

COSTING OF INJURIES: ANALYSING THE ECONOMIC BURDEN OF INJURIES IN AN URBAN COMMUNITY IN SOUTH-INDIA**Chalageri H Vani¹, Nandagudi S Murthy^{2*}, Suradenapura P Suryanarayana², Nandakumar S Bidare²**

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Date of Submission : 01-02-2018**Date of online Publication** : 18-04-2018**Date of Acceptance** : 18-04-2018**Date of Print Publication** : 30-06-2018***Author for correspondence:** Dr. Nandagudi S Murthy, Professor of Biostatistics and Research Co-ordinator. Community Medicine, M. S. Ramaiah Medical College, Bengaluru. Pin: 560054. E-Mail: chinav.vani@gmail.com**Abstract**

Introduction: Injuries have become a costly affair in many nations and in India burden of injuries are rising. It can be assessed in terms of morbidity, mortality and currently through economic burden studies. Very few studies have been done to assess the economic effect of injury at household level. So the present study was done to assess the costing of injuries on the family at the community level in an urban area of Bangalore. **Methodology:** A cross section study was conducted in Bangalore on 3003 population through multi stage sampling technique. Details of moderate and severe injuries were collected and their expenditure details were also collected. SPSS 18 was used for analysis. Chi square test, Mann Whitney U Test and Kruskal Wallis test were used to assess the statistical significance. **Results:** Reported moderate to severe injuries were 148. Average cost per injury was Rs 25360 while direct cost was Rs 14825 and indirect cost was Rs27354. Total cost was high among males (P=0.035). The direct, indirect and total costs were high for elderly injured (≥ 60 years). All three costs were significantly high among 15-59 year age group, those who met with severe injuries and road traffic accidents. Among the lower socio economic status the indirect cost was high. **Conclusion:** Economic burden of injuries on the family was high in the urban community of Bangalore. Road traffic accidents and severe injuries accounted to higher expenditure. Injury among geriatrics resulted in higher economic burden on the family.

Key-words: injuries, costing, community, road traffic accidents, geriatrics**Introduction**

Injuries have become a costly affair in many nations¹ and currently even in India the burden of injuries is rising due to epidemiological transition. In 1990s injuries accounted to 8.6% of DALYs and 8.5% of total deaths while in 2016 it accounted to 11.9% of DALYs and 10.7% of deaths. Among the various injury types road traffic accidents and suicide have contributed significantly to disease burden.² According to global burden of disease; road injury stands 13th rank among the leading cause of age standardized rates of DALYs in 2010 while falls account to 15th rank.³

Whether a developing country or a developed country the burden of communicable disease in terms of Disability Associated Life Years (DALY) declines with age; while that of non communicable disease increases with age. But with injuries it is an inverted U shaped curve indicating that injuries affect the prime age group of 5-44 years. In general the communicable disease and non communicable disease are high among females but injuries are high among males.⁴

Burden of injuries can be measured in terms of mortality and morbidity. Economic impact of injuries can be assessed at macroeconomic and microeconomic level. Microeconomic level includes the households (i.e impact on household income or consumption pattern and overall expenditure by the family on the injured including medical and other expenses), firms, (impact of injury on the company's operating cost, output, profit and sickness absenteeism) and government (social security payments applicable for injuries could be diverted to control or prevent other disease of public health importance). Macroeconomic level is at society level i.e impact of injuries on Gross Domestic Product.⁵

Current trend now followed is to assess the severity of injury through economic burden studies like costing of illness.⁵ Cost of illness methodology includes direct cost and indirect cost. Direct costs include medical (hospital inpatient/outpatient, transport/ambulance, physician charges, drugs, rehabilitation charges, laboratory tests and counselling) and non-medical (policing and imprisonment, legal services, foster care and private security) while indirect costs include tangible (loss of productivity, lost investments in social capital,

life insurance and indirect protection, macroeconomic) and intangible costs (health-related quality of life i.e pain and suffering, psychological and other quality of life (reduced job opportunities, access to schools and public services, participation in community life).⁶

Following an injury in a family, the injured person reduces their productive activity (may be paid or unpaid) while there is increased consumption of health services and may reduce the consumption of non health goods and services like on clothes, social activities at household level. Some may try to balance the household expenditure by liquidating household assets like cash savings or through loans.⁵ So the economic burden of injury on the family includes the direct expenditure for travelling to and fro to hospital, hospital charges (inpatient/outpatient/rehabilitation/physiotherapy charges) and indirect wages lost due to absence from work and additionally the loans borrowed or the properties sold.

