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Retrospective Autopsy Based Study of Fatal Road Traffic Accidents in Fiji

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Abstract

Objective: To describe the demographic profile and distribution of injuries from autopsy cases due to fatal Road Traffic Accidents (RTA) in Fiji.

Methods: This is a retrospective autopsy based study consisting of 102 medico-legal autopsies performed by the Fiji Institute of Forensic Science, Fiji Police Force during the period of two calendar years from January 1st 2011 to December 31st 2012.

Results: Out of the 1454 medico-legal autopsies performed during the study period, 102 (7%) were due to fatal RTA. There were 72 (70.5%) males and 30 (29.5%) female fatalities with an overall male and female ratio of 2.3:1 and the 30 to 44 years age group showed highest number of victims of 30 (29.4%). The months of October in 2011 and August in 2012 took the maximum toll of road traffic deaths of 9 (8.8%) and 12 (11.6%) respectively. The highest number within the road user group were the passengers of 53 (51.9%) followed by the pedestrians and drivers of 32 (31.2%) and 16 (15.6%) respectively. Human behavioural errors or factors by all the road users of 95 (93.1%) was the highest contributing factor and pre-hospital mortality was most common, particularly road traffic death at the scene (51.9%) and those whilst en route to hospital (29.4%). Highest number of injuries were head injuries of 67 (65.7%), followed by multiple injuries of 57 (55.6%), thoracic injuries of 56 (54.9%), abdominal injuries of 31 (30.3%), vertebral injuries 21 (20.5%) and major vessel injuries of 12 (11.7%). The most common mechanism of death was haemorrhagic shock of 90 (88.2%) followed by asphyxia of 7 (6.8%), arrhythmias of 3 (2.9%) and finally septic shock of 2 (1.9%).

Conclusion: This study emphasizes the need for better pre-hospital and hospital trauma management, improved traffic law enforcement, effective traffic related and health policy creation, and the establishment of a national traffic traumatic injury surveillance registry in Fiji.

Keywords: Fiji; Autopsy; Road traffic accidents; Fracture; Head injury

Introduction

Road Traffic Accidents (RTA) accounts for 1.7% of global mortality and 91% of the world's fatalities on the roads occur in the low-income and middle-income countries [1]. In middle-income and developing countries like Fiji, the costs incurred as a result of RTA account for 3 to 5% of the gross domestic product [2]. Furthermore, RTA are considered part of the "diseases of development" and occur as a result of third world development components that include the increase in the number of motor vehicles, environmental changes, increased population densities and pollution [3,4]. The average population growth rate in Fiji is 0.8% [5] with the recorded total population of 837 271 in 2007 [6] and 874 700 in 2012 [5]. There has been a constant growth of the number of motor vehicles in Fiji from 185 (2007) to 199 (2012) per 1000 population [6]. The majority of motor vehicles in Fiji are four wheeled whilst the two wheeled vehicles account for 2.9% of all vehicles [6]. Fiji has a number of measures enforced by the Land Transport Authority to ensure road safety. These measures include demerit point system, appropriate road type speed limits and laws on drink-driving, seat-belt, child restraint, mobile phones used whilst driving and motorcyclist not wearing helmets [7]. The raw surveillance of RTA is carried out by Traffic Control Division of the Fiji Police Force. Accordingly, the survey of the RTA from 2010 to 2013 showed that on average 5.2 RTA occur daily and there was a road traffic death rate of 5.7 per 100 000 population occurring annually in Fiji.

Objective

Therefore, the aim of this study is to describe the demographic profile and distribution of injuries from autopsy cases due to fatal RTA.

This in turn, can be used for public awareness on road safety and aid the improvement of emergency services in response to road traffic accidents in Fiji. Particularly, improving the transportation of those post-crash seriously injured via ambulances which occurs in 10% of RTA in Fiji [7].

Materials and Methods

This is a retrospective autopsy based study consisting of 102 medico-legal autopsies performed by the Fiji institute of Forensic Science, Fiji Police Force during the period of two calendar years from January 1st 2011 to December 31st 2012. The detailed analysis of these cases was based on the situation or inquest reports, investigation officer's accounts, medical records and evaluation of autopsy reports.

There was a detailed proforma prepared to capture and record the epidemiological data and details of injuries sustained etc. and the observations were thereafter statistically analyzed.

