Afr. J. Med. med. Sci. (2011) 40, 385-392

Economic costs of motorcycle injury among crash-involved commercial motorcyclists in Oyo State, Nigeria

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11/6/12

Abstract

Objective: This study presents the costs of injury from road crashes sustained by commercial motorcyclists in Oyo state, Nigeria.

Methods: A cross-sectional survey of 373 commercial motorcyclists selected using a multi-stage sampling technique was conducted. Information on injury costs for 44 (11.8%) of them who were reportedly involved in a road crash in the 12-month preceding the survey are presented.

Results: The mean age of the 44 crash-involved motorcyclists was 33.6 ± 9.1 years. Daily income ranged from N300.00 ($2.31) – N1, 500.00 ($11.54). Thirty-three (75.0%) of those involved in crashes sustained injuries and 7 (21.2%) of them were admitted. Common injuries sustained were bruises (75.8%), fractures (12.1%), cuts (6.1%) and burns (6.1%). Median number of days away from work was 14 (range: 1 – 150). Median number of days on admission was 60 (range 7 - 90). The median cost of treatment was N2, 000.00 ($15.38), range: N20.00 (about 16 cents) - N25, 000.00 ($192.31) and this was paid by the injured motorcyclist alone in about 47% of cases. Median productivity costs lost was N7, 000.00 ($ 53.85), range N300 ($2.31) – N72, 000.00 ($553.85).

Conclusion: The study showed that the costs of injuries were considerable. Efforts to prevent road crashes must be intensified to reduce the ensuing economic losses.

Keywords: *Injury costs, Road crash, Commercial motorcyclists, Nigeria*

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Résumé

L'étude présente les couts des blessures soutenues lors des accidents routiers des motocyclistes commerciaux à dans l'état Oyo, Nigeria. Trois cent soixante treize (373) motocyclistes commerciaux étaient sélectionnés par un technique multistage. L'information sur les couts des blessures chez 44 (11.8%) des cas rapportés sur les accidents routiers dans les derniers 12 mois de cette étude. La moyenne d'âge des 44 cas d'accidents des motocyclistes était de 33.6 ± 9.1 ans. La recette journalière variant entre N300.00 ($2.31) – N1, 500.00 ($11.54). Trente-trois (75.0%) des accidents avaient des blessures et 7 (21.2%) étaient hospitalisés. Les blessures communes étaient des écorchures (75.8%), fractures (12.1%), coupures (6.1%) et brulures (6.1%). Le nombre de jours médiane hors du service était de 14 (Intervalle: 1 – 150). La durée d'admission médiane était de 60 (intervalle de 7 - 90). Le cout médian de traitement était de N2, 000.00 ($15.38), intervalle: N20.00 (environ 16 cents) - N25, 000.00 ($192.31) et ce cout était payé par le motocycliste blessé seul chez presque 47% des cas. La perte de la productivité était de N7, 000.00 ($ 53.85), variant de N300 ($2.31) – N72, 000.00 ($553.85). Cette étude montre que les couts des blessures étaient considérables. Les efforts de prévention des accidents routiers doivent être intensifies afin de réduire les Lourdes pertes économiques.

Introduction

Worldwide, road crashes and ensuing injuries constitute a significant public health problem [1]. A study conducted by the Global Road Safety Project (GRSP) in 1999 showed that about 10 per cent of global road deaths occurred in Sub-Saharan Africa with South Africa and Nigeria, accounting for most of the reported deaths [2]. The prevailing economic circumstances in Nigeria have led to an increase in the use of motorcycles for private and commercial

purposes [3, 4]. Motorcycles are cheaper to procure and maintain than cars and also easier to manoeuver on bad roads. This makes them favoured by commuters in both rural and urban areas [3, 4]. As far back as the early 1990's increases in the occurrence of road traffic deaths have been documented in a number of low and middle income countries [5]. Morbidity and mortality following road crashes are also on the increase in Nigeria [6, 7] and available data from the Federal Road Safety Commission (FRSC), Nigeria revealed that in 2004, motorcycle crashes constituted about 31.5% of the 14, 087 road crashes reported nationwide [8].

