An Analysis of the Economic Burden of the Trauma Services at a Level 1 Public Sector Trauma Center in South Asia

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Abstract

Background: Incidence of road traffic injuries (RTIs) is increasing and accounting for country’s 3% gross domestic product. It is crucial to perform a cost analysis of trauma systems to allocate resources judiciously. Aim and Objectives: To study the economic burden of trauma care on the patient attending a level I trauma center including stratification of costs according to injury. Materials and Methods: This is a prospective study, with patients of polytrauma (Injury Severity Score >16) admitted in the center. Cost analysis (cost descriptive study) was done by calculating direct costs to hospital by bottom-up microcosting considering fixed and recurrent costs including reference unit prices (RUPs). According to the anatomical site of injuries, major injury groups (MIGs) costs were also analyzed. Results: The demographics including mode of injury were similar to other studies. The RUP’s and MIG’s were defined which represented majority of the sample size. Due to highly subsidized nature of services in this Government institute, the cost to patient is less compared to other countries. Still, the total expenditure incurred by the low-income group was higher than the minimum wages at that time. The creation of plausible RUP’s and the grouping of MIG’s can help in reducing the costs by targeting and implementing strategic cost reduction measures. Conclusion: The study has shown that microcosting is feasible. Considering the low-income population demanding trauma services, further efforts are required to reduce costs substantially.

Keywords: Major injury groups, microcosting, reference unit price, trauma

INTRODUCTION

Traumatic injury is recognized as a pandemic disease and is a serious growing global health issue[1] out of which India accounts for about 10% of road crash fatalities.[2] In 2015, 1.46 lakh people died on Indian roads costing Rs. 4.07 lakh crores, accounting for approximately 3% of the country’s gross domestic product (GDP). The incidence of death in 2011 figure translates into one death on Indian roads every 5 min and is expected to escalate to one death every 3 min by 2020[3] despite commitment by the government to reduce the burden.[4] There is a lack of injury-related economic data from Low and Middle Income Countries (LMICs) and a standardized approach is needed to further prioritize investment in injury prevention.[5] Since the resources for support of health programs are limited and finite, it is crucial to perform a cost analysis of trauma systems to judiciously allocate resources.[6,7]

Aim

To study the economic burden of trauma care on the patient attending a level I (considered as providing highest level of surgical care) trauma center (hospital, combined patients’, and caregivers’ perspective) including stratification of costs according to injury.

Settings and design

This study is a prospective bottom-up microcosting study at level I trauma center in India. It aims to perform the cost analysis of trauma care on patients admitted with Injury Severity Scale (ISS) ≥16. Each patient was prospectively followed up, till discharge/death. Patients brought dead were excluded. Demographics and mode of injury along with patient outcome were recorded. Then, stratification of cost was done as per ISS/New Injury Severity Scores (NISS) and major injury groups (MIG’s). The study period selected was 1 year (2011).

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The proportion of trauma patients admitted in the trauma surgery unit during the study period were 4930 out of total footfall of 49,894 in the emergency department.

**Materials and Methods**

Cost analysis can be performed from the perspectives of hospital, the fixed cost of a bed, and total cost incurred in treatment and from angle of the caregivers which would include direct medical and nonmedical costs, indirect costs.[8]

**Sampling**

The study center is a level-1 trauma center located in the capital city and catering around one-third of the country’s population. We choose a convenient sampling of 100 patients representing major trauma defined as ISS score ≥16. As we were not testing a hypothesis, random selection of 100 patients allowed us to do the calculations based on normal distribution. Cost to the patient was calculated using analysis of data obtained from interview comprising of targeted questions estimating expenditure under various heads such as admission, transportation, stay, and income loss.