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Observations and Results

Out of the 1454 medico-legal autopsies performed during the study period, 102 (7%) were due to fatal RTA (Figure 1) accordingly. The 30 to 44 years age group showed highest number of victims of 30 (29.4%) and also had the maximum gender differentiation with a male and female ratio of 4:1. This was followed by the age groups 45 to 59 years of 27 (26.4%) and 15 to 29 years of 23 (22.5%) and with both age groups having a male to female ratio of 2.3:1 (Table 1). The months of October in 2011 and August in 2012 showed the highest number of fatal RTA of 9 (8.8%) and 12 (11.6%) respectively (Figure 2). The Fijians of Indian descent ethnic group had 51 (50%) of the road traffic deaths whilst the iTaukei (Indigenous) group had 47 (46%) (Figure 3a). There were 72 (70.5%) males and 30 (29.5%) female fatalities with an overall male and female ratio of 2.3:1 where males fully outnumber the female group.

The highest number within the road user group were the passengers of 53 (51.9%) followed by the pedestrians and drivers of 32 (31.2%) and 16 (15.6%) respectively (Table 2).

Human behavioural errors or factors by the road users of 95 (93.1%) was the highest contributing factor followed by environmental and machine factors respectively (Table 3). Vehicle-vehicle collision was the commonest type of fatal road traffic accident collision causing death of 48 (47%) followed by those hit by light goods vehicle (taxi, private car, jeep, van etc.) of 24 (23.5%) (Table 4). The national divisions having the most road traffic deaths were the Western of 52 (50.9%) and Central of 41 (40.1%). Majority of fatal RTA of 41 (40.1%) occurred on semi-urban roads and followed by those occurring on the highway of 26 (25.4%) and rural roads of 23 (22.5%) (Table 6). Most of road traffic deaths of 53 (51.9%) were immediate at the scene of the accident whilst 30 (29.4%) were en route to hospital and 18 (17.6%) were at the hospital (Figure 3b).

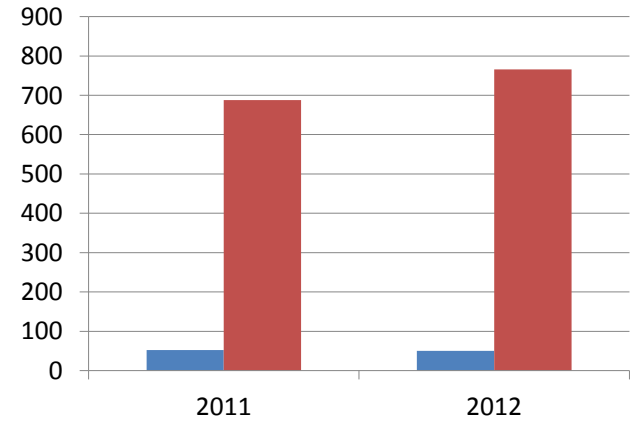

Figure 1: Annual distribution of total medico-legal cases for autopsies (Red bar) and the fatal road traffic accident autopsy cases (Blue bar).

Age group	Male	Female	M: F ratio
A (0 to 14 years)	7	5	1.5:1
B (15 to 29 years)	16	7	2.3:1
C (30 to 44 years)	24	6	4:1
D (45 to 59 years)	19	8	2.3:1
E (> 60 years)	6	4	1.5:1
Total	72 (70.5%)	30 (29.5%)	2.3:1

Table 1: Age and gender distribution of road traffic deaths.

Road user	n=102	Percentage victims
Driver	16	15.6
Pedestrian	32	31.2
Passenger	53	51.9
Bicyclist	1	0.9

Table 2: Road user distribution of road traffic deaths.

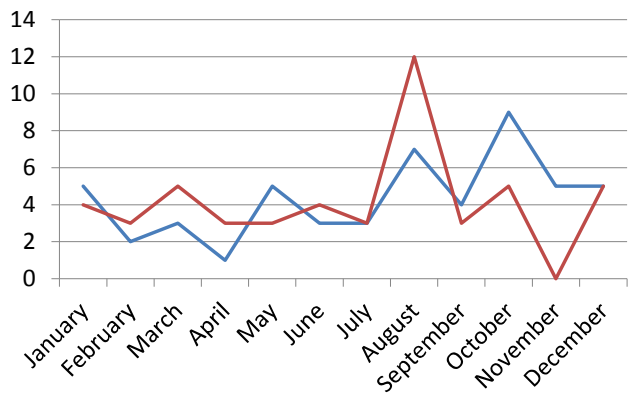

Figure 2: Distribution of fatal road traffic accidents according to month for the year 2011 (Blue bar) and 2012 (Red bar).

