Pakistan Journal of Social Sciences 4 (6): 774-777, 2007
ISSN: 1683-8831
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Seatbelt Use Survey: A Case Study

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Abstract: Highway crashes have remained unabated since motorisation became a necessity of life. The economic and social impact of these crashes is equally scaring. Various efforts are thus being made to increase safety and reduce especially, fatality. This study presents the use of seatbelt as one of such measures and tries to assess the amount of risk attributable to defaulting in its use as well as the percentage reduction in the incidence derivable from compliance. It also found that those who don't use seatbelt have 1.77 times as much risk as those who comply. It also found that there will be 43.7% reduction in fatality incidence if those do not use seatbelt change their driving habit and begin to use it.

Key words: Seatbelt, case study, efforts, highway crashes, Nigeria

INTRODUCTION

Accident is any occurrence that affects the normal working of the roadway such that someone dies, is injured or something is damaged without anyone intending it to be. It is usually in form of crashes involving motorcycles, cars, heavy duty vehicles, pedestrians, passengers, e.t.c. due to exposure to traffic.

Highway crashes are a major public health problem all over the world. It is estimated that 1.2 million road traffic deaths occur and about 50 million people are injured in the world every years (WHO, 2004), most of them in the developing countries.

In developing nations, highway crash problems have been on the increase since the 1970 when several countries became dependent on motorised transportation in general and automobile transportation in particular. Highway crashes in developing countries have in some cases become more deadly than diseases that historically affected the population (WHO, 1999) for developing countries; the economic cost of accident is between 1 and 2 % of the Gross Nation Product (GNP) (WHO, 2004).

As such various efforts are being put into reducing accident occurrence and especially crashes resulting in fatalities. The American Association of State Highway and Transportation Officials (AASHTO) Strategic Highway Safety plan, for example identified some goals that were broadly divided into drivers, vehicles or the highway oriented strategies. For the drivers' approach, increasing the use of seatbelt and improving the knowledge and use of airbag functions are areas being addressed (NCHRP, 2004). From the result of various studies, it has been found that vehicle occupants are about 50% more likely to be hospitalized from crash-related injuries if they were not wearing a seatbelt at the time of the crash (John and Sharp, 1996a, b).

Motorised vehicles in general are much more damaging in the face of the much higher kinetic energy involved and its harming potential. Actual level of damage however, facial display of accident record does not give all the material information required by the highway engineer and policy makers. The records will not be very useful until they are processed and analysed it is only then formulating policies that are efficient for traffic management becomes possible.

Epidemiology studies (Kaelin and Bayona, 2004) which focuses on the identification and assessment of risk factors may find usefulness at this processing and analysis stage. They try to predict the impact of removing a particular exposure on the risk of falling a victim of its effect. They help to answer the following questions:

- What amount of the risk of incidence is attributable to a particular exposure?
- By what percentage would the risk of incidence be reduced if the exposure were eliminated?

These questions are usually answered using the contingency table. It is the goal of this study to assess the level of compliant to the use of seatbelt using this tool and the implication for traffic safety.

Seatbelts first came into use in the 1930's when several U.S.A. physicians equipped their cars with lap belts and began to urge manufacturer to provide them in all new cars (SRTRI, 1998). They, however, didn't really begin to appear in vehicles (especially as seatbelt) until the 1950's (NCHRP, 2004). Studies also show that even then the use of seatbelt did not increase much above 10%

until mandatory laws were enacted. In the U.S.A. studies revealed that the percentage use grew to about 62% within a decade and has risen to over 80% towards the close of last century. It further showed that there was between 5% and 22% rise in percentage use when government stated to enforce the law on its usage, they alone are not sufficient to increase use. The 1998 Motor Vehicle occupant safety survey in the US found that the 86% of the public strongly agreed that of they were in a motor vehicle crash, they would want to have their seat belt on. It also showed that public support of standard enforcement increased from 52% in 1996 to 58% in 1998.

