

# The impact of seat-belts in limiting the severity of injuries in patients presenting to a university hospital in the developing world

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## ABSTRACT

**Background:** Road traffic injuries are major public health problems and a leading cause of death and injury around the world. Approximately 1.2 million people are killed each year in road crashes worldwide, with up to 50 million more injured. Over 95% of these deaths and injuries occur in the low- and middle-income countries of the world. The aim of this study is to evaluate the impact of the use of seat-belts in reducing the severity of injuries from road traffic crashes and to determine the compliance and awareness of the importance of the use of seat-belts among Nigerian motorists. **Patients and Methods:** The injury patterns and outcome of care in 140 patients who were seen at the emergency department of our tertiary hospital were evaluated. Initial care and resuscitation was carried out on all patients using the advanced trauma life support protocol. **Results:** A total of 81 (57%) patients used seat-belts, while 59 (42.1%) did not. Nineteen (13.6%) patients died as a result of their injuries; 4 (21.1%) of these had used seat-belts, while 15 (79%) had not ( $P = 0.001$ ). The mortality rate of 79% for patients who did not use seat-belt was statistically significant. **Conclusions:** The seat-belt is an effective safety tool that not only saves lives, but also significantly reduces the severity of the injury that a vehicle occupant may have sustained if they were not wearing the device. More public enlightenment is needed to increase the awareness and compliance of use of seat-belts among Nigerian motorists.

**Key words:** Cohort study, community, hospital care, motor vehicles, public health, restraints, seat-belts, university hospital

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## INTRODUCTION

Increasing motorisation worldwide has brought more crashes and injuries to vehicle occupants, particularly in low- and middle-income countries like Nigeria. These injuries vary in severity depending on the circumstances surrounding the crash. Each year, road traffic injuries take the lives of about 1.2 million men, women and children around the world, and seriously injure millions more.<sup>1</sup> The death toll is the highest and still growing in low- and middle-income countries, where pedestrians, motorcyclists, cyclists and passengers are especially vulnerable.

The seat-belt is the single most effective feature in a vehicle to reduce the severity of injury to the vehicle occupants that results from road traffic crashes. Failure to use a seat-belt is a major risk factor for road traffic deaths and injuries among vehicle occupants. Passengers who do not wear seat-belts and have a frontal crash are most likely to suffer a head injury.<sup>1,2</sup>

The financial burden of increased death and injury severity can have a major impact on the finances of the government and local communities which deal with road crash victims and their families in the aftermath of a crash. Legislation of use of seat-belt was first implemented in the Australian state of Victoria in 1969, which later gained acceptance in the United Kingdom and the United States of America.<sup>3</sup> Mandatory use of seat-belts by all motorists was enforced by the Federal Road Safety Service Commission on 1 January 2003 in Nigeria. In many low-income countries, there is no requirement for seat-belts to be fitted or used, and rates of use are therefore correspondingly low. For many of these countries, there is significant potential for improvement in the wearing rates of seat-belts.<sup>3,4</sup> At the

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emergency department of our hospital, about 400 new cases of road traffic injury victims present for management every month with varying degrees of injuries. Many of them are referred from other health care facilities around the country for evaluation and further specialist care. This hospital is a first-generation teaching hospital located in the southwestern part of the country. The patient load is from all the six geo-political zones of the nation because of the number of specialists and the facilities available for diagnosis and patient care. Most of the patients present with injuries to the limbs, head, maxillofacial region, abdomen (blunt and penetrating), chest and spine. Studies have shown that the number of fatal injuries can be reduced by the use of seat-belts.<sup>4,5</sup> The increasing rate of motor vehicular crashes and the complexity of injuries from such crashes make this study relevant at this time. Most motorists in our country still believe that the use of seat-belt is an unnecessary inconvenience and are only able to comply when law enforcement agents are around. The use of seat-belts has been found to be effective in reducing the severity of injuries attributable to motor vehicular crashes.

## PATIENTS AND METHODS

This is a prospective study that was conducted between April and September 2011. All patients including the dead presenting in the emergency department of our hospital who were occupants of motor cars, buses and heavy duty vehicles involved in road traffic crashes were included in the study. An informed consent was obtained from all the patients or the relations and a proforma was completed for each patient or deceased by the medical officer in attendance. Information about those who were brought in dead from the scene of the crashes was either obtained from the relations or co-passengers who were not seriously injured. Physical examinations were carried out on the patients to determine the pattern and the extent of injuries. The patients were followed up until they were discharged home from the hospital.

