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Road Traffic Accidents in Bahrain

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Objective: To determine (a) the incidence of Road Traffic Accident (RTA) casualties treated at Salmaniya Medical Complex (SMC) and its distribution characteristics; (b) injury severity and casualty types; and (c) the affect on SMC health system.

Method: A total of 23,006 RTA casualties between the ages of 1 to 99 years from 1996 to 2001 were studied at SMC Emergency and Inpatient facilities. The data were collected from database of case records.

Results: The incidence of RTA casualties treated at SMC were 73.59% Bahrainis, 26.38 % non-Bahrainis. Male Bahraini drivers between the age of 15 and 29 represented 13.90% of RTA casualties treated at SMC. Drivers between the age of 15 to 17 inclusive, accounted for 187 of RTA casualties between 1996 and 2001.

The incidence of RTA injuries treated at SMC indicated 42.5% increase in casualties treated from 1996 to 2001. Slight injuries increased 27.2% while ambulance cases increased by 244.6% and inpatient admissions increased by 18.8%. Inpatient deaths decreased by 75%. SMC records indicate that the incidence of death is decreasing while police reports indicate that the incidence of death has increased by 75%. SMC records do not include all police recorded deaths, and police records do not include SMC inpatient deaths unless payment cases.

Fractures represented 46.76% of all inpatient injuries, followed by intra-cranial injuries (29.76%). Total days of care for RTA casualties over six years were 31,595 days with an estimated economic cost of 3,097,869.7 Bahrain Dinars.

Conclusion: The evidence strongly supports the need for tougher enforcement of legislation and policy for speed limits, seat belts, driver education programs, and collaborative studies to support road traffic accident prevention and safety.

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Motor vehicle accidents are the leading cause of death for the young and contribute to a high degree of morbidity and mortality for all ages[1]. The incidence of RTA and level of severity of casualties resulting from RTA directly affect the financial and human resources of health service.

The total population of Bahrain according to the 2001 census[2] is 654,619; Bahrainis constituted 62.3%. The healthcare delivery system in Bahrain shares responsibility between government and private sector, government 90% and private sector 10%.

Research on RTA in the Middle East is limited. Data on the incidence of RTA in Bahrain are limited to two major sources of information; the Traffic Accident Facts (TAF)[3], and the Ministry of Health Statistics book (MOHS)[4]. The TAF is a complete census of all fatal crashes on Bahrain road that result in death at the scene of the accident, reported morgue incidents, and reported payment incidents. Cryer et al, reiterate the importance of analyzing police reported data linked to hospital data[5].

Length of stay (LOS) provides an approximate indication of case severity and can be used to calculate direct inpatient cost of RTA injury affect on the health system[6].

About 90% of disability adjusted life years lost world wide due to RTA occur in developing countries. The problem is increasing at a fast rate due to rapid motorization in addition to other factors, and policy makers need to recognize this problem as a public health crisis and design appropriate policy responses[7].

Bener's study of United Arab Emirates RTA mirrored Bahrain's trend in police reported RTA; little change in death rate related to population and number of vehicles, but an alarming increase in RTA injuries and death. Effects of UAE introduction of speed cameras resulted in decreased speed limit violations and monitoring radar system reduced RTA, injuries and death[8].

RTA directly effect society in terms of death, disability, suffering and cost. Public education, appropriate laws and enforcement, and research programs have been found to be effective in the prevention of RTA. O'Neill and Mohan's research reinforce that demonstrable gains produced by changing road user behavior have resulted from traffic safety laws. Laws in addition to the motorists' perceptions that they run the risk of being detected and punished for violating the law resulted in reduction of RTA[9].

Despite considerable progress in recent years from Bahrain Traffic Department in the collection of data and reporting of RTA, statistics have not been analyzed related to the affect on health systems, or effectiveness of legislation or education programs.

This retrospective analytic study aimed to determine (a) the incidence of RTA casualties treated at SMC between 1996 and 2001 inclusive, and its distribution characteristics; (b) injury severity and casualty types; and (c) the type of injuries and affect on SMC health system.