The extent of injuries suffered by a motorcycle crash victim depends on the person's age as well as the amount of energy involved in the collision which is related to the type(s) of vehicle(s) involved and the speed at which the vehicle(s) were travelling when the impact occurred [9] and injury severity would influence the duration of stay on admission, the eventual outcome i.e. morbidity or mortality and ultimately the costs incurred. A study on, motorcycle helmet use, injury outcome and hospitalization costs from crashes in Washington, USA by Rowland *et al*, revealed that 20% of victims involved in motorcycle crashes were hospitalized [10]. The average length of stay in hospital ranged from 9.9 (±1) to 12.6 (±1.4) days for helmeted riders and unhelmeted motorcyclists respectively [10]. Wick *et al* reported that the average stay for motorcycle crash victims (most of who sustained fractures) treated at the Trauma centre in Germany was 35.4 days; and about a quarter of them had to change jobs after the crash [11].

Worldwide, the annual cost of road crashes has been estimated at over US $500 billion, and in the developing world the estimated cost is about US $65 billion per annum [1, 12]. According to the WHO, the highest burden of road traffic injuries falls on low and middle income countries and within these countries the poor bear the brunt of the impact of injuries [13]. Injury costs can be classified as direct costs i.e. resources expended on obtaining health care and indirect costs or productivity costs i.e. resources forgone as a result of inability of the victim to work [14]. Health care costs include medical costs such as treatment costs, hospitalization, investigations and drugs while non-medical costs include those incurred in connection with treatment but not expended on medical treatment itself for example, transportation expenses. Injury costs would vary depending on injury severity and anatomical site of the injury sustained which would also influence the duration of stay in hospital. Costs would also vary by country. Findings from Rowland *et al*'s study in Washington, USA revealed that the average cost of hospital treatment was about $14 766.84 per rider [10]. Mock *et al* reported that health care costs of injured motorcyclists in Ghana ranged from $5.25 ± $3.5 to about $13.25 ± $11.64 [15]. Juillard and colleagues in their population-based study of socio-economic impact of road traffic injuries reported that the average total direct cost of treatment incurred by victims of road traffic injuries in Nigeria was US $25.4 (95% CI: 18.78 to 34.34) [16]. Ipingbemi in his study among crash victims in public and private hospitals in South-Western Nigeria reported that on the average, each victim spent a minimum of US$17 per day on medical expenses [17].

Productivity costs or resources forgone include the costs associated with lost or impaired ability to work due to morbidity or mortality and those costs associated with inability of other people apart from the victim (such as relatives, friends and other acquaintances) to work because they may become involved in taking care of the victim. According to Ipingbemi's findings, all the crash-involved victims he studied were said to have had at least one person attached to him/her throughout the period of admission [17]. In addition, costs of suffering or emotional turmoil experienced by the victim and family members and funeral costs in the event of the demise of the victim all serve to aggravate the outcome of road crashes [14].

In many developing countries, health care costs are often borne out-of pocket as Health Insurance is not yet widely available. In Nigeria, The National Health Insurance Scheme (NHIS) was established under Act 35 of 1999 by the Federal Government of Nigeria. It comprises various schemes such as the Formal Sector Social Health Insurance Programme, Urban Self-employed Social Health Insurance Programme and the Rural Community Social Health Insurance Programme to cover different segments of society [18]. Currently, the scheme is mainly operational in the formal sector hence treatment costs are often paid out-of-pocket by patients who belong to the informal employment sector (such as commercial motorcyclists).

A law mandating helmet use by motorcyclists was initially passed in Nigeria in the late 1970's but the law was never adopted in some states and in others it was later repealed [19]. Compliance and enforcement of helmet use in many states of the country has thus been sporadic. At the time of conducting the study, the nation-wide helmet law was yet to be re-enacted and there was no enforcement of helmet use in the study area.

A number of studies conducted in developed countries have documented injury costs from motorcycle crashes but a literature search did not reveal any such studies conducted in the study area. This paper presents findings on injury costs among crash-involved commercial motorcyclists in Oyo state. It was part of a larger study conducted to determine the incidence of accidents and pattern of injury among commercial motorcyclists in Oyo state, Nigeria.