## RESULTS

A total of 140 motor vehicular injury victims who had been involved in road traffic crashes within the metropolis and adjoining highways in the city were reviewed. The mean age of the patients was  $33.8 \pm 21.6$  years, while the age range was 2-94 years. Eighty-nine (63.6%) were males, while 51 (36.4%) were females. Figure 1 shows age distribution of patients involved in the road crashes.

One hundred and twenty-one (86.4%) patients survived, while 19 (13.6%) patients died. Ten (52.6%) males and nine (47.4%) females died during the study. There were 5 (26.3%) patients who died before arrival in the hospital, while 14 (74.7%) died during admission. All the patients who died prior to arrival in the hospital did not use

seat-belt. Those who died after admission died between 1 and 106 h of arrival. One patient each died after 1, 2, 3, 6, 24, 34, 39 and 106 h, while two patients each died at 10, 36, and 48 h. Figure 2 shows injury severity in patients and the use of seat-belts

Eighty-six (61.4%) of the crashes occurred on the highways accounting for 11 (58%) deaths, while 54 (38.6%) of them occurred within the metropolis accounting for 8 (42%) deaths.

Table 1 shows a breakdown of seat-belts' use and the incidence of mortality.

Those who did not use seat-belt are 8 times likely to die in the event of a crash ( $1 \div 0.152 = 8$ ).

The reasons adduced for the crashes include reckless driving, burst tyres, brake failure and drunkenness. Other reasons given include propeller and axle dislodgements. Figure 3 shows type of vehicles and the use of seat-belts.

Injury mechanisms include ejection from the vehicle (27.1%), dashboard collision (21.4%), injuries from the seat-belt itself (chest abrasions and clavicular fractures), and collision with co-passengers, vehicle seat

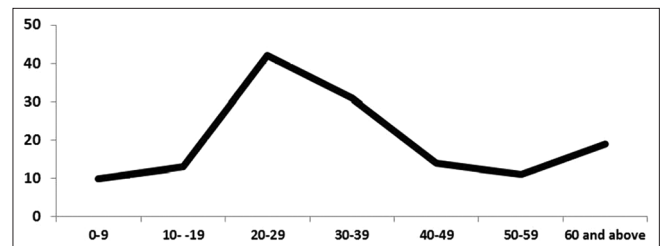


Figure 1: Age distribution of patients involved in the road crashes

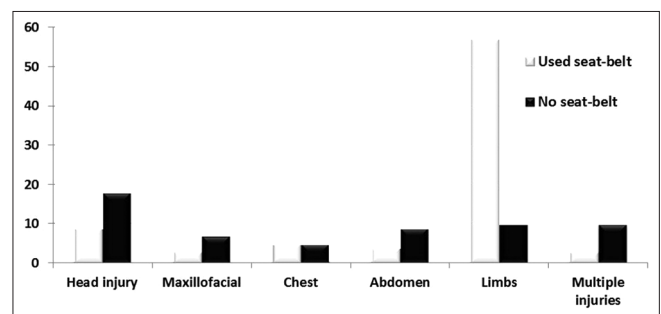


Figure 2: Injury severity in patients and the use of seat-belts

Table 1: Number of deaths in the road crash and the use of seat-belts

Number of deaths in crash	Use of seat-belts (%)		Total number (%)
	No	Yes	
No	44 (36.4)	77 (63.6)	121 (100)
Yes	15 (79)	4 (21)	19 (100)
Total	59 (42.1)	81 (57.9)	140 (100)

P value=0.000

and body of the vehicle. These are as a result of rear, side or frontal impact collisions of the involved vehicles.

Table 2 shows a breakdown of the collisions involved in the road traffic crashes.

There were 65 (46.4%) front seat occupants (including the driver). Figure 4 shows the seat occupancy and the use of seat-belt. The Federal Road Safety Corps (FRSC), the police and the by-standers helped to rescue the crash victims. A few of the patients, however, presented at our health facility by themselves. Details of the mode of rescue of patients are shown in Figure 5.

The patients were brought to the hospital in FRSC vehicles (17.1%), police vehicles (37.9%), cars (35%) and buses (6.4%). Five (3.6%) patients were brought in on motorcycles.

