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A study on the factors associated with motorbike accidents in Arniko-Highway, Kathmandu

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Abstract
The research is non experimental and cross sectional type. The study is carried out on two different sample populations, ie, 100 non accident cases from current motorbike riders, selected by simple random sampling method and 198 accident cases form the accident records of traffic police office, where census method is applied. The factors associated with motorbike accidents are identified through record review and the face to face interview has been applied to find their knowledge about traffic rules and the speed adopted by current motorbike riders. Bivariate analysis is done through Chi-square statistics to find the association among different factors of accident. Z test is done to find the significant differences between the proportions of two different populations. The findings revealed that majority of the motor bikers knew about the need to follow traffic rules for safe driving. Sex factor showed significantly high association with accidents (p=0.003) unlike with the age (p=0.423) of the motor bikers. Also, both recorded as well as field data focused on the rainy season as most vulnerable season for motorbike accidents (proportional difference: observed=39% and recorded=35%, Z=0.7). The speed of the motorbike riders was found to be prominent factor to impart accidents (proportional difference: observed=27% and recorded=24%, Z=0.6).

Keywords: Motorbike, Highway, Traffic rules, Accidents, Road safety.

1. Introduction
Motorcycles are one of the most affordable forms of motorized transport in many parts of the world. Motorcyclists face a number of risk factors. Most of the motorcycles (58%) are in the developing countries of Asia. The four largest motorcycle markets in the world are all in Asia: China, India, Indonesia, and Vietnam [1].

According to the U.S. National Highway Traffic Safety Administration, 13.10 cars out of 100,000 ended up in fatal crashes. The rate for motorcycles is 72.34 per 100,000 registered motorcycles [2]. Motorcyclists involved in accidents are 40 times more likely to be killed than car drivers. Motorcyclists represent 1% of traffic yet account for up to 20% of the deaths and serious injuries on our roads [3]. The reviewed literatures here in suggest that motorcycles are less in number, carry less passengers and travel less distances but the accidents and fatalities counted the highest percentage of all kinds of road accidents.

The factor for most motorcycle accidents is governed by the law of "negligence." If a driver is not reasonably careful he/she might injure someone [4, 5].

The Word Health Organization's (WHO) most recent Global Burden of Disease (GBD) study reported that motor bike accident as one of the fastest growing "epidemics" in the South East Asian Region (SEAR). The current epidemic of injuries, particularly motorbike injuries is expected to rise by 44% in the Region due to rapid motorization, increased mobility and inadequate attention to road safety [6].

Integrated Regional Information Network (IRIN) stated that 130 major accidents and thousands of minor ones are reported every day in Kathmandu, the capital of Nepal. At this rate, the roads are as deadly as the decade-long civil war that ended in 2006 after killing almost 18,000 people [7].

Among all types of injuries road traffic accidents are the major cause and the most vulnerable age group is 15-40 years, here in Kathmandu [8]. The six lane Arniko Highway has brought a lot of good results to the people and place here around. However, it has drastically increased the road accidents due to several factors and motorbike is the most accident prone vehicle of all.

Almost 70% of the people who die in road accidents are pedestrians, cyclists, or people on motor scooters and motorbikes, and many studies indicate that this proportion can be higher in poorer countries like Nepal. The six lane Arniko Highway has drastically increased the road accidents due to several factors and motorbike is the most accident prone vehicle of all. Injuries resulting from accidents are a major social problem in Nepal and disabilities due to injuries are increasing. So, this research would help bridging the gap between the bike accident problems and the factors associated with it and it would be a rear piece of research work at present.

2. Materials and Methods

The research design is non experimental and cross sectional type. The study is quantitative and descriptive in nature. There are two different study population, they are – the bike riders who have never had the bike accident and the bike accident records. The study site for the former one is Tinkune to Suryavinayak sector of Arniko Highway. There are 5 different sites were specified for data collection. For the second type of data, review of last year's (fiscal year 2011/12) accident records, occurring at the same sector of highway, was done from police station.

The sample size was 100 which was calculated by using the formula $\mathbf{Z^2pq/d^2}$, where, confidence interval, (Z) = (**1.96**); proportion of non-accident bike riders (P) = (**36%**) (Ref: Annual Report 2011/12, Traffic Police Office, Koteswor)

Proportion of accident cases (q) = (**64%**); differential error value (d) = (**10%**) and

Allowable error = 12% is added to the calculated sample.