Once the economic burden of injuries has been assessed, we need to focus on injury prevention. Field of injury prevention is heterogeneous and urgently requires economic evaluation studies based on the state of the art method. Applying economic evaluation studies in the injury prevention can be fruitful if the methods used are in harmony with the methods used for other public health issues. These studies assess the outcomes and costs of interventions designed to improve health. Also they do play an important role in setting priorities for injuries compared with other public health issues and compared within the domain of injuries. Thereby they guide policy-makers in making decisions to select cost effective injury prevention policy. Decision-makers commonly identify the usefulness and need for published economic evaluations. However, the actual use and knowledge of economic analysis are limited in injury prevention.⁷

These economic burden studies help to identify the possible solutions to reduce the cost of disease through appropriate prevention and treatment strategies. Very few studies have been done to assess the economic effect of injury at household level. So the present study was done to assess the costing of injuries on the family at the community level in an urban area of Bangalore.

Methodology

A cross section study was conducted in two BBMP ward number 17 and 36 during June 2012-March 2013 to assess the pattern of injuries and its socio-economic impact. The methodology has been explained elsewhere in detail.⁸ The present study focussed on costing of injuries. Estimated sample size was 2857 while totally 3003 population was covered by applying multi stage sampling technique. Initially screening questions were asked at every household to assess the presence of injury in the past one year. Only moderate (defined as any injury resulting in partial or complete incapacitation of the injured person lasting from 3rd day to 13 days in the

past 12 months) to severe injuries (defined as any injury resulting in partial or complete incapacitation of the injured person lasting ≥ 14 days (≥ 2 weeks) or resulting in permanent disability/coma/death in the past 12 months) were included in the present study. Among those moderately and severely injured people further detailed information was collected about the amount spent by the injured person or by the family for the healthcare costs (hospital, drugs etc), travel costs, legal cost, funeral cost and miscellaneous etc. Also information about number of days not able to attend the work by the injured or school in case of children; along with the wages lost was also collected including that of caregivers wages lost due to absence from work in order to take care of injured. The amount borrowed or taken for loan and any properties sold to compensate for the amount needed to run the family was also collected. These information were cross verified by checking the relevant receipts, bills, discharge summaries and relevant documents.

Statistical analysis: SPSS 18 versions was used for analysis. Quantitative data were summarised through descriptive measures like mean with standard deviation (SD); median with inter quartile range (IQR). Chi square test, Mann Whitney U Test and Kruskal Wallis test were used to assess the statistical significance. Ethical clearance was taken from the institutions ethical committee. Also consent from the families and the injured people to conduct the study were also collected.

Results

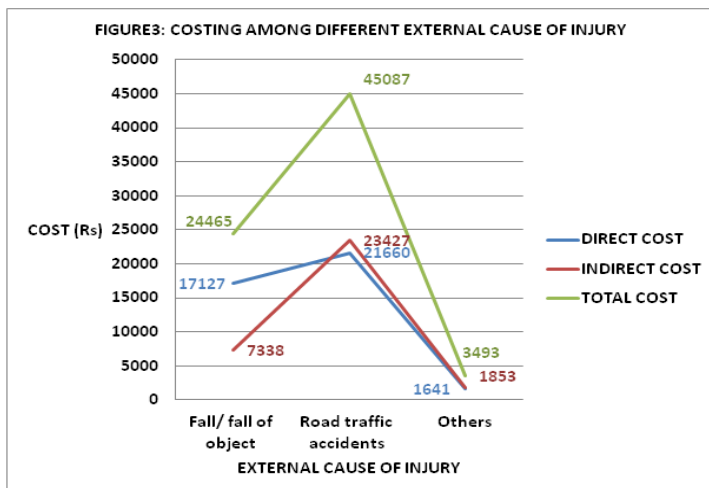
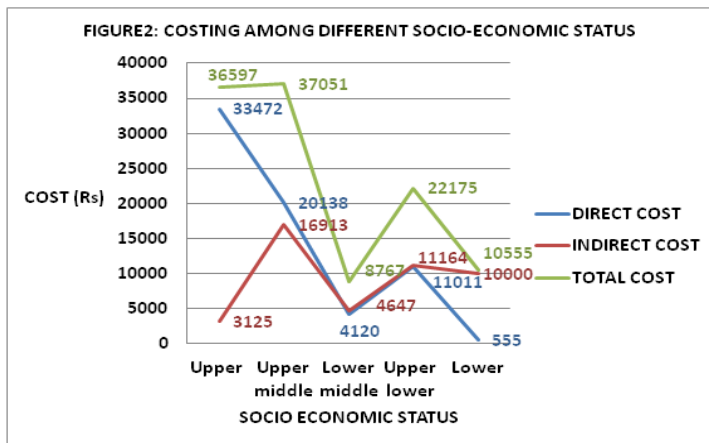
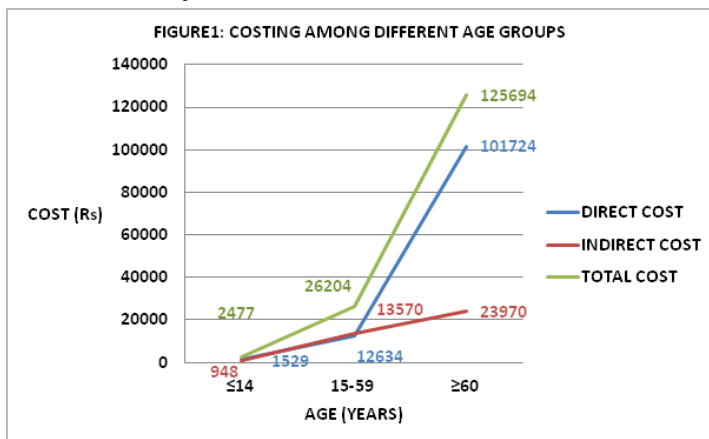
In our study out of 3003 population surveyed 148 moderate to severe injuries were reported. Average cost per injury was Rs 25360 while direct cost was Rs 14825 and indirect cost was Rs27354. The median (IQR) cost of injury was Rs 2250 (855-11304); minimum & maximum value being Rs50 & Rs500000 (Table 1)

