ORIGINAL ARTICLE

THE IMPACT OF FOUR-WHEEL DRIVES ON ROAD TRAFFIC DISABILITY AND DEATHS COMPARED TO PASSENGER CARS

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ABSTRACT

Objective: The aim of this study was to examine the pattern of injuries resulting from road traffic crashes involving four wheel drives (4WD) vehicles and passenger cars in the United Arab Emirates (UAE).

Design: Descriptive study.

Place and Duration of Study: Al-Ain and Tawam Hospital, UAE, during a period from 1st January to 31st December 2000.

Patients and Methods: A questionnaire was created and filled out concerning: sociodemographic information; data about driving behavior and attitude which included driving experience, adherence to traffic laws (including speed limits and wearing seat belt), driving habits, and assessment of sustained injury was performed according to the Abbreviated Injury Score (AIS).

Results: A total of 1157 motor vehicle crashes related casualty patients were hospitalized during the year 2000. Of these total patients, 495 victims (42.8%) were involved with 4WDs road traffic crashes related injuries and 72.9% of them required hospitalization. Of these, 76.8% were males, 60.7% were non-UAE nationals. The head injury was more common in those who had crashes from 4WD vehicles (45.6%) than those who had crashes from small cars (37.3%). Abbreviated injury scare showed that four wheelers caused more severe (9.1%), serious (10.3%), critical (8.3%) and moderate injuries (13.9%). A significant higher risk was observed for speed violations (OR=2.06; 95% CI=1.55–2.76, p<0.001); property damage (OR=1.54; 95% CI=1.07-2.22, p<0.014) and pedestrian accident (OR=2.09; 95% CI=1.46-2.99, p<0.001).

Conclusion: The present study findings indicated that nearly half of the road traffic crashes were involved with 4WD vehicles and that most of the injured individuals were pedestrian and younger drivers. Reduction in motor vehicle injuries and deaths represents a major public health success.

INTRODUCTION

Road traffic injuries are a major cause of death and disability globally, with a disproportionate number occurring in developing countries.[1,2] In many developed countries, injuries are now the leading cause of death among children and young adults.[3] Pedestrian deaths constitute the second largest category of motor vehicle deaths in the United States.[4-6] More recently Lefler et al.[5] and Roudsari et al.[6] compared pedestrians' impact risk factors for sport utility vehicles, pickups, trucks, vans and cars. In fact, the size of the problem is increasing at a fast rate in the developing countries due to rapid motorization and other risk factors such as behavior of an individual while driving with excessive speed and traffic violations.[7-9]

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A few studies reported that 4WD vehicles increase the risk of injury to drivers and pedestrians in motor vehicle crashes.[4,6,9,10] Although, four wheelers seem to be very stable and strong, unfortunately they are associated with frequent crashes and severe casualties and fatalities.[8] More recently, a study examined the vehicular damage resulting from motor vehicle crashes involving four-wheel drive vehicles and passenger cars in the State of Oklahoma.[9] The results indicated that passenger cars sustain significantly greater vehicular damage than 4WD vehicles.

The most common risk taking behavior which are reported to be associated with road traffic crashes are excessive speeding, careless driving, road traffic violations, and driving under the influence of alcohol or drugs.[3,7]

The aim of this study was to determine the pattern of all injuries due to road traffic crashes that involved 4WD vehicles and passenger cars in the UAE and associated risk factors.

PATIENTS AND METHODS

A study was performed on patients attending the Accident Emergency Department (AED) of Al-Ain and Tawam Hospitals during the year 2000. All patients who sustained a measurable body injury secondary to road traffic crashes were examined at the AED department and were included as study subjects. A standardized questionnaire was created and filled out by the consultant, casualty officers and staff nurses. The

questionnaire included the personal data including age, sex, nationality, marital status, educational level and occupation. The data about driving attitude including driving experience, adherence to traffic laws and driving habits was also collected. An assessment of injury sustained was made according to the Abbreviated Injury Score (AIS).[11,12] Road traffic crashes fatalities were defined to include all traffic-related deaths that occur within 28 days from the crash in accordance with World Health Organization criteria.[13]

Chi-square analysis was done to test for differences in proportions of categorical variables between two or more groups. In 2x2 tables, the Fisher exact test (two-tailed) was used instead of Chi-Square. In particular, when sample size was small. Odds Ratio (OR) and their 95% confidence intervals (CI) was calculated by using Mantel-Haenszel test. The level $p<0.05$ was considered as the cut-off value for significance.

Results

A total of 1157 road traffic crashes related casualty patients were hospitalized at Al-Ain and Tawam Hospitals. Out of 1157 subjects, 13 persons died from 4WD and 6 persons died from small passenger cars. The analysis was based on remaining 1138 persons (62% drivers, 13% pedestrians and 25% passengers). Overall, most of the drivers (57.7%) hospitalized were victims of crossing red traffic signal, 69.5% stated to excessive speeding; 32% smoking while driving; 69.5 % using telephones while driving; 32.3% kept their child in the front seat.