The direct cost from hospital perspective includes capital costs, recurring costs, and ongoing costs during treatment broadly classified as fixed and variable costs. The fixed costs included capital costs, equipment costs, and recurring costs which included salaries, overheads such as cost of electricity, laundry, and consumables from various stores. The variable costs vary from patient to patient depending on type of treatment required. Considering capital costs of building, the establishment of infrastructure, and fixed assets present in the unit were considered. The capital costs of building have been taken as per specifications and detailed analysis of cost per square meter of construction, as per the CPWD manual (Central Public Works Department, India). The total land area was multiplied by rate per square meter of the area (considering the cost index in the year 2012). It was estimated that the “useful” life year of building would be 100 years and therefore an annual depreciation of 1% would be reasonable estimation of annual cost of building. These capital costs include fixtures for plumbing work, electrical work, and firefighting alarm. Since the land area for the wards has been provided by the Government of India at a highly subsidized rate, its cost has not been taken into consideration. The capital costs also included permanent fixtures and surgical fixed assets which were calculated by adding 10% depreciation and annual maintenance cost at 5% per year assuming the useful life period as 7 years per equipment.

The details of costs under the head “salaries” have been calculated based on the proportion of actual human resource utilization (man-hours) of various personnel working in areas providing direct patient care. For example, consultant’s daily cover is given by a team of one professor and five assistant professors. Since the rotations of rounds among consultants are heterogeneous, an average of the salary based on the said proportions of consultants is taken. Referrals are sent to other departments of the center which feeds into the salary contribution to fixed costs. On an average, referrals are sent for 20 patients/100 trauma surgery patients admitted. Hence, 20% of salary of other departments’ assistant professors and senior residents are considered. Further apportioning of 67% of this part makes their actual salary contribution of 13%. The assumption by apportionment of the salaries of clinical faculty, nurses, technical assistant, and housekeeping employees as depicted in Table 1.

Overhead costs of electricity including air-conditioning, laundry, water supply, and maintenance costs were calculated by the average consumption of electrical power of major equipment and electrical fixtures of the area. For consumables, these were obtained from the yearly supplies of crystalloid, medicine, surgical, and general stores as demanded by the inpatient area as per actual consumption and tender rate contracts. The costs for each item were divided as special or general. There would be generation of two major headings to a maximum feasible degree, in all cost categories (wherever feasible) into “general” and “special.” The costs subdivided into “general” category will be applicable to all patients admitted to the ward and would be used up in the calculation of fixed cost. Those costs subdivided into “special” category were levied only to patients requiring specific treatment.

**Principle for calculation of fixed cost of a bed per day**

Under the capital costs, the costs of land, building, fixed assets, and air-conditioning were categorized under the “general” category as a whole; whereas, those of equipment were subdivided into “special” category and “general” category. Similarly, under the recurrent costs, the costs of salary, electricity, laundry, general stores, and stationary stores were categorized under “general” category as a whole; whereas, those of the surgical stores and medical stores were subdivided into the “special” category and “general” category (microcosting method). Among the consumable items of medical and surgical stores, it is assumed that segregation of an item (e.g., gloves) into the “special” category (for estimating reference unit prices [RUPs]) correctly identified its usage in 90% of instances. Hence, only 10% of the total costs of the items under “special” category were used in the calculation of fixed cost of the bed.

**Principle for calculation of variable costs of a bed per day**

The resources consumed were mentioned under “special” category. To make a realistic and feasible estimate of these

| Table 1: Apportionment of the salaries of Hospital Staff |
|--------------------------------------------------------|
| **Category of staff** | **Type of patient care** | **Teaching and research (%)** |
|-----------------------|--------------------------|-------------------------------|
|                       | Direct (%) | Indirect (%) |                    |
| Faculty               | 67         | -             | 33                |
| Senior resident       | 67         | -             | 33                |
| Junior resident       | 50         | -             | 50                |
| Nursing staff         | 100        | -             | -                 |
| Technical assistant   | 100        | -             | -                 |
| Housekeeping          | 100        | -             | -                 |
measures, specific RUPs were created and it identified most of the potential areas where such variability could be created among admitted patients. The RUPs were subdivided into following categories: “procedure”, “investigations,” and “treatment”. The component utilization and costs of RUPs were made from direct observations and estimates obtained from administration. Since only prospective cases were enrolled during the study, a pro forma consisting of all possible RUPs was made and each tagged to the nursing record. The pro forma was filled on real-time basis. It was checked for consistency by the principal investigator and counter checked from the medical records and the nursing files. In addition to the RUPs mentioned in the charts, any additional usages of resources were also recorded. Since the center is a government funded nonprofit generating institution; the standard hospital charges levied to patients admitted in wards were used.