Table 1: Economic assessment of moderate to severe injuries

| Details | Average cost per injury (Rs) | Median (IQR) (Rs) | Minimum & maximum value (Rs) |
|--|------------------------------|----------------------|------------------------------|
| Direct cost | | | |
| Medical cost (148) | 11431 | 1150 (400-3962) | (50-270000) |
| Non medical cost (100) | 5024 | 400 (200-1875) | (30-230000) |
| Total direct cost (148) | 14825 | 1500 (500-4913) | (50-500000) |
| Indirect cost | | | |
| Wages lost by injured/caregiver (49) | 16737 | 5500 (750-10500) | (100-215000) |
| Property sold or loan amount borrowed (37) | 19976 | 5000 (2000-10000) | (200-200000) |
| Total indirect cost(57) | 27354 | 7500 (2000-17500) | (100-264000) |
| Grand total cost (148) | 25360 | 2250 (855-11304) | (50-500000) |

One US dollar = Rs 54.65 (2012-2013)

Figure 1 indicated that the direct, indirect and total costs for <14years was less and too high for >=60 years. Socio economic status was assessed through Modified Kuppaswamy's classification.⁹ From figure 2 we observed that upper the socio economic status higher the direct cost and total cost while the indirect cost was not much affected. Among the lower middle (48) group all three i.e direct, indirect ad total cost were low in-spite of many people belonging to this group. While in the lower socio economic status the direct cost was low but the indirect cost was high. From figure 3 we can interpret that among the various external causes of injury, road traffic accidents (RTA) accounted to increased direct, indirect and total cost. Figure 4 shows that severe injuries had high direct, indirect and total cost compared to moderate injuries.



and this was significant (P=0.035). All three i.e direct cost (P=0.001), indirect cost (P=0.022) and total cost (P<0.01) were high among 15-59 year age group. While high direct cost was observed among upper socio economic status. Among the various types of injuries, all three i.e direct cost (P=0.017), indirect cost (P=0.04) and total cost (P=0.004) were high among Road traffic accidents and the final cost being Rs 10000 (935-50625). Direct cost (P<0.01), indirect cost (P=0.003) and total cost (P<0.01) were high among the severely injured and were found to be statistically significant (Table 2).