Contributing factor or error	n=102	Percentage victims
Human behavioural	95	93.1
Machine	4	3.9
Environmental	6	5.8

Table 3: Contributing factors or errors to fatal road traffic accidents.

Type of collision	n=102	Percentage victims
Vehicle-vehicle collision	48	47
Hit by light goods vehicle	24	23.5
Hit by bus	2	1.9
Hit by truck	1	0.9
Off road and overturned	14	13.7
Runover by light goods vehicle	2	1.9
Runover by bus	1	0.9
Runover by tractor	1	0.9
Vehicle-object collision	8	7.8
Vehicle-parked vehicle collision	1	0.9

Table 4: Type of fatal road traffic accident collision causing death.

National divisions	n=102	Percentage victims	Divisional population
Western	52	50.9	3,19,611
Central	41	40.1	3,42,386
Northern	9	8.8	37,311
Eastern	0	0	37,311

Table 5: Distribution of road traffic deaths according to national divisions.

Type of road	n=102	Percentage victims
Highway	26	25.4
Urban	10	9.8
Semi-urban	41	40.1
Rural	23	22.5
Within the boundaries of a property	2	1.9

Table 6: Type of roads where fatal road traffic accidents occurred.

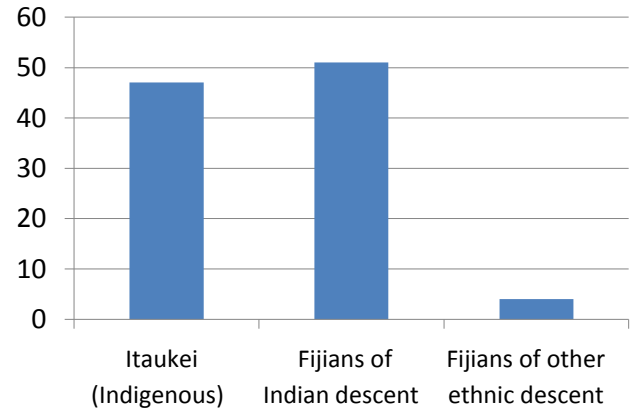

Figure 3a: Distribution of road traffic deaths by ethnicity.

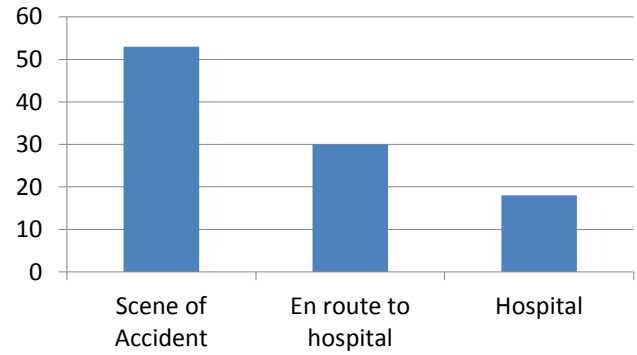

Figure 3b: Distribution of the place of road traffic deaths.

Out of the 18 road traffic deaths in hospital, 8 (44.4%) died within the first 24 hours and 3 (16.7%) died within the more than 24 hours to less than a week group, of which 2 had craniotomies and 1 had a laparotomy (Table 7).

Distribution of injuries

The highest number of injuries found was head injuries of 67 (65.7%), followed by multiple injuries of 57 (55.6%), thoracic injuries of 56 (54.9%), abdominal injuries of 31 (30.3%), vertebral injuries 21 (20.5%) and vessel injuries of 12 (11.7%) (Figure 4). Review of all the head injuries showed the commonest injuries were scalp injuries of 53 (79.1%) followed by the life threatening intracranial haemorrhages of 42 (41.1%), of which majority were subarachnoid of 36 (85.7%) and subdural of 31 (73.8%) (Table 8). The other head injuries were brain injury of 27 (40.2%), subscapular haematomas of 26 (38.8%) and torn meninges of 5 (7.5%).There were 39 (58.2%) head injuries with skull fractures and 28 (41.8%) without skull fractures (Table 8).

