RESEARCH PAPER

EPIDEMIOLOGY OF ROAD TRAFFIC CRASHES REPORTED IN THE KURUNEGALA POLICE DIVISION IN SRI LANKA

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Abstract

Background: Road Traffic Crashes (RTCs) kill 1.24 million people in the world annually. It has become a major but neglected public health problem in the world including Sri Lanka.

Objective: To describe characteristics of RTCs and socio-demographic characteristics of involved road users reported at the Kurunegala Police Division (KPD), Sri Lanka during April to December in 2013.

Materials and Methods: A descriptive cross-sectional study was conducted and the study participants were involved road users of consecutively reported RTCs to ten police stations in the KPD. Data were collected using an interviewer administered structured questionnaire and a data record sheet.

Results: 851 RTCs were reported during the study period with 1481 vehicles and 1887 road users involved. 7.8% of the RTCs were fatal, 70% resulted in non-fatal injuries and 22.2% caused damage only. The average rate of RTCs was 03 per day and majority (37.3%) was reported from urban areas between 12.00hr-17.59hrs. Fatal RTCs were higher between 0.00hr-05.59hrs in rural areas. The leading type of vehicles involved were motorcycles and the most vulnerable road users were males (84%) between 31- 40 years. The majority of motorcyclists and pillion riders (82.8%) were wearing a helmet at the time of the crash. The majority of pedestrians (85.2%) were injured while crossing the road, out of which 34% were on a pedestrian crossing.

Conclusion: Young males in productive age were the most affected by RTCs.

Keywords: Road-traffic-crashes, Involved-road-users, Socio-demographic-characteristics, Sri Lanka

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Introduction

More than 1.24 million people die from Road Traffic Crashes (RTCs) annually and about 90% of road traffic fatalities occur in low-income and middle-income countries, which comprise two-thirds of the global population[1]. RTCs are one of the top five causes of morbidity and mortality in the South Asian region[2]. RTCs have become an important public health problem that needs urgent attention.

Sri Lanka, a middle income country, is facing the burden of RTCs, and associated injuries and death, due to an exponential growth in motorization on a static road system. The traffic Police statistics of Sri Lanka shows an increase of RTCs reported during the recent past. During 2009-2015 period, the total number of RTCs increased by 15% while deaths increased by 17% [3].

The North Western Province (NWP) of Sri Lanka consists of six police divisions including the Kurunegala Police Division (KPD). This study was conducted in the KPD which is the most populated police division in the NWP, with an estimated mid-year population of 300,872 and a population density of 466 persons per km^2 in 2011[4]. In addition to the residential population, around 75,000 people visit the Kurunegala city, the capital of NWP, daily for education, administrative and business purposes[4]. Kurunegala is a major transitional centre in Sri Lanka, connecting Colombo, the capital with the other parts of the country. This has made Kurunegala a city with a high vehicle density, congestion and its flat, broad and straight road network conducive to high speed driving.

A comprehensive literature search on RTCs in the KPD revealed a scarcity of published articles, which made us to conduct this study to describe the epidemiology of RTCs reported in the KPD, Sri Lanka.

Materials and Methods

This descriptive cross-sectional study was conducted at the ten police stations and nine government hospitals situated in the KPD. A RTC was "an event that produced injury and/or property damage, involving a vehicle in transit, and occurring on a road"[5] and an Involved Road User (IRU) of a RTC was "a person who was driving or was in a vehicle involved in the RTC or a pedestrian hit by a vehicle"[1].

All the RTCs reported to the ten police stations in KPD from April to December in 2013 and all IRUs were included in the study. IRUs who, did not go to a police station or were not admitted to a government hospital situated in KPD were not included. With an expected proportion of injury producing RTCs of 55% [6] and a 3.5% desired precision, a sample size of 775 RTCs were obtained and with an expected non-response rate of 10%, 851 RTCs were studied[7]. A pre-tested, interviewer administered structured questionnaire and a data record sheet were used for data collection and young male trained data collectors with similar educational background collected data.

Any RTC needs to be reported to a police station within a stipulated period from the time of the crash, as specified in the Motor Traffic Act of Sri Lanka[8]. All injured IRUs admit to a government hospital, especially if the injured expect to initiate legal action and file for compensation. As health care at government hospitals in Sri Lanka are free of charge there is no inhibition to request admission to a hospital. In this study, the data collector was immediately informed of the RTC by the police officer attending the crash, and then the data collector visited the relevant police station or the hospital and interviewed the IRU. If the IRU was severely injured and the condition did not warrant an interview, his/her socio-demographic data was obtained from the relatives. When the

relevant information could not be obtained at the first visit, it was done at a subsequent visit/s. The information of the injured IRU who succumbed to their injuries was collected from the closest relative at the postmortem.