Table I presents the sociodemographic features of the subjects involved in road traffic injury by the type of car. Four hundred and ninetyfive victims (42.8%) were injured from 4WD vehicles and most of the injured individuals were young adults and below 35 years of age. Road traffic crashes were the most common and occurred during the evening and night time (43.6%).

Table II shows the comparison of AIS and the location of injury by four wheel drive vehicles and small passenger cars. The frequency of the different sites of injury was also compared between the two groups. Only the head was injured more often in those who had crashes from 4WD vehicles (45.6%) than those who had crashes from small cars (37.3%), 20.1% had chest injury from four wheelers whereas 25.2% from small cars. AIS showed that 4WD vehicles caused more severe (9.1%), serious (10.3%), critical (8.3%) and moderate injuries (13.9%) than small cars. Among all motor vehicle trauma, head injuries were seen in pedestrians (45.8%), while 40.1% were for injured occupants. Lower extremity injury was second for pedestrians (36.8%) and occupants (39.4%), but spinal injuries were more for occupants (19.7%) than pedestrians (14.2%).

Table III shows the cause of injuries due to road traffic crashes by four-wheel drive vehicle and small car. A significant higher risk was observed for speed violations (OR=2.06; 95% CI=1.55–2.76, $p<0.001$); property damage (OR=1.54; 95% CI=1.07-2.22, $p<0.014$) and pedestrian accident (OR=2.09; 95% CI=1.46-2.99, $p<0.001$).

Table I: Sociodemographic features of subjects involved in motor vehicle injury by type of car during the year 2000 (N=1138)*.

Variables	Four wheel drive* N=482 n(%)	Small car** N=656 n(%)	p-value
Age group (years)			
<25	140(29.0)	170(25.9)	
25-34	131(27.2)	183(27.9)	NS
35-45	157(32.6)	216(32.9)	
>45	54(15.2)	87(13.3)	
Sex			
Male	360(74.7)	514(78.4)	NS
Female	122(25.3)	142(21.6)	
Nationality			
UAE	153(31.7)	294(44.8)	<0.001
Non UAE	329(68.3)	362(55.2)	
Marital status			
Single	155(32.2)	261(39.8)	
Married	307(63.7)	349(52.7)	<0.001
Divorce/widow	14(2.9)	3(0.5)	
Educational level			
Illiterate	119(24.7)	79(12.0)	
Primary	162(33.6)	158(24.1)	
Intermediate	47(9.8)	86(13.1)	<0.001
Secondary	100(20.7)	248(37.8)	
University	54(11.2)	85(13.0)	
Occupation			
Sedentary	89(18.5)	142(21.6)	
Manual	231(47.9)	248(37.8)	
Businessman	26(5.4)	87(13.3)	<0.001
Student	69(14.3)	72(11.0)	
Housewife	47(9.8)	85(13.0)	
Retired/not working	20(4. 1)	22(3.4)	
Timing of crashes			
6-12	119(24.7)	183(27.9)	
12-18	112(23.2)	203(30.9)	<0.001
18-24	210(43.6)	193(29.4)	
0-6	41(8.5)	77(11.7)	

**13 persons died from four wheel drive vehicles; ** 6 persons died from small passenger cars.*

Table II: Comparison of motor vehicle injury severity from four wheel drive vehicles and small cars during the period year 2000 (N=1157).

Variables	Fourwheelers N=482 n(%)	Small car N=656 n(%)	OR (95% CI)*	p-value
Abbreviated injury scale				
Uninjured	134(27.8)	223(34.0)	0.75(0.57-0.97)	0.026
Minor	131(27.1)	242(36.9)	0.64(0.49-0.83)	0.00056
Moderate	67(13.9)	46(7.1)	2.14(1.42-3.24)	0.0001
Severe	44(9.2)	27(4.1)	2.34(1.39-3.95)	0.0005
Serious	50(10.4)	59(9.0)	1.17(0.77-1.77)	0.4348
Critical	40(8.3)	20(3.0)	2.72(1.52-4.92)	0.0002
Maximum	16(3.3)	39(5.9)	0.6(0.33-1.12)	0.09
Died as a result of crash	13	6	2.96(1.04-8.78)	0.02
Location of injury				
Head/neck/facial injury	220(45.6)	245(37.3)	1.41(1.10-1.80)	0.005
Spinal injury	82(17.0)	134(20.4)	0.80(0.59-1.08)	NS
Abdominal and pelvic injury	69(14.3)	102(15.5)	0.91(0.65-1.26)	NS
Chest injury	97(20.1)	165(25.2)	0.75(0.56-0.99)	0.047
Upper extremity injury	114(23.7)	170(25.9)	0.89(0.67-1.16)	NS
Lower extremity injury	190(39.4)	254(38.7)	1.03(0.81-1.31)	NS

**13 persons died from four wheel drive vehicles; ** 6 persons died from small passenger cars; * Estimated odds ratio and 95% confidence interval by Mantel-Haenszel method; NS= Not significant.*

Discussion

This study used road traffic crashes data to examine the relationship between 4WD and severity of crashes in which an injury occurred. Four wheelers are becoming increasingly popular recreational devices and adolescents were identified

Table III: Cause of injury by four wheel drive vehicles and small cars.