Methodology

The study area and subjects

Oyo State which is located in South-Western Nigeria is one of the 36 states in Nigeria. It consists of 33 Local Government Areas also categorized into 6 health zones viz:

i. Ibadan zone comprising 11 Local Government areas (LGAs)- Akinyele, Egbeda, Ona Ara, Ibadan North, Ibadan Northeast, Ibadan Northwest, Ibadan Southeast, Ibadan Southwest, Ido, Lagelu, and Oluyole LGAs.
ii. Ibarapa health zone has 3 LGAs - Ibarapa Central, Ibarapa North, Ibarapa East;
iii. Oyo health zone has 4 LGAs - Afijio, Atiba, Oyo East, Oyo West;
iv. Upper Oke Ogun health zone is made up of 6 LGAs -Irepo, Olorunsogo, Oorelope, Saki West, Saki East, Atibso.
v. Lower Oke Ogun consists of Kajola, Iwajowa, Iseyin, Itesiwaju and
vi. Ogbomoso health zone is made up of 5 LGAs- Ogbomoso North, Ogbomoso South, Ogo Oluwa, Oriire and Surulere.

The state has a population of about 4.4 million people [20] the majority of whom are Yoruba. Majority of those living in the urban areas of the state are civil servants while those in the peri-urban and rural areas are mainly farmers, artisans and petty traders. The main modes of transportation are by private-owned vehicles, taxis, commercial mini-buses and motorcycles. The state operates a free health care system which includes free registration, consultation and drugs (consisting of available generic drugs on the essential drugs list only) in state government-owned primary and secondary facilities only. Other treatment costs – surgical interventions, immobilization of fractures etc are paid by out of pocket expenses.

Sampling technique

A multi-stage sampling technique was utilized to select respondents. In the first stage, two of the six health zones (Ibadan and Oyo) were selected using simple random sampling technique. The Local Government Areas (LGAs) in the two health zones were stratified into two groups – rural (comprising 5 LGA) and urban (comprising 9 LGA). One rural LGA - Afijio and one urban LGA - Ibadan North were selected using random sampling technique (stage 2). In the third stage, twenty five motor parks/garages comprising 14 in the rural and 11 in the urban area (i.e. third stage units) were selected through a simple random method from a list of the 23 rural and 18 urban garages in the selected LGAs. The number of respondents to be interviewed per park was estimated based on the approximate number of riders in each park. The riders interviewed in each park were then selected by simple random sampling (stage 4). A total of 373 riders were finally selected and interviewed.

Fifty-one riders had ever been involved in a crash of which 44 reportedly had a crash in the 12-month period preceding the study. Information on socio-demographic characteristics, average daily wages, history of motorcycle crashes and ensuing injuries, and consequences and costs of treatment for the 44 respondents involved in a crash in the 12-month preceding the study are reported here. A 12-month recall period was used to minimize recall bias. It has been noted that severe injuries are thought to be consistently reported up to 12-months post-injury although less severe ones are under-reported [21].

For the purposes of this study, injury costs determined were as follows:

i. Direct health care costs i.e. medical costs – respondents were asked to mention the total amount they paid for medical treatment (including admission, cost of surgery if applicable, costs of drugs etc) they received.
ii. Productivity costs i.e. resources forgone as a result of the inability of the crash victim to work was calculated by multiplying the respondents' average daily income by the number of days for which he was unable to work following the crash.

Data management

Data was analysed using SPSS version 15. Respondents' income and injury costs were right-skewed. Data were thus log-transformed and geometric means and 95% confidence intervals were computed. The summary statistics reported for days of work lost and days on admission (which were also skewed) were geometric means, medians and ranges.

Costs were obtained in Naira and converted to their dollar equivalent by utilizing an exchange rate of N130.00 to US $ 1. Since information on road crashes and injuries that occurred in the 12-month preceding the study were reported, the approximate

exchange rate of the dollar to the naira during the period from December, 2004 to January, 2006 was utilized. This ranged from US$1 to about N128 – N132. The level of statistical significance was $p < 0.05$.

Ethical considerations

Permission to conduct the study was obtained from the Oyo State Research and Ethical Committee and from the leadership of the commercial motorcyclists associations in both study sites. The objectives of the study were explained to each motorcyclist following which voluntary informed consent was obtained.

Results

Socio-demographic and occupational history of crash-involved commercial motorcyclists

A total of 373 commercial motorcyclists aged 19 to 60 years (mean age: 31.9 ± 8.6 years) were interviewed. Majority, 262 (70.2%) were married, 109 (29.2%) single and 2 (0.6%) separated/ divorced. Forty-four motorcyclists had been involved in a road crash in the year preceding the survey of which 33 (75%) of them reportedly sustained injuries from the crash.