Ethical clearance for the study was obtained from the Institutional Ethical Review Committee, Faculty of Medicine, University of Peradeniya, Sri Lanka and permission to conduct the study was obtained from relevant authorities. Informed written consent was obtained from the study participants prior to the data collection. Data was cleaned, entered to an Excel data sheet and imported to SPSS and analyzed using SPSS version 21. A univariate analysis was conducted initially and for selected variables a bivariate analysis was conducted subsequently, chi- squared test and student t test were used to identify statistical significance. A p value of <0.05 was used to identify statistical significance.

Results

The study included 851 RTCs involving 1481 vehicles and 1887 road users during nine months study period.

The majority (77.8%) of the RTCs caused an injury to an IRU. Three RTCs per/day were reported. Majority of fatal crashes occurred on public holidays (14%). A statistically significant association was observed between the time of the day and the severity of the RTC (*x2=23.293, df=6, p<0.05*) (Table 1).

Table 1: Distribution of the severity of RTCs by the environmental characteristics in KPD

Type of the day	Severity of RTCs			
	Fatal RTCs (No: %)	NFIP-RTCs* (No: %)	DO-RTCs ** (No: %)	Total RTCs (No: %)
Normal week day	33 (6.0)	386 (70.5)	129 (23.5)	548 (100.0)
Normal week end	26 (10.2)	179 (70.8)	48 (19.0)	253 (100.0)
Public holiday	07 (14.0)	31 (62.0)	12 (24.0)	50 (100.0)
Total	66 (7.8)	596 (70.0)	189 (22.2)	851 (100.0)
Time of the day				
0.00 hr - 05.59 hr	10 (12.2)	42 (51.2)	30 (36.6)	82 (100.0)
06.00hr - 11.59 hr	14 (6.5)	157 (72.7)	45 (20.8)	216 (100.0)
12.00hr - 17.59 hr	17 (5.4)	224 (70.7)	76 (23.9)	317 (100.0)
18.00hr – 23.59 hr	25 (10.6)	173 (73.3)	38 (16.1)	236 (100.0)
Total	66 (7.8)	596 (70.0)	189 (22.2)	851 (100.0)
Light condition of the environment at the time of the RTC				
Day time light	33 (6.0)	388 (70.7)	128 (23.3)	549 (100.0)
Night, with street lighting	12 (13.2)	52 (57.1)	27 (29.7)	91 (100.0)
Night, without street lighting	21 (10.0)	156 (73.9)	34 (16.1)	211 (100.0)
Total	66 (7.8)	596 (70.0)	189 (22.2)	851 (100.0)
Urban\Rural area				
Urban	26 (4.8)	370 (67.7)	150 (27.5)	546 (100.0)
Rural	40 (13.1)	226 (74.1)	39 (12.8)	305 (100.0)
Total	66 (7.8)	596 (70.0)	189 (22.2)	851 (100.0)

***Non fatal injury-producing RTCs = NFIP-RTCs, **Damage only RTCs = DO-RTCs**

Table 2: Distribution of the severity of RTCs by the road characteristics in KPD

Type of the road	Severity of RTCs			
	Fatal RTCs (No: %)	NFIP-RTCs* (No: %)	DO-RTCs** (No: %)	Total RTCs (No: %)
Major roads	57 (8.0)	499 (69.7)	160 (22.3)	716 (100.0)
Minor roads	09 (6.7)	97 (71.9)	29 (21.4)	135 (100.0)
Total	66 (7.8)	596 (70.0)	189 (22.2)	851 (100.0)
Type of junction of the road				
No junction with in 10 m	44 (6.4)	543(79.0)	100 (14.6)	687 (100.0)
Junctions (Y,T, 4 legged, multiple)	17 (11.6)	47 (32.0)	83 (56.4)	147 (100.0)
Others (roundabout, entrance by road, rail road crossing)	05 29.4)	06 (35.3)	06 (35.3)	17 (100.0)
Total	66 (7.8)	596 (70.0)	189 (22.2)	851 (100.0)