Also important to note is that 14 (33.3%) of all intracranial haemorrhages were found without fractures (Table 9). Out of the 39 (58.2%) that had skull fractures the commonest type of fracture was comminuted of 18 (46.2%) followed by linear and base of skull fractures of 15 (38.4%) respectively (Table 10). The skull bones commonly fractured were the temporal of 20 (51.2%), frontal of 16 (41%), parietal of 10 (25.6%) and with regards to base of skull, the middle cranial fossa had the majority involvement of 12 (30.6%) (Table 11). Abrasion,

Length of hospitalization	n=18	Percentage victims
<24 hours	8	44.4
>24 hours to <1 week	3	16.7
>1 week to <1 month	2	11
>1 month to <3 months	1	5.5
>3 months	1	5.5
Discharged and readmitted	3	16.7

Table 7: Length of hospitalization prior to a road traffic death.

Type of injuries	n=102	Percentage victims
Head	67	65.7
Scalp injury	53	79.1
Subscalpular haematomas	26	38.8
Intracranial haemorrhages	42	62.6
Extradural	2	4.8
Subdural	31	73.8
Subarachnoid	36	85.7
Intracerebral	2	4.8
Meninges torn	5	7.5
Skull fractures	39	58.2
No fractures	28	41.8
Brain injury	27	40.2
Thoracic injuries	56	54.9
Haemothorax	4	7.1
Clavicular and rib cage fracture	51	91.1
Lungs	14	25
Heart	4	7.1
Mediastinum	1	1.8
Abdominal injuries	31	30.3
Haemoperitoneum	16	51.6
Liver	16	51.6
Spleen	6	19.4
Kidney	4	12.9
Pelvic bone fractures	5	16.1
Multiple injuries	57	55.6
Abrasion, contusion and laceration	57	100
Limb fractures	17	29.8
Traumatic/ Flaying injuries	7	12.2
Vertebral injuries	21	20.5
Fracture/dislocation of the cervical vertebra	16	76.2
Fracture/dislocation of the thoracic vertebra	5	23.8
Major vessel injuries	12	11.7
Aorta	10	83.3
Superior mesenteric artery	2	16.6

Table 8: Distribution of all injuries due to fatal road traffic accidents.

	n=42	Percentage victims
Intracranial haemorrhage without fracture	14	33.3
Intracranial haemorrhage with fracture	28	66.6

Table 9: Distribution of intracranial haemorrhage with or without fractures.

Type of fracture	n=39	Percentage victims
Depressed	4	10.3
Comminuted	18	46.2
Diastatic	5	12.8
Linear	15	38.4
Ringed (Foreman magnum)	2	5.1
Base of skull	15	38.4

Table 10: Distribution of the type of skull fractures.

Skull bones fractured	n=39	Percentage victims
Frontal	16	41
Parietal	10	25.6
Temporal	20	51.2
Occiput	7	17.9
Sphenoid	8	20.5
Ethmoid	6	15.3
Anterior cranial fossa	3	7.6
Middle cranial fossa	12	30.6
Posterior cranial fossa	0	0
Mandible	6	15.3
Maxillary	7	17.9

Table 11: Distribution of the skull bones fractured.

Road user	n=102	Percentage victims
Passenger	10	83.3
Driver	1	8.3
Pedestrian	1	8.3

Table 12: Distribution of road user with major vessel injuries.

Mechanism of death	n=102	Percentage victims
Haemorrhagic shock	90	88.2
Septic shock	2	1.9
Asphyxia	7	6.8
Arrhythmia	3	2.9

Table 13: Distribution of the mechanisms of death.

contusion and laceration of 57 (100%) was seen with all multiple injuries followed by limb fractures of 17 (29.8%) and traumatic/flaying injuries of 7 (12.2%). Clavicular and rib cage fractures of 51 (91.1%) and lung injuries of 14 (25%) were the most numerous of the thoracic injuries whilst haemoperitoneum and liver injuries of 16 (51.6%) respectively were for the abdominal injuries.