The total fixed costs were arrived at by calculating the length of stay and multiplying it with the respective fixed costs of the bed. The total variable costs of the individual patients were calculated by summing up all the RUPs of the respective patients till the time of discharge of the patient.

**Costs to the patients**

After taking consent, costs incurred to patients was calculated by direct interview and categorized as direct medical costs which included hospital admission fees, costs for medications (included prosthetic, grafts, and specialized dressings purchased from private health caregivers), and investigations and others (included incentive spirometers, steam inhalers, and other devices required for treatment of patients). The direct nonmedical costs to the patient were hospital visit (cost of travel), food expenditure per day, costs involved in self-care of the attending relative (per day), and expenditure incurred due to additional help at home. Indirect costs included income lost by the patient and family members and charges incurred to reach trauma center from the geographical injury site. The socioeconomic status was calculated using Kuppuswamy’s Socioeconomic Status Scale (KSES).

**Stratification of costs**

The various costs were categorized in two ways. Firstly, according to the severity of injuries based on the Injury Severity Score (ISS)/New Injury Severity Score (NISS). This stratification allows one injury with an Abbreviated Injury Score (AIS) score of 4 in the first category and one injury with an AIS score of 5 in the second category. Second, according to the anatomical site of injuries, major injury groups (MIGs) which were based on the primary and secondary anatomical location of injuries (anatomical regions defined by the six regions described in scoring of AIS). Primary anatomical location is taken as one which is necessitating urgent admission at the time of presentation and secondary location was taken as equally important but not life-threatening and to be tackled after taking care of primary anatomical injury.

This study was cleared by the Institute Ethical Committee.

### Results

A total of 100 patients were enrolled in the study. Table 2 shows the demographic characteristics of the sample.

Most of the respondents, 78% were male and mean age of the participants was 29.61 years, where 71% were of patients in economically productive age group (19–50 years). Maximum number of patients had road traffic injury (58%), while 32% of patients had suffered unintentional injuries (92% of which were fall from height). Most of the injured patients had sustained injuries as blunt force (92%) and maximum were discharged. ISS values for the injured patients ranged 16–40 with a median value of 18 (SD=±4.1). NISS values for the injured patients were in the range of 16–50 with the median value of 20 (SD=±6.4). Majority of patients had injuries with ISS/NISS in range of 17–25.

Since patients with ISS ≥16 were enrolled in the study, most (79%) of them had injuries involving more than one anatomical region. 21% patients had severe enough injuries in single anatomical region such as abdomen (n = 64), chest (n = 48), head (n = 38), and extremities (n = 31). The length of stay of each patient ranged from 1 to 60 days with median stay (average length of stay [ALOS]) of 12.5 days (SD=±11.7 days) and 84% of patients underwent at least one surgical procedure. The mean cost of trauma care per person was Rs. 136529.7 (+79852.3).