For record review, since the available data of accident cases in the specified sector of Arniko Highway was 198 and due to a small sample available, all the samples were included in the study.

2.1 Instrumentation and Sampling technique

Motorcyclists at parking zones of 5 specified spots (Koteswor, Kausaltar, Thimi, Sallaghari and Suryavinayak) were chosen for interview. Equal proportion of sample (20%) motor bikers from each spot were selected. Those who had never had an accident were individually interviewed. Interviews were taken on first come first interview basis and if more than one motor bikers arrived at a time, random selection was done. Data was collected using semi structured questionnaire for respondents.

The record review guideline was followed for accident record review from the traffic police station, Baggikhana. Here, census method was applied in the accident population of fiscal year 2012/13.

3. Analysis

3.1. By Z test

The data from interview at field demonstrated the motor bikers view about the factors of accident and the practice of traffic rules during their ride. The record review showed the reality of casualties or fatalities of bike accidents. Since the data were collected from two different nature of populations, Proportional Z test between the variables of interview and accident records was done. The data from interview and the record review were compared by Z test by using the following formula –

$$Z = \frac{p1 + p2}{S\,\text{Ɛ}\,(p1 - p2)}$$

Where,

p1 = proportion of first group (interview group); p2 = proportion of second group (recorded group); S Ɛ = standard error.

Then,

$$S\,\text{Ɛ}\,(p1 - p2) = \sqrt{\frac{p1q1}{n1} + \frac{p2q2}{n2}}$$

Where,

q1 = 1-p1, q2 = 1-p2

n1= number of first group population, n2 = number of second group population

p value is compared with 0.05 (at 5% level of significance).

If p > 0.05, it is considered as having **significant difference** between proportions of two population samples, where, Z ≤1.

If p≤0.05, the difference is **insignificant** where, Z>1

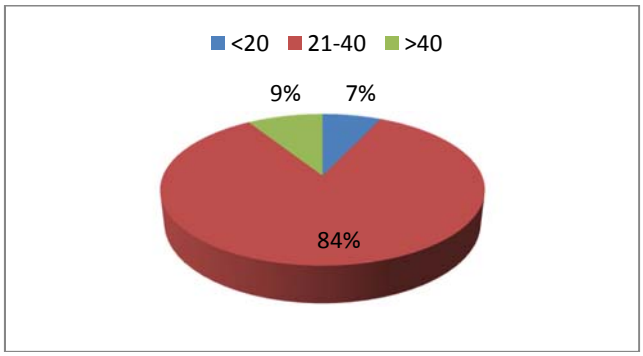
3.2. By Chi-square test

The bivariate analysis was done by Chi-square test. Here calculated and tabulated values were compared and if former is bigger than later, and p value was ≤0.05 the association was considered to be significant.

4. Results

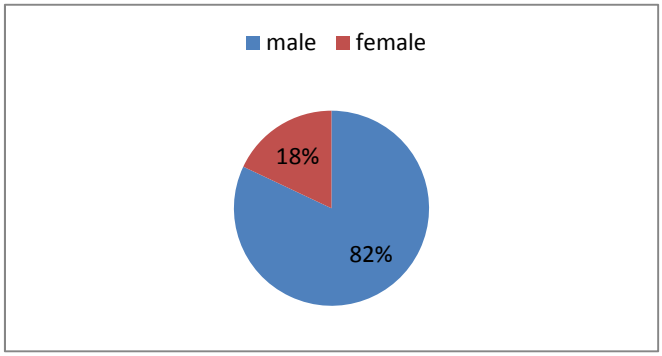
4.1. Bike riders' Age/ Sex

The findings of the data from interview showed that among the motorbike riders, majority of them (84%) were of adult group (figure 1) and the sex wise, significant number (82%) of motor bikers were the males (figure 2).



(Source: Field survey, 2014)

Fig 1: Bike riders by age



(Source: Field survey, 2014)

Fig 2: Bike riders by gender

4.2. Fatalities and injuries by accidents

As reviewed from police record, the sex wise effect of accident on human life is such that out of 183 accident cases of motorbike, 74% males and 26% females were injured. Similarly, out of 15 fatalities, total 9(60%) were males and 6 (40%) females in the year 2012/13 (Table 1).