Aortic transection was most common of 10 (83.3%) with the only major vessel involved was the superior mesenteric artery transection of 2 (16.6%) (Table 8). Also to note that for all major vessel injuries there were 10 passengers, 1 pedestrian and 1 driver involved (Table 12). Furthermore, out of the 10 passengers 3 were restrained by seat belts while the restrain status of the other passengers was unknown. The most common mechanism of death was haemorrhagic shock of 90 (88.2%) followed by asphyxia of 7 (6.8%), arrhythmias of 3 (2.9%) and finally septic shock of 2 (1.9%) (Table 13).

Discussion

RTA produce disabilities, absenteeism and fatalities that lead to loss of productivity, increase in cost, increased financial borrowing, increased debt and decreased food consumption [1]. Fiji's estimated road traffic death rate is 4.4 times lower than that of a country of similar demographic profile like Guyana. In this study males constituted 70.5% while females were 29.5%. In Fiji, males are the majority breadwinners

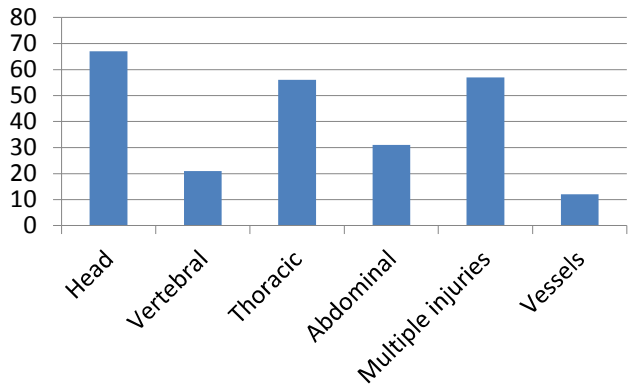

Figure 4: Distribution of injuries according to body regions injured.

and more often exposed to out of the household movement, therefore explaining the increased males involved in fatal RTA. This has been seen by many other researches [8-13].

The highest road traffic deaths according to age groups were from 15 to 44 years (51.9%) and this was generally similar to studies in other countries [8-17]. This age bracket is the most socially, economically and physically dynamic period of life of an individual and are found frequently outdoors. Therefore, they are a high risk group and awareness on road safety should be focused at this age group.

The two main ethnic groups of iTaukei and Fijians of Indian descent were the most frequent to succumb (96%) to fatal road traffic accidents. Proportionally this correlates with the overall population ethnic group standing.

The Western (50.9%) and Central (40.1%) divisions are located on the main island of Viti Levu and having 70% of Fiji's population [6]. These divisions had the most road traffic deaths due to the high population [6] and for being the most dynamic divisions. The western side of Fiji is the largest with the tourism and sugar industry whilst the central division houses the capital city and executive parts of business, institutions, government departments etc.

Upon analysis, majority of fatal RTA (40.1%) occurred on semi-urban roads and followed by those occurring on the highway (25.4%) and rural roads (22.5%). This is due to the increase in the urban and suburban population due to rapid urbanization.

In this study the commonest type of road user were the vehicular occupants (67.5%) who included passengers (51.9%) and drivers (15.6%). Generally pedestrians have the highest numbers of road traffic deaths but not in this study that has similar findings to that of another report [18-20]. When considering all vehicular disruptive collision types (69.5%), it is clear that more emphasis of passenger preparedness and the enforcement of the national passenger and driver related laws need to be greatly improved, since current enforcement ratings stand accordingly at 2 to 6 out of 10 for Fiji [7].

The remaining collision types were related to pedestrians (30.5%) and matched up with the second commonest type of road user, the pedestrian (31.2%). This highlights the need for effective promotion of traffic rules education and the provision more sidewalk particularly outside of the urban centers.

Human behavioral error or factors (93.1%) by all road users in this study was the most recorded causing fatal road traffic deaths.

Examples include alcohol intoxication, speeding, distractive habits like using mobiles or managing the car radio etc. and sleep deprivation for drivers [21-25], poor awareness and preparedness for pedestrians and passengers.

This study period showed highest number of fatal road traffic accidents occurring in the months of October in 2011 (8.8%) and August in 2012 (11.6%). In Fiji, the last quarter of the year sees the beginning of festive season and vacation period.