## DISCUSSION

The number of deaths and disabilities due to road crashes escalates every year. Strangely, this is most marked in Africa, where ownership of motor vehicles is among the lowest in the world.<sup>6</sup>

It has been projected that by 2020, road traffic deaths will increase by 60% worldwide and by 80% in Africa.<sup>6,7</sup> The World Health Organization (WHO) predicts that road traffic injuries will rank third among cases of disability-adjusted life years lost.<sup>6</sup> Road traffic injury death rate is the highest in Africa, accounting for 28.3 per 100,000 population compared to 11.0 per 100,000 in Europe.<sup>6,8</sup>

The first human fatality associated with a motor vehicle was a pedestrian in 1899.<sup>9</sup> Ever since, the patterns of injury from motor vehicles have been modified by safety devices such as the seat-belts and airbags. The severity and complexity of injuries from road traffic injuries is worsening by the day.<sup>10</sup> The seat-belt is the single most effective feature in a vehicle to reduce the severity of injury to the vehicle occupants that results from road traffic crashes.<sup>8,11</sup> Article 7 of the Vienna Convention

on Road Traffic of 1968 states: “The wearing of safety belts is compulsory for drivers and passengers of motor vehicles, occupying seats equipped with such belts, save where exceptions are granted by domestic legislation.” Restraints save lives and reduce injury severity and all

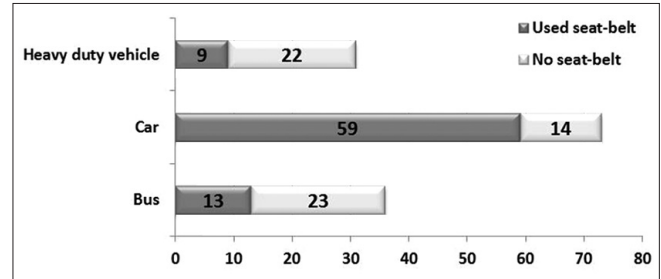


Figure 3: Type of vehicles and use of seat-belts

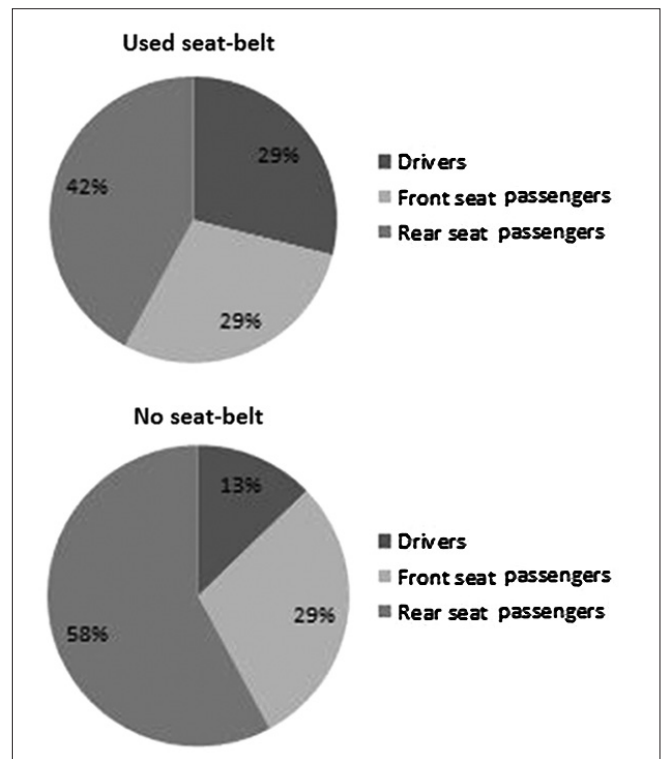


Figure 4: Seat occupancy and use of seat-belts

Table 2: Types of collision involved in the road crashes

Count	Rear impact collision	Side impact collision	Frontal impact collision	Total
Injury sustained				
Head injury	4	7	16	27
Maxillofacial	1	3	6	10
Chest	2	3	5	10
Abdominal	2	4	7	13
Limb	9	17	41	67
Multiple injuries	1	3	9	13
Total	19	37	84	140

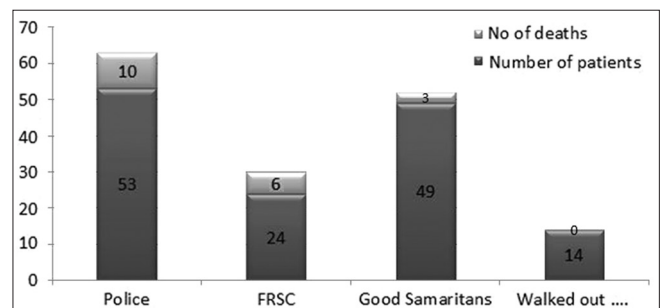


Figure 5: Rescue personnel and number of deaths in the crashes

vehicle occupants should be appropriately restrained when travelling in a motor vehicle.

We found car drivers complied more with seat-belt use than commercial bus drivers in this study, a finding which is similar to those of *Cook et al.*<sup>12</sup> and *Knoblanch et al.*<sup>13</sup> A study done in Abeokuta, Nigeria, in 2010 reported a compliance rate of 80% for private car owners and 20% for commercial drivers, which is comparable to 62.5% and 25%, respectively, found in this study.