Table 1: Human loss and Injuries by bike Accident

Variables	Fatalities	Injuries	Total	Percent (%)
Male	9	137	146	74
Female	6	46	52	26
Total	15	183	198	100

(Source: Traffic Police record of FY 2012/13)

4.3. Malpractice of traffic rules

Out of 104 responses about the malpractice of traffic rules, one third (32%) of them ride in a mood of winning with the speed. Around one fourth (24%) of them neglect about the pedestrians and do not stop for them to cross the road. About 17% cleared that they did not follow side light rule while stopping or taking turns. While, at least 6% of them were there who drove in spite of red light (Table 2). However, it was found that 82% of the bike riders had an adequate knowledge about the traffic rules.

Table 2: Malpractices of traffic rules

Variables	Frequency	Percentage of responses
Driving in spite of red light	6	5.8
Driving while pedestrians cross road	25	24.0
Using wrong lane while driving	22	21.2
Not following side light rule	18	17.3
Winning with the speed	33	31.7
Total	104	100

Source: Field survey, 2014

4.4. Casualties of the Accidents

From the table below it was understood that, out of 198 casualty cases, majority of them (70%) had careless drivers. It was followed by 24% by high speed. Least (0.5%) of the cases were found to be caused by mechanical fault and overtaking the vehicle each (Table 3).

Table 3: Casualties of the Accidents

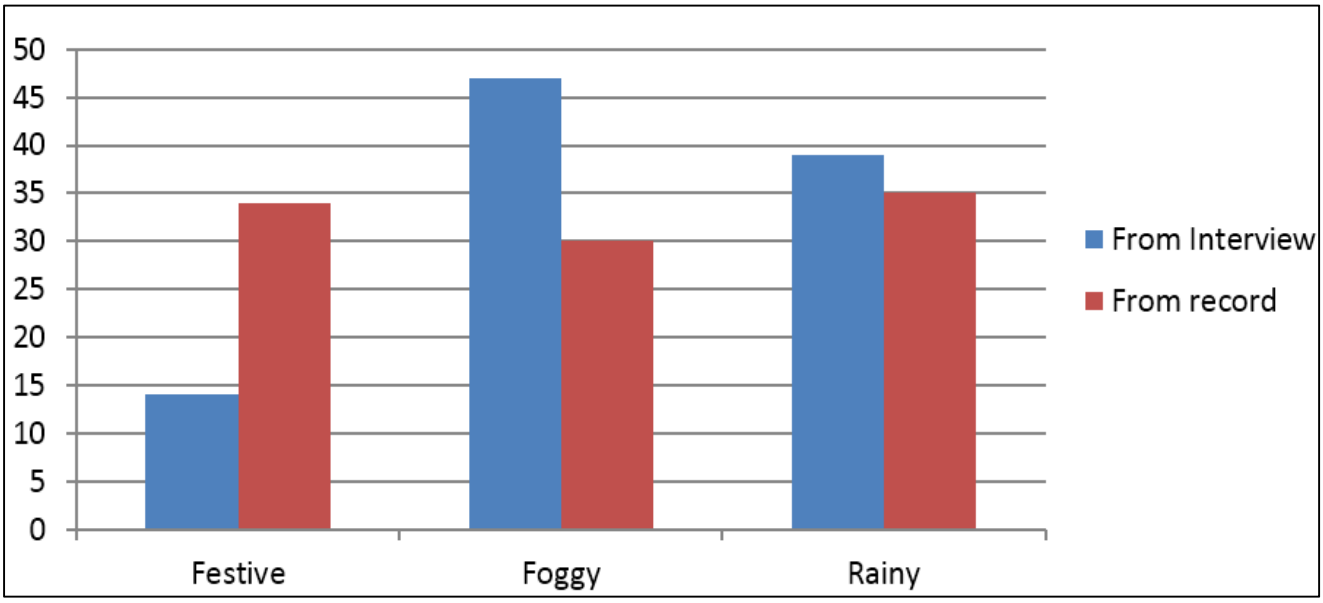
S/n	Causes	Frequency	Percent (%)
1	Carelessness of drivers	138	69.7
2	High speed	47	23.7
3	Drink and drive	9	4.5
4	Pedestrians' fault	2	1.0
5	Mechanical fault	1	0.5
6	Overtake	1	0.5
	Total	198	100