Considering the ALOS, the cost of trauma care per patient per

| Table 2: Epidemiological and Socio-economic profile of the study group |
| --- |
| **Characteristics** | **Percentage** |
| **Gender** |  |
| Male | 78 |
| Female | 22 |
| **Age group (years)** |  |
| 1-10 | 10 |
| 11-18 | 11 |
| 19-50 | 71 |
| >50 | 8 |
| **Mode of injury** |  |
| Road traffic injury | 58 |
| Unintentional | 32 |
| Assault | 9 |
| Suicidal | 1 |
| **Type of injury** |  |
| Blunt | 92 |
| Penetrating | 8 |
| **Patient outcome** |  |
| Discharged | 91 |
| Death | 9 |
| **Income group (range) (Rs.)** |  |
| Group 1 (15188-30374) | 18 |
| Group 2 (1521-4555) | 23 |
| Group 3 (4556-7593) | 30 |
| Group 4 (7594-11361) | 17 |
| Group 6 (11362-15187) | 12 |
| Group 10 (15188-30374) | 18 |
day in a tertiary setting would be approximately Rs. 10,922. The mean direct costs to the hospital were Rs. 123067.7 (±74028.7). The mean direct and indirect costs incurred by the patient and caregivers per patient were Rs. 13420.4 (±14998.7).

**Costs as per hospital perspective**

**Contribution of fixed costs and variable costs per bed**

The fixed cost of the bed constitutes 75.9% of the total cost incurred by hospital and the RUPs created for the study as in Figure 1 accurately identified 86.6% (of the remaining 24.1% of the hospital costs) of the variable costs.

**Analysis of various reference unit prices**

The contribution of procedural, investigational, and treatment costs constitute 1.9%, 5.9%, and 13%, respectively. The procedural costs are insertion of the Foley catheter, central line, endotracheal tube, intravenous catheter, intercostal drainage (ICD), orogastric tube insertion, and suction. Among these, the central line insertion contributed to the maximum, that is, 61% of the total hospital costs followed by ICD insertion which was 9.3%. Among investigations, these were broadly grouped into imaging and blood investigations. The imaging services constituted 37.5% of total investigation cost and blood investigations constitute 68.9% cost. Among imaging modalities, contrast-enhanced computed tomography (CECT) scan contributed to the maximum and non-CECT scan about 18%. Among blood investigations, liver and renal function tests and acid-blood gas analysis shared almost equal cost, about 18% each. Median days for occupancy of ventilator bed are 5 days among the patients requiring mechanical ventilation. Using the microcosting model, the median cost due to ventilation per se constituted 2.3% of the total median hospital cost among these patients. The treatment costs were broadly grouped into surgical (35%), pharmacological (50.4%), mechanical ventilation (2.9%), and blood transfusion (11.7%).

**Analysis based on Injury Severity Score and New Injury Severity Score**

The cost of trauma care under various injury score categories with their respective median length of stay is as depicted in Tables 3 and 4.

On analyzing the data it was observed that the costs across the different categories varied widely. Furthermore, within a given category, there are wide ranges of both the costs and duration of hospital stay.

**Analysis based on major injury groups**

The patients were grouped under same MIG if they had similarities in final injury diagnosis, requirement of ventilation or surgical procedure, and hospital length of stay. This classification resulted in a reasonably homogenous case-mix category and inclusion of 86% of patients as depicted in Table 5.

**Costs to the patients**

Approximately 63% of patients seeking care were above or equal to middle class (class III) and income in this group correlated with the socioeconomic status. In the socioeconomic status in lower class (class V), the monthly income varied widely with KSES. The average cost incurred to the patient per day was Rs. 1165.1 INR. Among this, the median direct medical costs were Rs. 5993.91 INR, direct nonmedical costs Rs. 1180 INR, and indirect costs were Rs. 6250 INR. Since some of the drugs and consumables are provided by the center to the patients free of cost and are charged a nominal amount of Rs. 37.5 INR/day for bed, large share of direct medical costs incurred to patients were those related to purchase of vacuum-assisted closure (VAC) dressings, grafts, prosthetic’s, and investigations done later during admission, as depicted in Figure 2.

**Income loss**

Overall, 74% of patients and caregivers reported an income loss which for 63% of total patient costs and was maximum in the lower income group (<Rs. 7593 per month), wherein it contributed to 71% of the total patient expenditure as shown in Figure 3.

