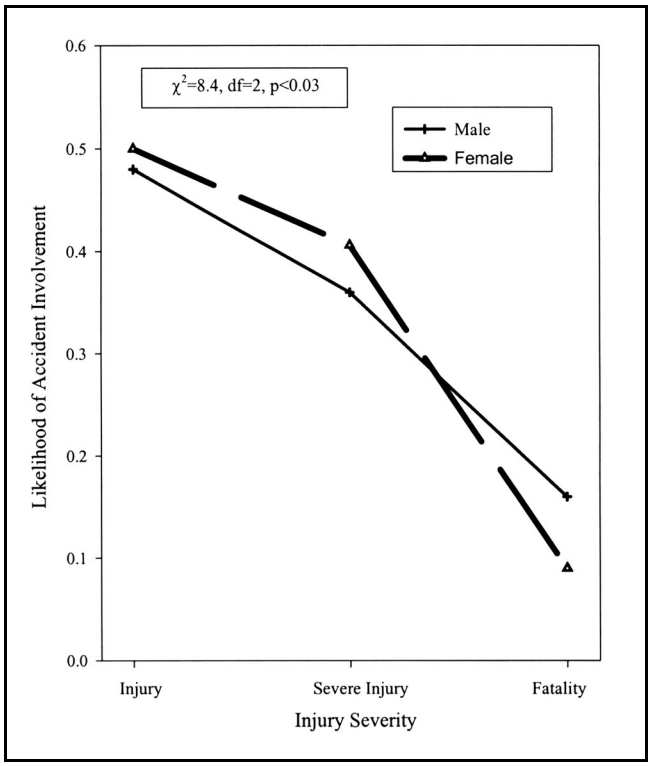

Fig.2. Likelihood of Injury Severity by Gender for Accident-involved Pedestrian

Further analysis of the data revealed that the distribution of Kuwaiti and non-Kuwaiti male pedestrians in the three categories of injury, severe injury and fatality were similar. For the sample female pedestrians, the non-Kuwaitis were more present (59.7%) among those who received severe injuries, and significantly less among the fatalities (27%).

A main reason for the higher presence of female Kuwaitis among the pedestrian road accident fatalities may be partially caused by the prevalence of mobile phone use among this group (Koushki *et al.* 1998). A recent study has shown that 83% of Kuwaiti adults own mobiles (Al-Qotom *et al.* 2000). The same study also indicated that, over the last three years, those who used mobiles while driving experienced 60% more road accidents that those who did not.

The result of the analysis of the data with respect to pedestrian nationality and the severity of accident injury indicated that no major difference was found to exist between the Kuwaiti and the non-Kuwaiti nationality groups with regard to injury and severe injury. However, while nearly 17% of the sample Kuwaiti pedestrians died in road accidents, only 13% of the non-Kuwaiti pedestrians were fatally injured.

Since most non-Kuwaitis in the State are from among the working-age groups, a cross-classification analysis was performed on the data to examine the age distribution of the two nationality groups of the accident-involved pedestrians. As presented in Table 6, while more than 62% of the Kuwaiti pedestrian victims of road accidents were from among those 20 years in age or less, only 25% of the non-Kuwaiti injured/fatal pedestrians belonged to this age group. As the data in Table 6 reveals, most of the non-Kuwaiti injuries/fatalities were within the 25-50 year age range, as was expected. The differences in accident involvement rates of the two nationality groups, by age, were statistically significant, as confirmed by the test of chi-square ($\chi^2 = 62.8$, df = 6, $p < 0.0001$).

Table 6. Pedestrian Accidents by Nationality and Age

	Age (years)							
Variable Name	**≤20**	**21-25**	**26-30**	**31-40**	**41-50**	**51-60**	**> 60**	**Total (%)**
Nationality:								
Kuwaiti:	62.3	9.2	6.9	9.3	4.6	4.6	3.1	100
Non-Kuwaiti:	25.0	8.8	17.9	26.6	14.0	4.9	2.9	100
	($\chi^2 = 62.8$, df = 6, $p < 0.0001$)							

CONCLUSIONS

The objectives of this research study were to highlight the poor safety aspects of the pedestrian mode of travel worldwide, and to present a profile of recent pedestrian accidents in the State of Kuwait.