Source: Traffic Police record of FY 2012/13

4.5. Accident cases based on season

Based on the festive time and weather conditions, the 12 months are categorized into 3 seasons. June-September represent rainy season, October, November, April, May represent Festive season and December, January, February, March represent Foggy season. The accident record cases showed that highest percentage of accident (about 35%) took place in rainy and festive season while little less (30%) cases had taken place in foggy season.

From interview with bikers, they opined that the accidents might occur highest (47%) in foggy and least in festive (14%) seasons (Figure3).



Source: Field survey, 2014 and Traffic Police record of FY 2012/13

Fig 3: Accident cases and the seasons

4.6. Association between age and speed of the bikers

The riders' speed while driving is seen to be highest (73%) among age group 21-39. People rearly (12%) drove the bike at less than 40 km/hr speed. The chi-square test was applied to show the relationship between speeds of motorbikes with age distribution of the riders. The chi square value was found to be 3.879 at 2 df at 95% CI. The corresponding P- value was 0.432. Since the P-value was more than 0.05 (Table 4), the association was found to be insignificant. So, it is clear that the speed did not depend on age variation of the riders.

4.7. Association between Sex and Speed of the bikers

The chi-square test was applied to show the relationship between speed of motorbikes with sex distribution of the riders (Table 4). The value was found to be 11.739 at df 1and 95% CI. The corresponding P- value was 0.003 (< 0.05) and hence the association was found to be significant. So, we could conclude that the of speed of motorbike was significantly varied as sex and here, it is explored that females were driving with lesser speed than the males.

Table 4: Association between Age/ Sex and Speed of the bikers

		Speed	(km/hr)	Total	P-value.
Age(years)	**>40**	**41-60**	**>61**		
<20	0 (0%)	5(71.4%)	2(28.6%)	7(100%)	
21-39	10(11.9)	61(72.6)	13(15.5%)	84(100%)	**.423**
>40	2(22.2%)	7(77.8)	0(0%)	9(100%)	
Total	12(100%)	73(100%)	15(100%)	100	
Sex of respondents					
Male	6(7.3)	61(74.4)	15(18.3)	82(100%)	
Female	6 (33.3%)	12 66.7%)	0(00.0%)	18 (100%)	**.003**
Total	12(12%)	73 (73%)	15(15)	100(100%)	

Source: Field survey, 2014

4.8. Proportion Distribution of seasonal variation in accidents as compared by proportional Z test

a. Association between motorbike accident and the season

The z-test statistics is applied to find the association between motorbike accident and the season for calculating significance of difference between two proportions (figure 3).

The table below showed that proportional difference was highly significant in festive and foggy seasons and both have P value less than 0.05 that is 0.0003 and 0.0038 respectively (Table 5). In rainy season, the proportional differences between recorded and interviewed data are not found significantly different (z= 0.7 and p>0.05). That means, the proportion of non-accident cases saying that the accidents occur more in rainy season (that bike riders are well known and also aware about) and the actual accidents (from record) occurring in the same season are matched. While, in festive and foggy seasons, the proportion of interviewed and recorded data were significantly different. This cleared that the accidents significantly occurred in rainy season.

Table 5: Association between different seasons (Z test)

Variables	Observed proportion	Recorded proportion	Z value	P value	C I at
Rainy	39 %	35%	0.7	0.498	0.07-0.15 (0.07)
Festive	14%	34%	3.7	0.0003	0.09-0.30 (0.2)
Foggy	47%	30%	2.9	0.0038	0.05-0.28 (0.17)

(Source: Field survey 2014 and Traffic police record of FY 2012/13)

b. Association between casualties and motorbike accident

Using the z-test statistics, the association between motorbike accident and its various causes are analyzed. Significance of difference between these two proportions were calculated. The table below showed that difference was highly significant in the casualties like – neglect of traffic rules, drink and drive and mechanical fault whose P value is calculated as 0.000, 0.0001 and 0.0001 respectively (all are <0.05). In case of the speed and accident, the proportional differences between recorded (24%) and interviewed (27%) data are not found significantly different ie, Z value=0.06 (Table6). That means, the proportion of non accidents cases saying that the accidents occur more due to high speed and the actual accidents (from record) occurring due to same cause are found matching (p= >0.05). So, we come to know that accidents occurring here is mainly due to high speed.