The mean age of the 44 crash-involved commercial motorcyclists was 33.6 (± 9.1) years. Majority of them were married, 33 (75.0%) and 23 (52.3%) had secondary education (Table 1). The median number of years for which the respondents had been riding for commercial purposes was 2.8 years (range: 6 months – 8.5 years) and they worked for a median of 6, range 2 – 7 days.

Table1: Respondents'socio-demographic characteristics

Socio-demographic characteristics	N (%) N = 44
Age group (years)*	
20 – 29	16 (37.2)
30 – 39	12(27.9)
40 – 49	13(30.2)
≥50	2 (4.7)
Mean Age (±S.D) years	33.6 (±9.1) years
Marital status	
Single	10 (22.7)
Married	33 (75.0)
Separated/divorced	1 (2.3)
Highest level of education	
No formal education	2 (4.5)
Primary	14 (31.8)
Secondary	23 (52.3)
Post secondary	5 (11.4)

** no response = 1*

Majority of them, 37 (84.1%) owned the motorcycles they used for commercial purposes. They made an average of N603.39 *(US$4.64)* [95% C.I = N 532.23 *(US$4.09)* – 684.07 *(US$5.26)* per day and about N3, 226.17 *(US$24.82)* per week. Most earned N500 *(USD$3.85)* per day; range: N300.00 *(US$2.31)* – N1, 500.00 *(US$11.54)*.

History of road crashes and injury

In all, 17 (38.6%) crashes occurred in the morning, 14 (31.8%) in the afternoon and 13 (29.6%) at night. Common objects collided with were, another vehicle 20 (45.5%) and another motorcycle 6 (13.6%). Nine (20.5%) motorcyclists were involved in lone accidents (Table 2). Only one motorcyclist admitted to having taken alcohol on the day he was involved in a crash. Thirty-three (75.0%) of the 44 motorcyclists involved in crashes sustained injuries which mainly affected the lower 15 (45.5%) and upper limbs 11 (33.3%). Injuries sustained included bruises 25 (75.8%), fractures 4 (12.1%), cuts 2 (6.1%), burns 2 (6.1%). One victim each reported that they sustained a hip dislocation (3.0%) and broken teeth (3.0%) (Table 2).

Table 2: History of road traffic crash and injuries sustained

History of road traffic crash	N (%)
Object respondent collided with	
A vehicle, car	20 (45.5)
Lone accident	9 (20.5)
A motorcycle	6 (13.6)
A pedestrian	3 (6.8)
A stationary object	3 (6.8)
Gutter	2 (4.5)
An animal	1 (2.3)
Injury site**(n = 33)	
Lower limb	15 (45.5)
Upper limb	11 (33.3)
Head/ face	5 (15.2)
Chest	1 (3.0)
Pelvic area/ hip	1 (3.0)
Others	3 (9.0)
Injury type** (n = 33)	
Bruises	25 (75.8)
Fracture	4 (12.1)
Cuts	2 (6.1)
Burns	2 (6.1)
Dislocation	1 (3.0)
Others	1 (3.0)

*** Multiple response*

Health care received for injuries

Health care was mainly sought in private clinics 14 (42.4%), Patent medicine stores 11 (33.3%) and General Hospitals 5 (25.2%). Two (6.1%) respondents patronized traditional bone setters for management of limb fractures and one (3.0%) was treated in a tertiary hospital (Table 3). Seven (21.2%) of the injured motorcyclists were admitted in hospital for treatment. Average number of days on admission was 32 (± 2.9) days and median number of days on admission was 60 (range 7 – 90).

Table 3: History of treatment received

History of treatment received	N (%)
***Facility where treatment was received* (n = 33)**	
Private clinic/ hospital	14 (42.4%)
Patent medicine store	11 (33.3)
General hospital	5 (15.2)
*Others	3 (9.1)
Bill paid by (n = 30)	
Self	14 (46.7)
Self and friend	1 (3.3)
Self and relation	1 (3.3)
Self and colleagues	2 (6.7)
Self and driver of vehicle involved in crash	1 (3.3)
Driver of other vehicle	6 (20.0)
**Others	5(16.7)