METHODS

All case records of RTA (n=23,006) that were registered in Accident and Emergency (A/E), admitted as an inpatient, died in hospital, or were transferred from Limited Private Practice, Outpatient clinics, or Private clinics, between January 1st, 1996 and December 31st, 2001, were included in this study. SMC is the main referral hospital in Bahrain for RTA. The number and characteristics of this population are therefore viewed as representative of RTA casualties in Bahrain.

Data Source for the study included all case records entered into the McDonald Douglas Information System (MDIS) as follows:

- SMC Emergency patients treated from January 1st 1996 to December 31st 2001.
- SMC hospital discharges occurring from January 1st to December 31st, 1996 to 2001 inclusive, were downloaded.

SMC statistics have been categorized by injury type and casualty type for the purpose of analysis. Injury type include deaths, slightly injured and seriously injured of which inpatient admissions and ambulance cases were included. Casualty type included driver, passenger, and pedestrian casualties. A/E statistics were already categorized through SAS as RTA – driver, passenger, or pedestrian encounters. The CPR and admission date of these cases were linked to the inpatient admissions and added to the E-code admissions for RTA.

The variables of age, nationality and gender, casualty type, injury type, and length of stay were gathered in a prepared format.

Data were extracted using the Statistical Analysis System. Data were categorized using Excel, and statistical analysis was completed utilizing Statistical Package for Social Sciences (SPSS).

RESULTS

The incidence of RTA casualties treated at SMC increased by 42.55% from 1996 to 2001 (Table 1). The percentage increase of SMC casualties from 1996 to 2001 are as follows: casualties per population 31.16% increase; casualties per number of vehicles 8.57%; and casualties per reported accidents 4.24%. If analyzed based on casualty rates by population (# casualties divided by total population), the rate has increased from 0.52% in 1996 to 0.68% in 2001. Casualty rates have also increased slightly based on number of vehicles (# casualties divided by number of vehicles) from 1.75% in 1996 to 1.91% in 2001, and number of road accidents (# casualties divided by number of road accidents) from 11.06% in 1996 to 11.53% in 2001.

Table 1.

Figure 1 illustrates the mean age distribution of casualties treated at SMC over the six year period. High casualty age group (>200) is 5 to 9 and 15 to 44 years of age.

Male Bahraini drivers between the age of 15 and 29 years represented 13.90% of all RTA casualties treated at SMC. Drivers between the age of 15 and 17 inclusive accounted for 187 of the RTA casualties between 1996 and 2001. Males constitute 47.27% and females constitute 45.9% of casualties in the 15-29 age group. The incidence of RTA casualties treated at SMC was 73.59% Bahrainis, 26.38 % non-Bahrainis, and .03% undetermined. The percentage of Bahraini male and female casualties was 63.14% and 36.86%, respectively. The highest frequency of casualties for non-Bahrainis was in the age group 30 to 45 years of age; 78.79% of non-Bahraini casualties were males and 21.21% females.

Figure 1

Table 2 shows the increasing affect on the health system illustrated by trends in injury acuity and casualty type resulting in increase in both severity and incidence. The incidence of injury severity is classified as slight injuries, serious injuries or death. The incidence of RTA injuries treated at SMC indicate 42.5% increase from 1996 to 2001. Slight injuries increased 27.2% while ambulance cases increased by 244.6% and inpatient admissions increased by 18.8%. Inpatient deaths decreased by 75% from 1996 to 2001.

Table 2.

Drivers treated in SMC accounted for 40.14% of all RTA casualties. They accounted for 48.1% of the slight injuries, 50.8% of the ambulance cases in emergency not admitted, and 25.9% of the inpatient admissions. Pedestrians accounted for 35.7 % of inpatient deaths. 18% of all ambulance RTA (n=4233) arriving in Emergency were admitted as inpatients (n=762).

Morbidity Incidence of Inpatient Hospitalizations

Figure 2 shows the morbidity effect of RTA by comparing the percentage of inpatient body injuries treated at SMC. Hospitalizations due to Intracranial Injuries accounted for 29.76% (n=821) of all inpatient admissions, including deaths (n=2759). Fractures accounted for 46.76% (n=1290) of all injuries.