Table 6: Association betweeen different causes of accident from record and field (Z test)

Variables	Observed proportion	Recorded proportion	Z value	P value	C I at 95%
Neglect traffic rules	0.16	0.7	8.8	0.000	0.41-0.66 (0.54)
High speed	0.27	0.24	0.6	0.572	0.07-0.13 (.03)
Drink and Drive	0.22	0.45	2.39	0.0001	0.11-0.34 (0.23)
Mechanical Fault	0.19	0.05	3.90	0.0001	0.06-0.21 (0.14)

(Source: Field survey 2014 and Traffic police record of FY 2012/13)

5. Discussions

A study by Chang H L and Yeh T-H, in 2007, cleared that the young male riders were more likely to disobey traffic rules, and they also had a higher tendency towards negligence of potential risk and hence there is increased risk of accident on males than on the females [9]. Similarly, a public report issued by US Department of Transportation, National Highway Traffic safety Administration revealed that almost 50% of total Motorbike deaths is of male [10]. These studies evidently support the result that comparatively, more males are prone to injuries as well as fatalities due to motorbike accidents here in Kathmandu.

Sexton B. *et al*. (Road safety department, 2004, U.K.) has explored that Just over 11% of male riders and over 15% of female riders are prone to accident injuries. The accident liabilities fell as the experience of riding and the age rises. Statistically, the 'all season, all weather' riders showed that the risk decreases from 0.65 to 0.19 during the ages 17 and 60 respectively [11]. Yet another study by the Australian Transport Safety Bureau (ATS) found that Motorcycle riders aged below 40 are 36 times more likely to be killed than other vehicle operators of the same age [12]. Contrasting to it, in our case, the accidents showed no significant relation with the age factor.

Among the respondents, around one third of them enjoy motorbike riding by winning with the speed on roads. Even from the Z test, it is clear that there is significant relation between speed and the motorbike accidents. This finding was amply supported by the study carried out by The online fact sheet of motorbike's world, WebBikeworld's Accident Statistics, where it clears that speeding is one of the major contributing factors in motorcycle crashes especially among the riders under age of 30. Almost two thirds of the fatalities were associated with speeding [13]. This study has shown that

more than four fifth of the riders who belonged to age 21-39 years rode with the speed 41-60 km/hr. This is a maximum speed in a crowded city like Kathmandu. The finding is even more supported by the study of Dr. Lim L R and *et al* in , who demonstrated that Darkness (adjusted OR=1.65) and greater speeds (adjusted OR=1.63 to 4.69) also increased the odds of greater injury severity [14].

In interview cases, around half of the respondents said that foggy season was the most vulnerable season for accident but the accident case revealed that more than one third of the accident occurred in rainy (35%) season. Also, Department of Engineering, De La Salle University, Manila Philippines [15] found that a negative coefficient is attributed to the consciousness of drive in more challenging season like rain and wind. This was even supported by the Z test result that no significant difference in proportion of observed (39%) and recorded (35%) data indicated the strong association between the accidents and the rainy season.

Regarding the cases of drink and drive when related with the accident cases, the proportional Z test (table 6) showed that there is significant difference in proportionate values of recorded (0.45) and observed (0.22) data indicating that no association do exist between these two. In contrast to that, in the US in 1998 over one in three motorcyclists involved in fatal accidents were intoxicated, although this was an improvement on earlier studies where the figure was more than a half [16].

6. Conclusions

There is no association between age / sex and knowledge of riders on motorbike accidents. The rainy season is the most vulnerable season for motorbike accidents.

The motor bikers view that high speed is the most prominent cause of accident, which is also verified by the accident records of traffic police. Here, males are the speed riders and may be, due to that reason they are more prone to accidents than the females both in case of injuries and fatalities.

The people are still not sincere about the safety measures and the traffic rules. It may be due to weak monitoring and passive regulations.

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