**Traditional bone setter and tertiary health facility*
***others such as colleagues*

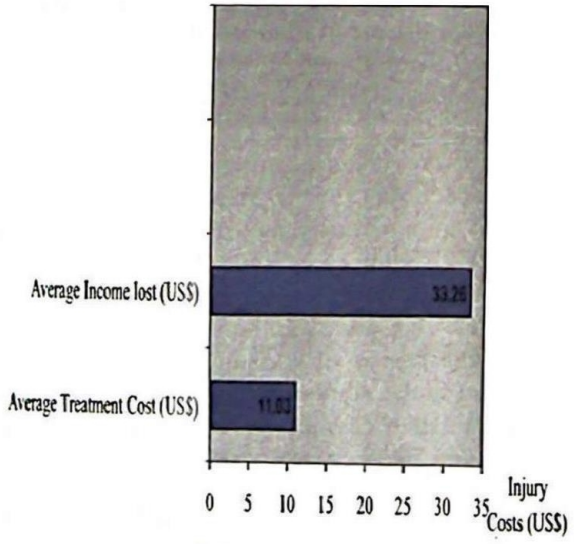

Fig 1 Average Injury costs

Injury costs

Treatment costs

Seven of the drivers who sustained bruises did not specify how much their treatment cost because other people paid in four instances while three could not remember how much they paid. The mean cost of treatment was N1434.60 (*US$11.04*), 95% CI = N717.46 (*US$5.52*) – N2868.14 (*US$22.06*) (Figure 1) and median cost of treatment was N2, 000.00 ($15.38), range: N20.00 (about 15 cents) - N25, 000.00 (*US$192.31*). Treatment costs were mainly borne by the motorcyclists alone 14 (46.7%), the driver of the other vehicle 6 (20.0%) and the motorcyclist and others (such as work colleagues) (16.7%) (table 3).

Lost productivity costs

Thirty (68.2%) of the crashed motorcyclists were unable to return to work on the day the road crash occurred. Mean number of days away from work was nine, median: 14 (range: 1 – 150). Half of the injured respondents returned to work within a week to a month after the crash, 33.3% returned less than a week after the crash while 16.7% resumed work more than a month after. The two motorcyclists who obtained care from traditional bone setters were unable to return to work until over 90 and about 150 days post-crash. Mean productivity costs lost was N4, 323.25(*US$33.26*) [95% CI = N2, 191.29 (US$16.86) - N8, 531.00 (US$65.62)] (Figure 1) and median productivity costs lost was N7, 000.00 ($53.85); range N300 ($2.31) – N72, 000.00 ($553.85).

Table 4: Association between selected variables and treatment costs

Variables	Treatment Costs ≥ N3,226.17 ($24.81)n (%)	Above N3,226.17* ($24.81)n (%)	Fisher's exact p-value
Reported helmet use			
Yes	7 (63.6)	4 (36.4)	
No	9 (60.0)	6 (40.0)	1.000
Main injury type			
Bruises	14 (87.5)	2 (12.5)	
Cuts	1 (50.0)	1 (50.0)	
Fracture/ dislocation	—	5 (100.0)	< 0.001
Burns	—	2 (100.0)	
Others	1 (100.0)	—	

**The average income made by the motorcyclists per week*

Treatment costs and associated factors

Slightly more motorcyclists who were not wearing their helmets securely fastened at the time the crash occurred (40.0%) spent more than N3226.17 ($24.81) (the average income made by the motorcyclists per week) on treatment compared to those who wore their helmets securely fastened (36.4%) although this was not statistically significant. All motorcyclists who sustained fractures and other bone-related injuries and all those with burns spent more than this amount on treatment (table 4).

Discussion

This study of injury costs among crash-involved commercial motorcyclists in Oyo state, Nigeria revealed that motorcycle injuries resulted in considerable economic losses. Common injuries sustained were bruises and fractures and the limbs especially the lower limbs were mostly affected. This is similar to findings in other parts of Nigeria [22 – 24]. Reported helmet use by the motorcyclists at the time of the accident (37%) was much higher than Owoaje's study which reported that none of the crashed commercial motorcyclists in Igbo-Ora, South western Nigeria used a helmet [24]. It was however lower than rates obtained in an observational pilot study on helmet use conducted in Ibadan North West LGA, at a time, when there was ongoing active enforcement by the Federal Road Safety Commission [25].