Fractures of lower limbs resulting from RTA accounted for 32.39% (n=10,233) of the total RTA inpatient days of care (n=31,955).

Figure 2.

Table 3 provides the estimated economic costs for emergency and inpatient stays, and are calculated based on the patient days of care of RTA cases. Total six year costs for RTA (3,097,869.7 million BD) have increased by 46.9% since 1996, a 35.18% increase per capita.

Table 3. **Estimated SMC inpatient RTA cost**

	1996	1997	1998	1999	2000	2001
No. of hospital discharge	404	475	500	437	482	461
No. of length of stay	4046	6434	5887	5422	5133	4673
Cost/inpatient Day (BD)	8380	9200	9560	10050	10930	10660
Total estimated hospital Costs (BD)	339054.80	591928.00	562797.20	544911.00	561036.90	498141.80
Cost per capita (BD)	0.57	0.95	0.88	0.82	0.81	0.77
Population	598625	620378	642972	666442	690821	650604

DISCUSSION

Traffic crashes are predictable and therefore, not 'accidents' because they are preventable[2]. Pre-crash preventive measures include education and enforcement of laws for alcohol, speed and traffic safety compliance. Strict enforcement of speed limits and seat belt legislation have been found effective in reducing the number and severity of RTA casualties in the USA. The UAE study of RTA concluded that simple measures such as speed limit enforcement and wearing seat belts would reduce death and disability[8]. They also found that compared to developed countries, UAE RTA death rate per hundred million vehicle kilometers of travel (3.33), per 100,000 registered vehicles (119.8), and per 100,000 resident population (23.41) of UAE in 1998 were higher. In Bahrain, the fatality rate per registered vehicles for 2001 is high (3.26 deaths per 10,000 vehicles), higher than international statistics in Australia (1.39), New Zealand (1.7). In 2000, Bahrain fatality rate per registered vehicles was 2.45 as compared to Canada 1.6, Germany 1.5, USA 1.9 and UK 1.2[5]. One traffic accident is reported every 14 minutes in Bahrain. TAF reported that out of all injury accidents 5% were due to drunken driving, 5.6% due to speeding, and 5.6% due to carelessness of pedestrians[3].

According to Health Statistics Report 2001, SMC reported treating 4226 RTA casualties and BDF reported treating 1719 RTA casualties in 2001[4]. Therefore, SMC is considered the main representative of the population treated for RTA injuries.

Based on RTA database, 4399 casualties were treated at SMC in 2001. Validation of data indicated that some diagnoses were not coded as RTA (e-codes) but were in fact RTA casualties, for example, normal deliveries involved in RTA. This accounts for discrepancies in data between SMC Publication report and RTA database.

Police reports indicate in year 2001, 63 persons were killed, 422 seriously injured, and 1237 slightly injured in Bahrain[3]. The number of motor vehicles increased by 31.30% from 1996 to 2001 with accidents increasing by 36.80%[3]. Vehicle registration death rate

of 3.26 (fatalities per 10,000 vehicles) has fluctuated but not changed since 1996. This rate is over double the international rate of other countries[10].

RTA casualties treated at SMC are increasing both in incidence and injury severity. There has been 42.55% increase in total number of RTA casualties treated at SMC from 1996, yet there has only been an increase of 4.24% in police reports. This may be an indicator that RTA casualties treated at SMC are not all reported to police. Based on the international indicators, population and vehicles, the rate of casualties treated in SMC have actually declined. These international rates do not give a true picture of the affect on the health system.