Cause of crash	4 wheel drive=482 n(%)	Small car=656 n(%)	Odds ratio [OR]	95% confidence interval*	p-value
Careless driving	89(18.5)	237(36.1)	0.65	0.49-0.85	0.001
Speed violations	147(30.5)	115(17.5)	2.06	1.55-2.76	<0.001
Property damage	76(15.8)	71(10.8)	1.54	1.07-2.22	0.014
Pedestrian accident	90(18.7)	65(9.9)	2.09	1.46-2.99	<0.001
Traffic violations	63(13.1)	133(20.3)	0.59	0.42-0.83	0.001
Alcohol and drug	17(3.5)	35(5.3)	0.65	0.34-1.21	0.149

**Estimated odds ratio and 95% confidence interval by Mantel-Haenszel method, NS= Not significant.*

as high-risk four-wheeler user group in UAE and other Arabian Gulf countries. Road traffic fatalities are the second most common cause of death in all age groups in the UAE[7,8] and Saudi Arabia.[14] In the present prospective hospital based study, 42.8% of the victims were involved with 4WD road traffic crashes related injury. With the increasing popularity of 4WD, a corresponding increase in the injury and death rates have been noted. The present study is consistent with the most recent study which reported that as the number of light trucks and vans on US highways continues to increase, new area of concern regarding pedestrian safety has emerged.[5,9]

It is a well-known factor that crash severity is much worse for occupants traveling in lightweight vehicles that collide with heavier class vehicles especially 4WDs.[4,6,9] In UAE and other Arabian Gulf countries[1,2,7], because of lack of outdoor entertainment facilities, young people use their cars for competition and passing time in late afternoon and evenings, which, incidentally, is the time when most of the casualties occur. Further, major casualties occur at leisure time and during darkness.[15] Previous studies have shown that young male drivers and driving at night have a higher risk of involvement in traffic crashes.[8,15,16] This is consistent with the present study results that 43.6% of the 4WD road traffic crashes occurred late in the night. In Arabian Gulf countries, adolescents misuse four wheelers by driving most frequently at night and in the desert and on sand dunes for fun, which leads to sudden deaths and permanent disability. Most of the drivers violate speed limits in UAE, and in the last three decades excessive speed limits increased morbidity and mortality in UAE[7] as reported from western countries as well.[1,16]

Road crashes from four wheelers in United Arab Emirates ranked second, 12.3% in 1995; 18.7% in 1998 and 22.6% in 2000.[8] This evidence supports misuse or abuse of four wheelers by rash drivers. Similarly, pedestrian deaths constitute the second largest category of motor vehicle deaths in the United States[5,9] and a recent study reported that increased sport utility vehicles and pick-up trucks were associated with more pedestrian deaths and a higher pedestrian injury severity score.[4] On the other hand, it has also been reported that fatal crashes, involving sport utility vehicles and passenger cars, are not solely a function of the differential weight of the vehicles. Head-on crashes involving sports cars and passenger cars demonstrated higher fatality rates in the small passenger vehicles.[17] Wood[18] has used the fundamental relationships of Newton mechanics to derive a generalized equation for the relative safety of cars of different sizes when involved in frontal collisions, and proved that there was high level of correlation between the theory and field evaluation of relative injury risk. Reports also showed that mass of the vehicle was the most important vehicular parameter influencing fatality odds for all crashes.[19]

Overall, high risk of injuries and fatalities with 4WD reported in this study were: excessive speed, young drivers engaged in more risky behaviors, entering into the wrong lane and incorrect overtake; failing to give way to pedestrians, crossing a junction with red traffic light on or crossing a roundabout with excessive speed and impatient with slow driver. This is consistent with previous reported studies.[7,8]

Previous research has examined the role of education, engineering and police enforcement in changing reckless pedestrian and driver behaviors.[4] Road traffic crashes are particularly tragic and cause social and economic waste for the country.[2,8,14] Most of the road crashes are potentially preventable.[10] Most recently, strategy to improve road safety in UAE, Arabian Gulf countries and developing countries have been discussed in detail.[8,20,21] Road traffic crashes in the UAE ranked the second highest cause of death after cardiovascular diseases for the twelve-year period (1990 – 2002). If no preventive measures are taken, the toll due to road crashes will become the leading cause of death in 2020.

In the present study, there are, however, several limitations in the data obtained from the hospitals. One concern is that fatal injury, as reported by casualty doctor, includes death upto 28 days after crash, although an estimated 2% of deaths occur after 28 days. Second is the reliability of reported levels of injury severity by casualty doctor. Although, some misclassification between levels is possible. Third is under-reporting of crashes, especially for minor injury crashes. There may be differences in distribution between minor injury crashes that are reported and those that are not. This may result in selection bias.

Conclusion

The present study findings indicated that nearly half of the road traffic crashes were involved with 4WD vehicles and most of the injured individuals were pedestrians and younger drivers. The magnitude of motor vehicle injuries from 4WD vehicles is a growing problem and it needs very urgent attention.

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