***Non fatal injury-producing RTCs = NFIP-RTCs, **Damage only RTCs = DO-RTCs**

Table 3: Distribution of the severity of RTCs by the type of vehicle in KPD

Type of the vehicle	Severity of RTCs			
	Fatal RTCs (No: %)	NFIP-RTCs * (No: %)	DO-RTCs** (No: %)	Total RTCs (No: %)
Motorcycle	121 (24.4)	221 (44.7)	153 (30.9)	495 (100.0)
Dual Purpose vehicle	30 (12.9)	132 (56.7)	71 (30.4)	233 (100.0)
Lorry	20 (9.6)	147 (70.7)	41 (19.7)	208 (100.0)
Three-wheeler	32 (17.4)	108 (58.7)	44 (23.9)	184 (100.0)
Car	19 (11.4)	91 (54.5)	57 (34.1)	167 (100.0)
Private Bus	03 (3.8)	36 (45.6)	40 (50.6)	79 (100.0)
Pedal cycle	07 (10.6)	26 (39.4)	33 (50.0)	66 (100.0)
SLTB bus	03 (11.5)	13 (50.0)	10 (38.5)	26 (100.0)
Tractor	01 (7.7)	08 (61.5)	04 (30.8)	13 (100.0)
Articulated vehicle	01 (10.0)	2 (20.0)	07 (70.0)	10 (100.0)
Total	237 (16.0)	784 (52.9)	460 (31.1)	1481 (100.0)

***Non fatal injury-producing RTCs = NFIP-RTCs, **Damage only RTCs = DO-RTCs**

Occurrence of all types of RTCs (84.1%,n=716) and the fatal RTC percentage (8%) were higher on major roads than on minor roads. A statistically significant association was observed between the severity of RTC and the type of the junction where it occurred (x^2=145.5637, *df =4, p < 0.05)* (Table 2).

The leading types of vehicles involved in RTCs were motorcycles (33.4%,n=495), dual purpose vehicles (15.7%,n=233), lorries (14.0%,n=208,) and three-wheelers (12.4%,n=184) (Table 3).

Table 4: Distribution of the gender and age of involved road users in KPD

	Road user involved in RTCs		
Age (years)	Male (No :%)	Female (No :%)	Total (No :%)
0-10	02 (0.1)	02 (0.7)	04 (0.2)
11-20	101 (6.4)	18 (6.0)	119 (6.3)
21-30	440 (27.7)	36 (12.0)	478 (25.4)
31-40	529 (33.4)	61 (20.3)	590 (31.3)
41-50	276 (17.4)	83 (27.6)	359 (19.0)
51-60	149 (9.4)	84 (27.9)	233 (12.3)
>60	89 (5.6)	15 (5.0)	104 (5.5)
Total	1586(100.0)	301(100.0)	1887(100.0)

Males (84.0%,n=1586) were more involved in RTCs than females (16%,n=301). Highest number of IRUs (n=590,31.3%) were in 31-40 year age group (mean=34.3years, SD=2.7). The majority of males were in 31–40 year age group (33.4%, n=529, mean=36.2, SD=2.1) and females were in 51-60 year age group (27.9%, n=84, mean=50.9, SD=1.0) (Table 4).

A total of 920 (48.7%) drivers, 495(26.2%) motorcyclists and 176 (9.3%) pedestrians were involved in RTCs. A higher percentage of females who met with RTCs were passengers (47.6%) or pedestrians (42.6%). The mean age of IRUs was 38.4 years with a standard deviation of 2.9 years and the age ranged between 1 to 86 years. More than 80% drivers (n=745) and motorcyclists (n=403) were aged between 21-50 years. Three percent (28) drivers and 5.9% (29) of motorcyclists were less than 20 years of age. Seventeen percent (n=30) of pedestrians were more than 60 years of age. Only four IRUs were less than 10 years of age (Table 5).

The majority of drivers/motorcyclists had a valid driving license (81.4%,n=1150) and the majority of motorcyclists and pillion riders (82.8%) were wearing a helmet. The majority of pedestrians (144, n=85.2%) were injured while crossing the road, out of which 34% were on a pedestrian crossing (Table 5).