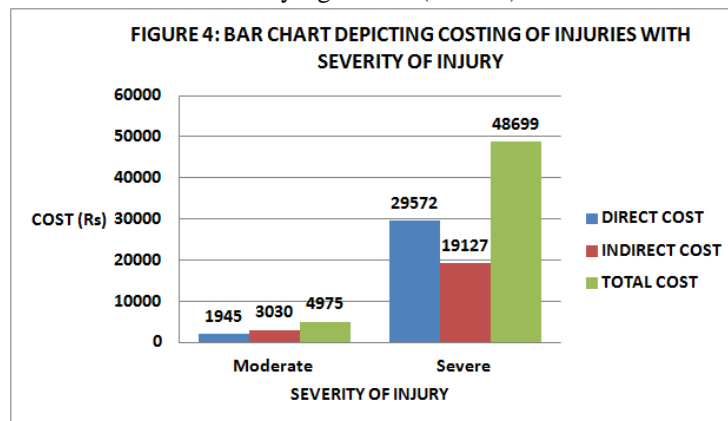


Table 2: Costing of injuries among various variables

| Variables | Total direct cost | Total indirect cost | Final cost |
|---------------------------------|-------------------|---------------------|-------------------|
| | Median (IQR) (Rs) | Median (IQR) (Rs) | Median (IQR) (Rs) |
| Gender | | | |
| Males (99) | 1735 (600-7200) | 0 (0-7500) | 3000 (950-17100) |
| Females (49) | 1250 (380-2650) | 0 (0-1117) | 1550 (600-5775) |
| Mann Whitney U Test | P=0.113 | P=0.115 | P=0.035 |
| Age (years) | | | |
| ≤14 (43) | 850 (250-2500) | 0 (0-500) | 1000 (350-2800) |
| 15-59 (96) | 2000 (638-7925) | 0 (0-8850) | 3625 (1500-17325) |
| ≥60 (9) | 1500 (450-204550) | 0 (0-367) | 1500 (610-312050) |
| Kruskal Wallis test | P=0.001 | P=0.022 | P<0.01 |
| Socio-economic status | | | |
| Upper (16) | 2900 (1050-7525) | 0 (0) | 2900 (1050-7525) |
| Upper middle (61) | 2000 (600-7850) | 0 (0-4750) | 2550 (835-15900) |
| Lower middle (48) | 1000 (405-3700) | 300 (0-4450) | 1868 (738-9243) |
| Upper lower (21) | 1000 (335-2425) | 500 (0-7650) | 1750 (450-9215) |
| Lower (2) | 555 (310-800) | 10000 (0-20000) | 10555 (310-20800) |
| Kruskal Wallis test | P=0.021 | P=0.053 | P=0.668 |
| External cause of injury | | | |
| Fall/ fall of object (73) | 1500 (600-4050) | 0 (0-2500) | 2250 (1000-7750) |
| Road traffic accidents (41) | 1800 (575-19500) | 0 (0-13050) | 10000 (935-50625) |
| Others (34) | 1000 (340-2200) | 0 (0-750) | 1450 (378-3900) |
| Kruskal Wallis test | P=0.017 | P=0.040 | P=0.004 |
| Severity of injuries | | | |
| Moderate (79) | 800 (310-1600) | 0 (0-600) | 1200 (400-2500) |
| Severe (69) | 4000 (1450-12150) | 0 (0-11750) | 9100 (2400-24300) |
| Mann Whitney U Test | P<0.01 | P=0.003 | P<0.01 |

Discussion

In our study the number of people injured in the age group of >=60 years was 9 while <=14years were 43. Though the number of injured were high among the lesser age group the overall expenditure was less when compared to injury expenditure among the elderly. So injury among the elderly resulted in higher expenditure. Probable reasons may be severity of injuries, longer duration for healing of injuries and associated co-

The total cost was high among the males Rs3000 (950-17100)

morbidities and complications followed by long term rehabilitation services.

We observed that those belonging to upper socio economic status their medical expenditures were high (i.e direct cost=Rs33472) while the wages lost or property sold (i.e indirect cost = Rs3125) were minimal. But those belonging to lower socio economic status the direct cost (Rs 555) were low probably due to availability of free service or subsidised services at government hospitals or may be these people were not affordable for high medical expenditure; while their indirect cost was high (Rs10000). The total monthly income of those injured belonging to lower socio-economic-status was median (IQR) Rs12500 (4000-21000) while that of upper socio-economic-status was Rs 65000(37500-115000). It implies that rich were affordable to pay for the injury without much affecting on their income. But those belonging to lower status had to lose their daily wages due to injury and were comparatively spending much less for treatment.