A review of pedestrian accident statistics for industrialized and non-industrialized nations was performed. Findings established the existence of a major disproportionality of pedestrians compared to all other fatal victims of road accidents worldwide, and especially in non-industrialized countries.

Analysis of pedestrian accidents in Kuwait revealed that the majority of the victims were male. The accidents happened most frequently at night and in the morning. Most involved autos and pick-ups, and the majority took place in streets and intersections. These findings are according to expectations. However,

more than 9% of the pedestrian accidents involving females, and more than 3% of those involving males, occurred in parking lots-a disturbing reflection of the excessive speed, reckless driving behavior, and total disregard for pedestrian rights which typifies driver behavior in the region. The fact that nearly 45% of parking lot accidents involving pedestrians were fatal underscores the urgency of the dangers to the walking public in Kuwait.

Reckless driving and high speed were cited as the cause in the largest percentage of pedestrian fatalities. The use of mobiles (especially by female pedestrians), was second, and darkness at night also played a significant role in both the fatal and injurious pedestrian accidents. Quite clearly, stricter enforcement of driver non-compliance with traffic rules and regulations should prove effective in reducing road accidents caused by reckless driving and disrespect of traffic speed limits.

In non-industrialized nations, in general, and those of the Persian Gulf region in particular, neglect, lack of identity, and lack of recognition of pedestrian travel characterizes entrenched attitudes toward both the walking mode of urban travel and those who use it. The fact that walking is the most sustainable and environmentally compatible mode of urban travel goes largely unrecognized in this region.

The research team's frequent site visits of pedestrian walkways and years of living experience in the area indicated that poor walkway construction also shares part of the blame for pedestrian accidents. Walkways are often poorly designed geometrically being not always continuous. Construction material, parked vehicles, and other hazardous objects placed in walkways frequently force pedestrians off of the sidewalk and into the path of unregulated and high-speed motorized traffic where there is little or no respect for the rights of pedestrians. Even in new cost-intensive urban infrastructural developments, pedestrian requirements are often ignored, and walkways are not fully related to major activity centers and public transit stations. Only a full separation of walkways and roadways will guarantee the safety of the pedestrian. At marked crossing points, the pedestrian should be given the full right-of-way, by law.

With every major urban area in the non-industrialized world experiencing a significant degree of air and other environmental pollutions, encouragement of pedestrian travel represents one of the most cost-effective ways to improve safety and air quality. In addition, walking offers numerous health and socio-economic advantages to its users. Societies will continue to benefit significantly if proper attention is given to the safety and the quality of service improvements of this efficient mode of urban travel.

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دراسة تحليلية لحوادث المشاة في دولة الكويت

أ. د. بازفيز كوشكي و د. محمد أحمد علي

قسم الهندسة المدنية – كلية الهندسة والبترول – جامعة الكويت
ص.ب. 5969 الصفاة – الكويت 13060

خلاصة

على الرغم من التوافق البيئي والاستدامة المثلى لعادة المشي للأفراد وتوفر الفوائد الصحية والاجتماعية والاقتصادية لهذه العادة، فإن سلامة المشاة لا تحظى بالعناية الكافية من جانب السائقين أو واضعي السياسات خاصة في الدول غير الصناعية، ويظل المشاة أكثر مستخدمي الطرق عرضة للمسألة. لذا عنيت ورقة البحث هذه بإلقاء الضوء على دور المشاة في عدد من الدول الصناعية وغير الصناعية وذلك عن طريق تحليل نتائج 450 حادثة من حوادث المشاة التي أدت إلى الإصابة أو الموت خلال فترة 3 سنوات ما بين 1996–1998 تم اختيارها كعينات عشوائية في مدينة الكويت وضواحيها. واهتمت الورقة بمناقشة خصائص حوادث المشاة المؤدية إلى الإصابة أو الوفاة ومقارنتها، وعمل التوصيات اللازمة لتحسين وسائل السلامة للمشاة في دولة الكويت.