**Subsidy by the government**

The total costs to patients were 12% of total (hospital and costs to patients/caregivers) costs. Hence, the caregivers had to pay approximately 88% less for treatment. If only the direct medical costs to patients were considered, the rate of subsidy to patients was 96%. Hence, the hospital charged only 4% of the total costs.

**Residential status**

Nearly 36% of patients were not residents of Delhi and preferred to stay at the hospital provided dharmshalas meaning “guest houses maintained by various organizations on nonprofit base.” Hence, costs involved in travel were noncontributory to the direct nonmedical costs (excluding one-time cost to bring patient from geographical trauma site). However, the costs of food were high and accounted for 15% of the total direct (medical and nonmedical costs). The latter fact is important since it involves direct out of the pocket expenditure to the patients, on a daily basis.

**Discussion**

Among the two methods of calculating direct cost, the microcosting approach is considered as the “gold standard.” [9]
Multiple injuries often require capital costs. This proportion was similar to previous costing studies in community hospitals. The mean cost of tertiary trauma care per day per patient is higher in our setting as compared to other hospital in North America. The characteristics of the study patients were similar to those of previous studies. The patients were predominantly young male (between 19 and 50 years).

The mean cost of acute trauma care clearly need to focus on such cost drivers, the potential for significant cost savings is limited by the mere fact that only 30% of total costs are variable and hence amenable to change, prolonged ICU, and hospital stay. The findings in this study were consistent in identifying a clear relationship between the severity of polytrauma injuries observed and overall treatment costs.

## Table 3: New Injury Severity score wise stratification of cost

| NISS group | Number of patients (n) | Median length of stay (range) (days) | Median hospital cost (range) (in Rs.) | Median cost incurred by the patient (range) (in Rs.) | Median total cost incurred in trauma care (range) (in Rs.) |
|------------|------------------------|-------------------------------------|-------------------------------------|--------------------------------------------------|--------------------------------------------------|
| 16         | 24                     | 12.5                                | 97270.2 (33063.0-238507.5)           | 7985.03 (0-21875.0)                               | 103560.2 (41845.5-260382.5)                      |
| 17-25      | 61                     | 12.0                                | 107051.5 (18042.5-431779.7)          | 10475.0 (2062.5-109191.7)                          | 125079.4 (20746.7-433842.2)                      |
| 26-75      | 15                     | 13                                 | 84813.8 (15048.7-269234.7)          | 7325.0 (0-63383.3)                                | 90818.8 (20486.2-276559.7)                       |
| Total      | 100                    | 12.5 (1-60)                         | 102991.7 (15048.7-431779.71)        | 8628.75 (0-109191.7)                               | 114789.8 (20486.2-433842.2)                      |

NISS: New Injury Severity Score

## Table 4: Injury Severity score wise stratification of cost

| ISS group | Number of patients (n) | Median length of stay (range) (in days) | Median hospital cost (range) (in Rs.) | Median cost incurred by the patient (range) (in Rs.) | Median total cost incurred in trauma care (range) (in Rs.) |
|-----------|------------------------|----------------------------------------|-------------------------------------|--------------------------------------------------|--------------------------------------------------|
| 16        | 45                     | 12                                    | 92259.9 (15048.7-431779.7)          | 7857.5 (0-109191.7)                               | 100079.0 (20486.2-433842.2)                      |
| 27-25     | 51                     | 13                                    | 107051.4 (19452.4-309931.9)         | 10532.5 (0-61925.0)                               | 123586.3 (21489.9-340405.6)                      |
| 26-75     | 4                      | 18                                    | 147073.0 (80363.0-269234.7)         | 8257.9 (6671.8-63383.3)                            | 183360.0 (87032.8-276559.7)                      |
| Total     | 100                    | 12.5 (1-60)                           | 102991.7 (15048.7-431779.71)        | 8628.75 (0-109191.7)                               | 114789.8 (20486.2-433842.2)                      |