Characteristic analysis indicates that Bahrainis accounted for 73.59% of the casualties with Bahraini males accounting for 63.14% of those casualties, 47.27% of which were between the age of 15 to 29 years. Twenty nine point ninety two percent of male Bahrainis between 15 and 29 years of age were driver casualties. One hundred and eighty seven driver RTA casualties were 15 to 17, under the legal driving age of 18. The higher percentage for non-Bahrainis RTA was between the age of 30 to 45 years of age. These figures are consistent with the corresponding figures cited in Bahrain TAF which indicate that of all drivers involved in injury accidents, 40% were under 1 year driving experience[3]. They also reported that drivers between the age of 15 to 35 were at fault for 65% of the accidents where injuries occurred. Results strongly suggest that inexperienced drivers are involved in RTA, and laws are not being complied with. Male drivers were at fault for 83% RTA and female drivers for 14%. Information received from the Directorate of Traffic Statistics Department stated that in 2001 females accounted for 22.03% of registered licensed drivers. This may suggest that females have safer driving habits than males. Findings strongly suggest that driver education programs as a preventative measure should target these age groups, particularly male nationals. Pedestrian accidents treated at SMC between the ages of 5-9, primary school age, accounted for 19.77% of Pedestrian accidents (3.46% of all SMC treated RTA). Pedestrian education programs at the school, flashing traffic crossings, school zone speed limits, and children safety patrol programs where older students help younger students at road crossings, are strongly indicated and the affects of program implementation are recommended for further study.

Injury severity is increasing; slight injuries increased 27.2% from 1996 to 2001, serious injuries by admission to hospital increased 18.8%, and ambulance cases increased 244.6%, while fatalities decreased 75%. One would conclude from the decreased percentage of fatalities in RTA, that seat belt legislation or speeding laws are effective[8]. However, TAF reports that in 2001, 55.67% of driver casualties utilized seat belts as compared to 70.75% in 1996.

SMC inpatient analysis indicates that cases presenting with intra-cranial injuries have decreased from 143 in 1996 to 113 in 2001. Skull fractures however have increased from 20 to 26 from 1996 to 2001 respectively, and open wounds to head neck and trunk have increased from 4 to 11. This may be due to seat belt utilization and enforcement of seat belt legislation. Fractures of upper limbs have also increased from 28 in 1996 to 55 in

2001. Lower limb fractures increased from 87 in 1996 to 112 in 2001. Further study of the relationship between injury type and casualty group (drivers, passengers, and pedestrians) and legislation and law enforcement, as well as education programs is strongly recommended.

Economic cost of accidents can be estimated by cost of vehicle replacement, lost productivity, the affect on the family, psycho-pathological consequences and post-traumatic stress disorders[11], medical, legal, insurance, and workplace cost are significant, difficult to analyze, and greatly impact on the community[12].

Although the true economic affect of RTA are difficult to analyze[13] as are the individual psychopathological costs[14,15], hospital cost are an indicator of the affect of RTA on health services. Hospital costs are calculated based on the number of care days and costs per day. Analysis of these costs indicate that costs per year for 2001 were lower than the previous four years but still 46.9% higher than in 1996. With the number of care days decreasing, this is either an indication that the initial severity is less, or the system of care is more efficient in treating and discharging patients.

Another indicator of cost is the utilization of ambulance services. This should be further investigated as only 18% of all ambulance cases encountered in Emergency at SMC were admitted to hospital as an inpatient.

Mandatory reporting to the police of casualties treated will provide a more accurate picture of RTA compared to international statistics and the affect on Bahrain. The increasing incidence of RTA casualties treated at SMC is significantly higher than that reported by the Road Traffic Accident Report[3] and is increasing both in incidence and injury severity.

CONCLUSION

The incidence of RTA casualties treated at Salmaniya Medical Complex is increasing in number. The highest percentage involves Bahraini male drivers between the age of 15 and 29. Drivers involved in RTA include 0.82% who are under the legal driving age (18 years). Stricter enforcement of laws for those who drive without license, and mandatory re-certification and education programs for frequent traffic law violators is recommended. Injury severity is increasing and death is decreasing. The affect of seat belt and speed limit legislation and enforcement, in addition to the affects of improved pedestrian cross walks, bicycle and school safety programs need to be monitored in accordance with the incidence of RTA. Affects of RTA on the SMC health system are increasing. Studies of the actual repercussion on family members, production loss, and economic cost requires further investigation. Closer monitoring and reporting in collaboration between the Traffic Department, Ministry of Interior and the Ministry of Health will result in more accurate data collection and identification of potential education and safety programs.

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