Figure 3 indicates that among various types of injuries, road traffic accidents accounted to higher economic expenditure which included both direct and indirect costs. So the government needs to address this issue and take necessary actions to prevent or reduce the burden of RTA and also provide financial assistance

The final cost was high for males compared to females since males were more injured in number, their work being outside the house the number of falls and RTA were high among them and also being an earning member of the family the indirect cost was also high. All three i.e direct cost, indirect and final cost were high among the 15-59 year age group since they are the working group being prone for injuries at workplace or on roads while travelling. Being the only earning member of the family (in certain families) the indirect cost was also high and their by the final cost. Among the various external cause of injuries road traffic accidents (41) had high direct cost since the medical expenditures of fracture/strain/sprain following RTA are high. The indirect cost for RTA was also high since such injuries needed atleast 6-8 weeks of rest thereby preventing from going to work thereby resulting in loss of wages. Hence the final cost was significantly high for RTA ($P=0.004$). It was observed that more severe the injuries greater was the direct, indirect and total cost. Probable reasons being severe injuries need prolonged inpatient service or constant medical services for a longer duration their by increasing the direct cost. Severe injuries require more time to recover back to normal thereby affecting the work and thereby the income, as a result the indirect cost gets elevated. Also in our study 9 people lost their jobs due to injury, among which 8 of them had sustained severe injuries which was found to be statistically significant ($\chi^2=6.9$, $P=0.03$). So over a period of time severe injuries do have long term economic consequences.

No studies were available on costing of injuries at the community level. However hospital based studies

and individual injuries like road traffic accidents costing were available. The same has been discussed below.

A survey conducted in five states of India during 1986-87 showed 1100 injuries of hospital based treatment and 615 injuries of non hospital based treatment. The public provider's share was high for hospital based treatment of injuries both in rural and urban areas. They found that the cost difference between public and private providers narrowed down with the severity of injury. Also found that the burden on households was higher for treatment of injury when compared to any other illness.⁴

A study was conducted in Hyderabad, India to know the out of pocket expenditure for road traffic accidents (RTA) during 2005-06. RTA reported alive or dead at emergency department of selected public and private hospitals were included in the study. Injury details were collected and follow up for 6 months was done. Information regarding medical and non-medical expenditure was collected in detail. The out of pocket expenditure (median values) medical and non medical were USD 170 and 162 respectively. The medical expenditure was 4 times high in private hospital and non medical expenditure was high in public hospitals. Prevalence of distress financing was 69% (95% CI 65.5-72.3) and was found to be high among those reporting to public hospitals and also among those belonging to the lowest per capita annual household income quartile.¹¹

A prospective cohort study was conducted in Chandigarh during the year 2013, where 220 patients admitted in the trauma centre were included in the study and followed up subsequently at 1, 2 and 12 months to assess the economic burden of hospitalisation following injuries. The average out of pocket expenditure per hospitalisation and up to 12 months post discharge was USD 388 (95% CI: 332-441) and USD 1046 (95% CI: 871-1221) respectively. Road traffic accidents accounted to 60%. They found that catastrophic expenditure was significantly higher among those belonging to the lowest income quartile ($P<0.01$). They found that injury treatment incurred high out of pocket expenditure and thereby resulted in significant economic burden to the family.¹²

A study conducted in Ghana to assess the economic consequence of injuries using cluster sampling technique, 21105 persons were interviewed both from urban and rural areas. It was found that the treatment costs and disability days following injury were high in urban than in rural areas. Most common coping strategy was intra-family labour reallocation. Borrowing money was more common among rural than in urban areas. There was decline in food consumption among rural households by 28% and 19% in urban areas. Money spent (mean (SD)) on injury treatment in urban and rural area respectively was US\$ 31(105) and 11(58) while the amount borrowed was US\$ 66(98) and 22(43). The primary effects of injury were more severe in urban area while the overall effect of injury (in terms of family food production and consumption and family income decline)

on the household was more severe in rural areas. They also found that the amount spent for severe injury was US\$ 55(150) and for minor was US\$ 6(13) and P value<0.001.¹³

During data collection respondents would have either over-estimated or under-estimated the expenditure occurred following injury. This response bias was reduced by cross checking the bills, receipts and other relevant legal documents.

Conclusion: Economic burden of injuries was high in the urban community of Bangalore. Road traffic accidents and severe injuries resulted in greater expenditure by the individual and by families. Injury among geriatrics resulted in higher economic burden on the family.

Recommendation: Based on our study, we would like to recommend taking necessary actions and steps to first prevent injuries, followed by efforts to reduce their severity. Make provision for health insurance or some kind of financial support specially those belonging to lower socio economic status till they recover from injury. If necessary vocational rehabilitation may also have to be provided (for those who have lost the job or physically not capable of doing the job which they were able to perform previously) to ensure that they will have a continuous source of income to maintain the family. Among various injuries economic burden of road traffic accidents were high, so there is a need to reduce the burden of RTIs and also their severity. Financial assistance immediately post-crash and till the time they get back to normal is also necessary to reduce the financial burden on the family.

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