ISS: Injury Severity Score

## Table 5: Costs pertaining to some of the common major injury groups

| Primary injury location | Secondary Injury location | Number of patients (n) | Median length of stay (in days) | Median hospital cost (in Rs.) | Cost incurred by the hospital per day (in Rs) | Median cost incurred by the patient (in Rs) | Median total cost incurred in trauma care (in Rs) |
|------------------------|---------------------------|------------------------|--------------------------------|--------------------------------|----------------------------------------------|---------------------------------------------|--------------------------------------------------|
| Head                   | Chest                     | 3                      | 9                              | 67599.56                        | 7511.062                                     | 5737.5                                      | 122666.4                                        |
|                        | Abdomen                   | 5                      | 20                             | 174779.9                        | 8738.995                                     | 10799.2                                     | 185579.1                                        |
| Chest                  | Head                      | 3                      | 11                             | 90801.7                         | 8254.7                                       | 6370                                        | 99645.7                                         |
|                        | Abdomen                   | 9                      | 11                             | 94828.9                         | 8620.809                                     | 5250                                        | 100079                                         |
|                        | External                  | 4                      | 13.5                           | 116057.5                        | 8596.852                                     | 8606.25                                     | 126190.7                                        |
| Abdomen                | Abdomen only              | 10                     | 9                              | 67572.1                         | 7508.011                                     | 7831.25                                     | 73984.6                                         |
|                        | Head                      | 14                     | 11.5                           | 100629.7                        | 8750.409                                     | 8247.9                                      | 108863.8                                        |
|                        | Chest                     | 12                     | 13                             | 99203.3                         | 7631.023                                     | 11577.9                                     | 108801.5                                        |
|                        | Extremities               | 8                      | 12                             | 102200.5                        | 8516.708                                     | 10293.35                                    | 110647.6                                        |
| Extremities            | Extremities only          | 7                      | 23                             | 136322.2                        | 5927.052                                     | 16508.3                                     | 152830.5                                        |
|                        | Head                      | 4                      | 17.5                           | 112210.4                        | 6412.023                                     | 11790                                       | 121613.8                                        |
|                        | Chest                     | 3                      | 20                             | 120725                          | 6036.25                                      | 26875                                       | 142594.8                                        |
|                        | Abdomen                   | 4                      | 38.5                           | 274233.8                        | 7122.956                                     | 21862.1                                     | 296790.7                                        |

Despite a number of European studies discussing the importance of trauma economics, the literature available is only limited. Acute trauma care costs have not yet been synthesized regarding the elements of care and characteristics of trauma injury that drive the total costs. A need to identify and define the key cost drivers has been documented. This study has attempted in defining the lacking data. Since the exhaustive microcosting used in this study included all components of the patient’s care, hence is more likely to be a true reflection of the cost.

For a representation of this study, the cost structure of the hospital was considered. The percentages for labor, material, and capital costs of the hospital were 42.2%, 27.5%, and 30.3%, respectively. The proportion for labor cost had the highest percentage (about 50%), followed by material and capital costs. This proportion was similar to previous costing studies in community hospitals. The mean cost of tertiary trauma care per day per patient is higher in our setting as compared to other hospital in North America.
India where this cost is Rs. 9585.\textsuperscript{[21]} The average direct cost per patient as per ISS/NISS was Rs. 1,147,89.8 INR, India’s per capital GDP in 2012 was Rs. 93,749.19 INR as per the World Bank Data. It clearly shows that costs outweigh the income. This is a consistent finding in other countries like Thailand.\textsuperscript{[13]} The mean medical and nonmedical expenditure is Rs. 4450 INR and Rs. 1745 INR, respectively. The mean indirect cost was Rs. 8396 INR. The medical expenditure is higher as suggested by other studies done in India.\textsuperscript{[22]} The transportation expenses are noncontributory in our case as there is facility for the attendants to stay at the “stay-in” temporary facility provided by the government (except one-time transportation from the geographical trauma site). This is not the case in other countries.\textsuperscript{[22]} It is also evident that burden of medical expenditure was highest in lowest per capital annual household income quartile than the highest income quartile.