Use of seat-belt is very crucial in preventing deaths as a result of road traffic crashes, and this study, just like previous ones, shows a significantly increased risk of death in road crash victims who did not wear seat-belts.<sup>7,10</sup> Since the 1960s, studies conducted throughout the world have shown conclusively that seat-belts save lives, when worn and fitted correctly. The use of seat-belts has been shown to reduce the probability of being killed by 40-50% for drivers and front seat passengers and by about 25% for passengers in rear seats.<sup>14</sup> Limb injuries accounted for most non-fatal injuries in this study, while fatalities resulted more from head and multiple injuries. This is even more likely with non-usage of seat-belts. More detailed analyses indicate that seat-belts are most effective in frontal impacts and run-off-road crashes, where the probability of being ejected is high if seat-belts are not worn.<sup>7,14</sup> The most frequent and most serious injuries occurring in frontal impacts to occupants unrestrained by seat-belts are to the head, followed in importance by the chest and then the abdomen. Among the disabling injuries, those to the leg and neck occur most frequently.<sup>9,14,15</sup> Seat-belts are approximately 50% effective in preventing fatalities in crashes in which motorists would otherwise die. It is estimated that seat-belt use prevented about 15,200 deaths in the United States in 2004. If all passenger vehicle occupants over 4 years of age in the United States had used seat-belts in 2004, nearly 21,000 lives could have been saved (i.e., an additional 5800 lives).

Many reasons have been associated with road traffic crashes. These include human errors like excessive speeding, dangerous overtaking, alcohol and drug abuse, driver distraction such as use of cell phones and poor driving standards. Others are vehicle overloading and poor maintenance, bad roads and terrain.<sup>16</sup> These were the same causes we found in this study. Human factor has been recognised as the highest contributor to road crashes. In a study conducted among 23 European countries and in two African studies, vehicle factors came second, followed by environmental factors.<sup>17,18</sup> The reason for increased number of faulty vehicles as causes of road traffic crashes may not be unconnected with the number of rickety and unsafe vehicles plying our roads. In our environment with poor regular mandatory vehicle inspection schemes, it would be expected that many vehicles may not be roadworthy. This study, however, did not evaluate contributions from road design and safety.

When a crash occurs, a car occupant without a seat-belt will, because of inertia, continue to move at the same speed at which the vehicle was travelling before the collision and will be catapulted forward into the structure of the vehicle – most likely into the steering wheel if they are driving, or into the back of the front seats if they are rear seat passengers. Alternatively, they can be ejected from the vehicle completely. Being ejected from a vehicle drastically increases the probability of sustaining severe serious personal injury or being killed.<sup>7,18</sup> The American College of Emergency Physicians advocates the use of seat-belts as the best protection against ejection in a crash. Ejection from a vehicle is one of the most injurious events that can happen to a person in a crash, with 75% of all vehicle occupants ejected from a vehicle in a crash dying as a result.<sup>10,19</sup> Overall, 44% of unrestrained passenger vehicle occupants killed are ejected, partially or totally, from the vehicle, as compared to only 5% of restrained occupants.<sup>12,18,19</sup>

Several studies have shown that seat-belts can actually result in fatal injuries in the event of a crash.<sup>20,21</sup> Seat-belts were responsible for a few minor injuries in this study. One bus driver in this study was actually submarined under his seat-belt during the crash although he sustained non-life-threatening injuries. Patients who survived the road traffic crashes in this study were followed up until discharge from the hospital, and the various complications and disabilities as a result of their injuries were not studied.

Many individuals are usually of help at the scene of crashes. These include the law enforcement agents, the FRSC members and the good Samaritans, otherwise called the by-standers. The high number of mortality in those rescued by the police is probably because they are involved in more rescue efforts than the others.

Programmes that set and enforce mandatory seat-belt legislation, combined with public education campaigns, are effective at increasing seat-belt wearing rates, and thus reducing injuries and fatalities. Seat-belt laws that are implemented through primary enforcement are more effective in increasing wearing rates than the laws implemented through secondary enforcement. There should be concerted efforts to ensure regular mandatory motor vehicle inspection and maintenance. The state of our roads should also be improved to reduce the carnage on our roads.

## CONCLUSION

The seat-belt is an effective safety tool that not only saves lives, but also significantly reduces the severity of injury that a vehicle occupant may have sustained if they were not wearing the device. About half of all deaths of front seat occupants could be prevented through the correct use of seat-belts. Motor vehicle users make up a high proportion of overall traffic injuries and deaths in high-income countries, and in low- and middle-income countries the



proportion is growing as motor vehicle ownership is increasing. It is therefore vital that seat-belt use is enforced in these countries to prevent death and injury among vehicle occupants.

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