Pre-hospital mortality was the highest in this study particularly road traffic death at the scene (51.9%) and those whilst en route to hospital (29.4%). This is a common observation by different researchers [22,23]. Also with reference to the type of roads where fatal road accidents occur, this study showed semi-urban (40.1%), highway (25.4%) and rural (23%) areas were the commonest and farthest from the reach of prompt mobile medical consult and proper paramedic ambulance transfer. Considering that only 10% of all post-crash seriously injured are transported by ambulances [7] and the road traffic accidents occurring farthest from proper mobile medical treatment explains the increase in the high pre-hospital mortality in Fiji.

Regarding hospital mortality, this study showed majority of these were within the first 24 hours (44.4%) and the rest were within three months of hospitalization (33.3%). There is a need for better systematic coordination between all levels of medical care inclusive of intensive care, radiology, physiotherapy etc. in response to the occurrence of a post-crash seriously injured individual.

The commonest injuries were head (65.7%), followed by multiple injuries (55.6%), thoracic injuries (54.9%), vertebral injuries (20.5%) and vessel injuries (11.7%). This is also found in other countries research [26-28].

Regarding head injuries scalp injury (79.1%) was most seen followed by intracranial haemorrhages (62.6%), skull fracture (58.2%) and brain injuries (40.2%). Majority of intracranial haemorrhages were subarachnoid (85.7%) and subdural (73.8%). Remarkably 41.8% of all head injuries were without skull fractures and 33.3% of all intracranial haemorrhages were found without fractures. Therefore, treating physicians should bear in mind that the absence of skull fractures does not rule out the presence of intracranial haemorrhages and be sensitive to prompt radiological survey. In this study commonest type of skull fracture was comminuted (46.2%) followed by linear and base of skull fractures (38.4%) individually. In addition to this, the skull bones commonly fractured were the temporal (51.2%), frontal (41%), the middle cranial fossa (30.6%) and parietal bone (25.6%).

External body surface abrasion, contusion and laceration (100%) were noted in all multiple injuries trailed by limb fractures (29.8%) and traumatic/flaying injuries (12.2%).

Clavicular and rib cage fractures (91.1%) and lung injuries (25%) were the most numerous of the thoracic injuries, consistent with a study from India [17], whilst haemoperitoneum and liver injuries (51.6%) respectively were for the abdominal injuries.

Major vessel injuries (11.7%) were found in more than a tenth of all injuries with only transection of the aorta (83.3%) and superior mesenteric artery (16.6%) noted in this study. Of all major vessel injuries there were 10 passengers, 1 pedestrian and 1 driver involved, with 3 of this 10 passengers noted to be restrained by seat belts while the restrain status of the other passengers was unknown.

Mechanisms of death are physiological and biochemical derangements that contribute to death of the individual and in this study the majority were haemorrhagic shock (88.2%) followed by asphyxia (6.8%), arrhythmias (2.9%) and finally septic shock (1.9%). This is similar to the other studies [18,29,30] where haemorrhagic shock is due to multiple external and internal visceral organs. Therefore, in response to an oncoming fatal RTA case the receiving health care facility should be prepared to manage massive haemorrhages at all levels accordingly.

Conclusion

This study concludes the pre-hospital mortality was the highest and highlights the need to establish quality accessible pre-hospital or mobile trauma care services particularly since most of fatal RTA occur in semi-urban roads. This study also showed predominance and significance of head injuries due to fatal RTA with a third of all intracranial haemorrhages presenting without fractures. Therefore, trauma management from scene of accident to the emergency department and availability of good neurosurgical care inclusive of radiological support is essential for these patients. There is need to strengthen the involvement of the National Blood Service to complement the management of commonest mechanism of death in fatal RTA, that is haemorrhagic shock.

Also this study it has been observed that the human behavioural error or factors are mainly responsible for fatal RTA in Fiji. The high risk age bracket was 15 to 44 years with passengers being the highest road traffic deaths. The road safety and traffic rules awareness at all levels of society should be strengthened and directed at the high risk groups with more emphasis placed on the human errors and enforcement of current national traffic laws.

In this study pedestrians formed a third of all fatal RTA victims and this points out a need for more semi-urban pedestrian pathway clearing and sidewalk creation.

Also a proper national traffic traumatic injury surveillance registry is seriously required to reveal the contributing factors, circumstances and sequence of events leading to the RTA. This will be profitable to strengthen traffic law enforcement, fortify policy making to reduce the road carnage and improve trauma management at the national level in Fiji.

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