Societal expectation that trauma centers should be equipped with the best technologies to achieve the optimal patient outcome\textsuperscript{[23]} should be based on evaluating the balance between costs and benefits of interventions.\textsuperscript{[24]} The challenge for critical care practitioners is to meticulously assess new innovations in therapy and to adopt the most efficient technologies that improve unit function, staff efficiency, and enhance patient outcome at a reasonable cost.\textsuperscript{[25]}

Our study, the first of its kind has created raw database of the various cost components. The RUPs generated can be used in an itemized model of costing to predict the total costs of care. More importantly, the study shows that microcosting of trauma care is feasible.

Measures to reduce costs can be as follows: to reduce the procedural costs, reduction of days of Total Parenteral Nutrition (TPN), development of indigenous central lines, and evidence-based standard best diagnostic and surgical practices would be required. Reduction of the investigational costs can be attained by investing money in equipment with known frequent utility value, avoiding unnecessary investigations, especially acid-blood gases. Costly equipment with lower rates of actual utility but with higher clinical utility shared from a common pool, which can be made sector wise in each region. The treatment costs could be curtailed by reduction of days on ventilation and the rational use of antibiotics. Furthermore, following best clinical practices such as use of emergency resuscitative measures, thorough handwashing, and avoiding unnecessary investigations would go a long way. This study is consistent with the findings of The REHABIL-AID project published in 2016, wherein the highest severity of injury leading to increased costs was in the central part of the body, considered as abdomen in our study.\textsuperscript{[26]}

Patient/caregivers costs could be ameliorated by providing a reasonable all comprehensive health insurance schemes, development of low-cost indigenous VACs, grafts, surgical and rehabilitative options, and provision of low-cost food. Employers should develop schemes to prevent wages loss during the hospital admission period. Finally, the cost reduction process should proceed in a logical, systematic manner with the assistance of formal economic studies of which cost-effectiveness analysis is one of the tools – it allows physicians to compare the financial consequences of different approaches to resource allocation.\textsuperscript{[27]}

In nutshell, recommendations for different stakeholders are as follows:

**Recommendation for hospital administration** –
1. Protocolized approach of most common injuries management
2. Stringent action to reduced infection-related burden
3. Promotion of research to invent customized low cost and low maintenance equipment.

**Government** –
1. Wider application of health insurance, especially in nonorganized sectors
2. Provision of local need-based health-care facilities to reduce burden of transportation
3. Financial data need to be taken into consideration for planning of trauma system.

**For general population** –
1. Preventive measures to avoid unexpected financial burden
2. Better utilization of stated sponsored support policies and insurance scheme.
Policy implications

The proposed data can provide a good insight into trauma-related financial burden on society compared to other communicable and lifestyle-related diseases. There is also need to analyze the effect of preventive measure promotion expenditure. Further such data to be generated from all level of health-care delivery system for better resources allocation.

Conclusion

There is increasing evidence of the substantial financial burden associated with RTI from various parts of the world, reinforcing the need for implementation of evidence-based and cost-effective strategies to reduce the burden of RTI as is also evident from the data presented in this paper.

Limitations of the study

The threat of selection bias does exist in the study as the samples were chosen as convenient. Although we have tried to minimize the bias by analyzing only major trauma patient prospectively, we cannot assess the impact of selection bias. The patient sample sizes in some of the MIGs are few to generalize. The costs of human resources based on the actual number of hours spent per shift per patient should have been considered. Due to subsidized nature of service, the true evaluation would be available only from a study from a private institute.

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Conflicts of interest

There are no conflicts of interest.

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