However, improving safety belt use is said to be the single most effective strategy a nation can embrace in reducing facilities and injuries when a motor vehicle crash occurs. Safety belt use is the single most effective strategy a person can employ to prevent deaths and injuries and reduce the costs associated with motor vehicle crashes. Its use is said to have saved more than 100,000 lives within two decades in the USA while more than 7,000 persons are killed and over 100,000 injured every year due to the failure to wear their safety belts (http://www.nhtsa.dot.gov/people/injury/SafetyBelt/OPIPT_FinalRpt_07-17-03.html).

It is therefore, very important to appreciate the extent of damage in order to take enforcement serious. The public must be made aware of the laws and must have a reasonable expectation that the laws will be enforced. This is more true as it has been shown that many fear being fined significantly more than they do being injured or killed due to being unbelted in a crash (http://www.nhtsa.dot.gov/people/injury/SafetyBelt/OPIPT_FinalRpt_07-17-03.html). In Nigeria in the year 2002, the Federal Road Safety Commission, (FRSC), mandated the use of seatbelt when travelling to reduce the risk of accident fatality and has since continued to enforce it.

MATERIALS AND METHODS

The analysis in this research has been carried using contingency table. A contingency table is used to calculate measures of incidence frequency and association from dichotomous categorical variables. A typical 2×2 contingency table is as in Table 1.

Attributable risk measure: Road accidents occur as a result of several reasons. Such reasons could be drivers' fault, vehicle fault, or road/environmental causes.

Attributable risk measures can be used to identify and assess risk factors as well as plan and evaluate interventions or control measures to reduce the incidence of accident in the population. Being able to predict the impact of removing a particular exposure on the risk of occurrence of an accident is an important consideration. It allows those who are responsible for highway management make decisions about allocating scarce resources (time, energy, money and political capital) where they will have the most impact. It helps them answer the following questions:

Table 1: A typical 2×2 contingency table

	Cases	Non-cases
Exposed	A	B
Non exposed	C	D

- What amount of the risk of occurrence of accident is attributable to a particular exposure?
- By what percent would the risk of occurrence of accident be reduced if the exposure were eliminated?

For highway management decision-making purposes, it is valuable to be able to answer these questions from 2 perceptions: From the perspective of the impact of eliminating the exposure on only those who are exposed and from the perspective of the impact of eliminating the exposure on the entire population, those who are exposed and those who are not exposed.

Attributable risk in the case of accident studies could be the proportion of, say accident (fatal and injury) that is attributable to a certain factor or the size of the reduction in the number of accidents (fatal and injury) that will be achieved by removing the risk factor. The following description will enhance understanding.

Incidence rate: It is a measure of disease frequency that assesses the force of morbidity, or the probability of developing a disease in a given period of time. It is calculated by dividing the number of new cases by the product of the total number of susceptible people at the beginning of the study period and the time of observation.

Attributable Risk (AR): AR is the portion of the incidence of an accident in the exposed that is due to the exposure. It is the incidence of an accident in the exposed that would be eliminated if exposure were eliminated. The AR is calculated by subtracting the incidence in the unexposed (Iu) from the incidence in the exposed (I_e).

Attributable Risk percent (AR%): AR% is the percent of incidence of an accident in the exposed that is due to the exposure. It is the percent of the incidence of an accident in the exposed that would be eliminated if exposure were eliminated. The AR% is calculated by dividing the

Table 2: Accident occurrence and seatbelt violation data for Ekiti State

Year	No. of accidents	No. of cases of injury/ fatal	No of cases of damage only	No. of violators	No. of violators involved in fatal/injury cases	No. of violators involved in damage only
Cases						
2002	70	22	48	52	9	12
2003	106	27	79	245	22	41
2004	96	35	61	300	29	37
2005	117	32	85	420	25	52
Total	389	116	273	1017	85	142

Attributable Risk (AR) by the incidence in the exposed (I_e) and the multiplying the product by 100 to obtain a percentage.

Population Attributable Risk (PAR): PAR is the portion of the incidence of an accident in the population (exposed and non exposed) that is due to exposure. It is the incidence of an accident in the population that would be eliminated if exposure were eliminated. The PAR is calculated by subtracting the incidence in the unexposed (I_u) from the incidence in total population (exposed and unexposed) (I_p).