Discussion:

Type of RTCs: A total of 1481 vehicles and 1887 road users were involved in 851 RTCs in the KPD during the nine months in 2013, with 7.8% fatal, 70.0% non fatal injury-producing crashes. These figures were higher than the corresponding national figures (6.1% for fatal and 49.1% for non fatal injury producing) in 2011 indicating an increased mortality and morbidity[6]. An average of 95 RTCs per/month was reported. This was similar to the average in the study area during 2008 to 2011 (100 per/month)[4]. The recorded rate of RTCs was similar on a week day, week end or a public holiday which was 3 RTCs per day in KPD. More

Table 5: Distribution of the gender, age and type of involved road user in KPD

	Type of involved road user						
	Total road users involved in RTCs N=1887	Driver N=920	Motorcyclist N=495	Pedal cyclist N=66	Pedestrian N=176	Passenger N=143	Pillion rider of motorcycle/ Pedal cycle rear seater N=87
Percentage	100.0	48.7	26.2	3.5	9.3	7.6	4.7
Gender	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)
Male	1586(84.0)	813(88.4)	482(97.3)	56(84.8)	101(57.4)	75(52.4)	59(67.8)
Female	301(16.0)	107(11.6)	13(2.7)	10(15.2)	75(42.6)	68(47.6)	28(32.2)
Age (years)	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)
0-10	04(0.2)	00(0.0)	00(0.0)	00(0.0)	02(1.1)	02 (1.4)	00(0.0)
11-20	119(6.3)	28(3.0)	29(5.9)	08(12.1)	16(9.1)	30(21.0)	08(9.2)
21-30	478(25.4)	220(23.9)	161(32.5)	08(12.1)	30(17.0)	38(26.5)	21(24.1)
31-40	590(31.3)	345(37.5)	154(31.1)	13(19.7)	33(18.8)	23(16.1)	22(25.3)
41-50	359(19.0)	180(19.6)	88(17.8)	17(25.8)	39(22.2)	20(14.0)	15(17.3)
51-60	233(12.3)	122(13.3)	46(9.3)	14(21.2)	26(14.8)	14(9.8)	11(12.6)
>60	104(5.5)	25(2.7)	17(3.4)	06(9.1)	30(17.0)	16(11.2)	10(11.5)
Mean age	38.4	38.2	35.8	41.9	42.3	34.3	36.1
(SD) (years)	(2.9)	(3.05)	(2.78)	(2.60)	(3.70)	(2.61)	(3.21)
Minimum age & Maximum age (years)	01 & 86	17 & 73	17 & 72	15 & 76	02 & 86	1 & 73	04 & 78

than 60% of RTCs were recorded during the day time between 6.00hrs to 17.59hrs, the time when people are more active and mobile on roads. Similar findings were found in previous studies[9,10,11]. The highest risk period for fatal RTCs was at night (between 0.00 hrs-5.59hrs), similarto previous studies conducted in Sri Lanka and India[11,12]. The possibilities for this high fatality rate during night could be due to higher speeds of vehicles due to low traffic volume, higher frequency of driving under the influence of alcohol and fatigue. The number of RTCs varies according to the time of the day as it influences the visibility of the road. Even though the visibility is better during day light, the recorded RTCs was higher during day time (64.5%) than night time (35.5%) which coincides with the higher traffic flow during day time, a similar pattern as shown in a previous study in Kandy[13]. The present study showed the total RTC including fatal RTCs reported in urban areas (64.2%) was higher than in rural areas (35.8%), as showed as in a previous study conducted in Colombo district in 2011[14].

Socio demographic characteristics of the IRUs:

Nearly 84% of IRUs were males and 33.4% of them were in the 31-40 year age group. The majority of drivers (88.4%), and motorcyclists (97.3%) were males. The male predominance among drivers confirms the traditional and cultural aspect present in the country and observed in previous studies in Sri Lanka, showing that more than 80% were men[13]. In the present study, drivers and motorcyclists consisted the majority (75%), with similar statistics reported in 2012 in Sri Lanka [6] and in a study conducted in Batticoloa[15]. Involvement of pedestrians (9.3%) and pedal cyclist (3.5%) were low in the present study. A study conducted in 2005 highlighted that pedestrians/pedal cyclists accounted for more than 50% of all RTCs and motorcyclists accounted for an additional 13%[16]. The changes in economic growth in Sri Lanka may have contributed for the different findings, with more people using vehicles for transportation at present. Importantly, 17.0% of pedestrians were more than 60 years of age, highlighting the dependent nature of the road user. The majority of pedestrians (85.2%) were injured while crossing the road, out of which 34% were on a pedestrian crossing. These findings highlight the need for strict road safety measures in the study area. Driving needs skills and requires training and experience which is a crucial factor for road safety[1]. Having a valid license is considered as a compulsory requirement to drive a vehicle. The study revealed that the majority of drivers/motorcyclists had a valid driving license (81.4 %) at the time of the crash as seen in previous studies, conducted in Kandy (93.6%) and Batticoloa (83%) [13,15]. However, it was as low as 15% of drivers in an Indian study[9]. The WHO, stated that rapid increase of motorcycle use in low and middle-income countries is being accompanied by an increase in the incidence of head injuries. The non-use of protective helmets is a well established risk factor for head injuries[1]. The present study showed that the majority of motorcyclist and pillion riders were wearing helmets (82.8%) and the usage of helmets was significantly higher among motorcyclists than pillion riders. The helmet usage in the KPD among motorcyclists (87.3%) and pillion riders (33.3%) was lower than the corresponding national figures which were 99% and 87% respectively; in 2010[17]. A study conducted in Batticaloa reported that only 25% of riders/pillion riders were wearing a helmet[15] and zero use of helmets by the users of motorized two-wheelers in an Indian study[9].

Road characteristics:

The percentage of RTCs recorded on major roads (84.1%) was higher than on minor roads which coincide with the road structure categorization of KPD, where the length of major roads is higher than the length of minor roads[17]. A majority of RTCs (80.7%) occurred on locations where there was no junction within 10 meters. Although the recorded RTCs was low (2.0%) on locations near roundabouts, entrance byroads and rail road crossings, the recorded fatal RTCs (29.4%) were higher on those locations followed by "junctions" (11.6%). A statistically significant association was observed between the severity of RTC and the type of the junction where it occurred. These findings reveal the behavior of the drivers where they tend to drive faster on straight roads. Disobeying the road rules may be the cause for higher fatal RTCs on locations near roundabouts, entrance byroads, rail road crossings and junctions.

Vehicular Characteristics:

Motorcycle (33.4%) was the main vehicle responsible for any type of RTC while 12.4% was by the three wheelers. The country profile of traffic statistics also

showed that motorcycles and three-wheelers were responsible for 38.7% of all RTCs in 2011[6]. RTCs caused by motorcycle was the commonest (71%) in Batticaloa[15] and was 22.8% in an Indian study[9]. The use of vehicle is frequently related to the socio-economic status of the road user[18]. Nearly 50% of motorcycles and 25% of three-wheelers were newly registered in the year 2012[19] in Sri Lanka and they are the cheap and affordable transportation modes although they are comparatively vulnerable vehicles in the aspect of safety to the user. Overcrowded, unsafe modes of public transport also contribute to RTCs in Sri Lanka. The public transport buses are either owned by the government or by private owners. The private-owned buses (5.3%) were more involved in RTCs than government buses (1.8%) indicating that travelling in a privately-owned bus has a higher risk of RTCs than travelling in a government bus as also shown in a previous study conducted in Kandy[20].

Limitations of the study:

As specified in the Motor Traffic Act of Sri Lanka[8], all RTCs should be reported to the nearest police station. Although the law mandates this, all RTCs which occurred in the KPD, may not have been reported to a police station. Also, all injured IRUs may not have visited a government hospital in the KPD. These persons were not included in the study.

Conclusions and Recommendations

The study concluded that young productive males were the most vulnerable IRUs and the motorcycle was the highest involved vehicle in RTCs.

Interventions in RTCs and road traffic injury prevention are broad based and include rules and regulations, legal action and community awareness. In primary preventive measures of RTCs, the focus should be on implementation of client-oriented community and school-based awareness programmes on road signs, pedestrian's and other road users' rights, their behaviors and the use of protective measures, such as helmets and seat belts. Severity of injuries can be reduced by improving quality of pre-hospital care and improving the knowledge of first-aid. Strict implementation of the helmet law for motorcycle riders should be done by the Department of Police. Identification of "hot spots" and CCTV cameras will be useful to reduce RTCs and the severity of injuries. Attention should be paid to the implementation of road safety measures for road users in urban development and roadway planning.

Young productive males required for development in the country are unnecessarily being killed and injured by RTCs. The RTCs, and associated mortality and morbidity may be contributing to the propagation of poverty in the country by injuring the principle wage earner of the family and RTCs have become a social problem too. Therefore, prevention and control of RTCs and associated injuries and deaths are an urgent need for Sri Lanka.

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