About a fifth of injured riders were admitted in hospital for an average of 32.7 days. Median duration of admission was 60 (7 – 90) days. Other hospital-based studies have reported durations of hospital admission ranging from 10 to about 35 days [10, 11, 26]. Rowland *et al.*, reported that the average length of stay in hospital for the helmeted and unhelmeted crash victims they studied in Washington State, USA was 10 and 12.6 days respectively [10]. Wick *et al.* reported that the average duration of admission for victims of motorcycle accidents at the Trauma centre was 35.4 days [11] while Bried and colleagues reported an average of 13 days of admission [26].

The costs of healthcare incurred by the motorcyclists in Oyo state ranged from N20.00 (about 15 cents) to N25 000.00 ($192.31) with an average of N1434.60 ($11.04). Although this average is lower than $25.4 (95% CI: 18.78 to 34.34) reported by Julliard *et al,* the wide range of costs reported by motorcyclists in Oyo incorporates the average observed by Julliard *et al.* [16]. Our findings are comparable to estimated health care costs (ranging from $5.25 ± $3.5 to about $13.25 ± $11.64) incurred by urban and rural motorcyclists in Ghana in 1999 [15]. The similarity in costs in spite of the fact that our study was conducted about 6 years after the study in Ghana could be as a result of variations in injury severity and cost differentials as well as differences in rates of inflation between countries. Healthcare costs in our study were much less than estimated average hospital charges in developed countries which ranged from $13,368 to $16,408 per patient [10, 11, 26]. These could be attributed to the differences in health care costs between developed and developing countries as well as the differences in injury severity especially as our study being community based and not hospital based would have included a number of minor injuries. Injury costs were mainly borne by the motorcyclists in Oyo state. This is similar to Mock *et al*'s findings in Ghana which reported that hospital fees and supplies are paid for out-of-pocket by patients and their relatives [15] but is contrary to findings in the U.S where private insurance and government reportedly cover a considerable proportion of injury costs [15, 27]. The National Health Insurance Scheme was introduced in Nigeria recently and currently, those enrolled are mostly in formal sector employment. Hence, majority of the population still pays for health care out-of-pocket.

About 17% of the injured commercial motorcyclists we studied were unable to return to work until more than a month post-crash. This is comparable to findings by Julliard *et al,* who reported that about 19% of those involved in road crashes were unable to work for more than a month after the incident [16]. In our study, the mean number of days away from work was 9, with a median of 14 and range of 1 to 150 days. Mock, Forjuoh and Rivara reported mean days of disability of 14.8 ± 11.9 and 10.5 ± 4.7 for crashed motorcyclists in urban and rural areas of Ghana respectively [15]. Differences in days away from work among injured motorcyclists would be as a result of differences in injury type and severity. Other factors such as the underlying health status of the crash victims, and other socio-economic factors affecting the period of convalescence might have contributed to the number of days of disability. The longest number of days away from work in our study was reported by a commercial motorcyclist who obtained treatment from traditional bone setters. Literature on the period of convalescence for treatment of fractures obtained from unorthodox health care providers is however limited.

It has been estimated that the indirect costs of injury could be as high as two and a half to seven times the direct costs [28]. This was similar to our study findings as median productivity costs lost by the respondents was about three times the treatment costs. This further emphasizes the far-reaching economic effects motorcycle injuries have especially in Nigeria where the GDP per capita between 1995 – 2005 was $ 320.00 and about 71% of the population were reportedly living on less than 1$ per day [29].

Conclusion

The study showed that costs from motorcycle crashes were considerable and productivity costs lost much more than treatment costs. Generally, efforts to prevent road crashes from occurring need to be intensified in order to reduce the health, social and financial implications of road crashes. Also, more efforts should be put in place to include those in the informal sector in the NHIS. This group of people tend to be worse hit when they incur unexpected health care costs as occurs following a road crash. An injury registry which documents mild, moderate and severe injuries needs to be established so that comprehensive costs can be computed. This would provide data necessary for advocating for evidence-based injury prevention interventions and also enable such interventions to be properly evaluated. A longitudinal study commencing from presentation of crash-involved riders in the hospital and following them up till they resume at work would also provide a comprehensive picture of economic costs of injury among riders who present in hospital as this would also capture mortalities.

Limitations

The study obtained costs of injuries associated with mild to moderately severe injuries. Information on minor injuries is often missed by studies which utilize hospital-based data and police records. However, information on motorcyclists who sustained permanent disabilities that resulted in them changing their occupation or who died as a result of injuries sustained could not be elicited. In addition, data on reported helmet use by the motorcyclists at the time of the crash was obtained.

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