Population Attributable Risk percent (PAR%): PAR% is the percent of the incidence of an accident in the population (exposed and non exposed) that is due to exposure. It is the percent of the incidence of an accident in the population that would be eliminated if exposure were eliminated. The PAR% is calculated by dividing the Population Attributable Risk (PAR) by the incidence in the total population and then multiplying the product by 100 to obtain a percentage.

Relative risk: The Relative Risk (RR) is a measure of association between an accident or condition and a factor under study. It is calculated by dividing the incidence rate among those exposed to the factor by the incidence rate among those not exposed to the factor.

$$RR = \frac{\text{Incidence in the exposed}}{\text{Incidence in the nonexposed}}$$

The RR is a measure of the relationship between the incidence in the exposed and that in the nonexposed. RR = 1 means that the incidence in the exposed is the same as that in the nonexposed and so there is no association between exposure and risk factor. RR >1 denotes a larger incidence in the exposed that in the nonexposed-thus exposure to the factor seems to increase the probability of occurrence of accident. With the same reasoning, RR < 1 denotes a smaller incidence in the exposed as compared to the nonexposed –thus exposure to the factor seems to decrease the probability of occurrence of accident.

This study presents the result of an assessment of attributable risk owing to the use of seatbelt by drivers in Nigeria. Ekiti State is being used as case study in this work.

Database: The data used in this work have been sourced from the FRCS and are presented in Table 2. The data show the level of compliance with the use of seatbelt and the resultant effect in cases of accident occurrence in Ekiti State for the years between 2002 and 2005, both years inclusive.

RESULTS AND DISCUSSION

By using the contingency table to calculate the relative risk of incidence occurring, using an average of the entire period under study, the results presented in Table 3 are obtained.
From above

Percentage compliance = 42.416%
Percentage Violation = 57. 583%
Incidence in the exposed I_e = a/(a+b) = 36.61 per 100
Incidence in the unexposed I_u = c/(c + d) = 20.61 per 100
Incidence in both combined I_p = (a + c)/(a + b + c+ d) = 29.82 per 100

$$\text{Relative Risk, RR} = \frac{\text{Incident in the exposed}}{\text{Incidence in the unexposed}} = 1.77$$

Attributable Risk AR = e – Iu = 16. 00 per 100
Attributable Risk percent, AR% = (AR/Ie)100 = 43.704%
Population Attributable Risk PAR = Ie- Iu = 9.21 per 100
Population Attributable Risk Percent, PAR% = (PAR/Lp)100 = 30.896%

The use of safety belt reduces the incidence of injury/fatality in case of accident. This is shown in the ratio of injury/fatality to damage only varying from 58% of cases for violators to a low 26% for cases of compliance. This is in line with previous studies that show that

Table 3: Contingency table entries for present study

	No of cases of injury /fatal	No of cases of damage only	Total
Violators	82(a)	142 (b)	224
Compliant	34(c)	131(d)	165
Total	166	273	389

safety belt reduces fatality and injury in accident occurrence. This also agrees with the relative risk value of 1.77 incidence for violators.

Moreover, the above analysis shows a reduction in incidence from 37.61-20.61% if compliance is followed. This implies that violation accounts for increase 16% fatality/injury occurrence. Moreover, it further shows that 9.21% fatality/injury would be averted it everybody uses safety belt. This is in line with previous studies which show that fatality and injury can be reduced if safety belt use is improved.

Finally, the above shows that 100% compliance is not even achieved in spite of enforcement just as (NCHRP, 2004) noted.

CONCLUSION

Going by the record from the office of the FRSC and the analysis carried out this work, it is inferred that:

- Those that don't use seat belt have 1.77 times as much risk (higher incidence) as those who use seat belt.
- If those who do not use seat belt change their driving habit and begin to use seatbelt, their incidence of fatality will decrease by 16 per 100 accidents that occur, which would represent 43.7% reduction in fatality incidence.
- A reduction of 9.21 new cases of fatality per 100 persons (exposed and unexposed) is expected if everybody used seat belt always whenever driving such reduction represents a 30% reduction of the incidence in the population.

ACKNOWLEDGEMENT

The author wishes to acknowledge the efforts of Mr Aiyegbusi Ayodele whose B.Sc project (9), carried out under the supervision of the author provided data for deriving some of the data used in this research.

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