

## ORIGINAL ARTICLE

# A cost analysis of conservative management of spinal cord-injured patients in Nigeria

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**Study design:** A prospective study.

**Objectives:** To determine the cost of acute phase of injury (ASCI) among spinal cord-injured patients managed conservatively in Nigeria.

**Settings:** Gwagwalada, Abuja.

**Methods:** Over a 1-year period (1 January 2009 to 31 December 2009), the cost of ASCI of consecutive spinal cord-injured patients, gainfully employed preinjury, who paid the hospital bill directly from their purses and could estimate their daily income, and who were managed conservatively for 6 weeks before discharge to rehabilitation, was prospectively examined.

**Results:** A total of 34 cases of spinal cord-injured patients with a mean age of  $35.4 \pm 12.8$  years were included in this study. The mean cost of ASCI over 6 weeks was \$1598.29, an average of 6.4–232.8% of patients' annual income where > 50% of the people live on less than a dollar a day. The mean cost of hospitalization was 14.9% of the total cost of ASCI in this study. It was significantly more expensive to treat tetraplegics compared with paraplegics.

**Conclusion:** This study identified the cost of acute phase of spinal cord injury in Nigeria to assist clinicians in planning treatment that could reduce financial burden on the patients but optimize patients' care.

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**Keywords:** acute phase; spinal cord injuries; cost analysis; cost income quotient

## Introduction

In the developing countries such as Nigeria, spinal cord injury (SCI) registries are non-existent, and thus actual incidence cannot be quoted. The population-based rate of SCI over the last 30 years has remained stable at ~40–50 per million population in the developed countries.<sup>1,2</sup> With an average incidence of 11 000 cases year<sup>-1</sup>, resulting in an estimated 4 billion dollars of medical and supportive care costs, the human and economic costs of these injuries are substantial.<sup>3</sup> Many studies<sup>4–14</sup> have estimated the financial burden of injury to a patient, his family and the society in developed countries; however, few studies have focused on the financial burden of SCI in the developing countries.

The cost-of-illness method was used for this study,<sup>5</sup> which represents the most common method used in this type of study. The cost of injuries sustained in road traffic crashes is difficult to measure accurately.<sup>4</sup> Cost assessment can be

carried out using the society, healthcare provider or the payer, who may be the patients themselves, their employers or the insurance companies as models.<sup>6</sup> Analysis of cost from society's perspective is comprehensive and more expensive compared with analysis from the perspective of the patients.<sup>6</sup>

The treatment of traumatic injuries has always been very expensive, and places a heavy financial toll on patients.<sup>14</sup> This cost has been a source of increasing concern to physicians, patients and the government.<sup>14</sup> The hospital charges, although easily measured, are usually a small percentage of the total cost.<sup>10</sup> In this study model, the cost of injury included the direct and indirect cost. Direct cost is the monetary value of the diagnosis and treatment of injuries, whereas the indirect cost defined lost production resulting from cessation or reduction of productivity.<sup>4</sup>

In Nigeria, the official poverty rate is 57.8% with 70 million people living on less than a dollar a day.<sup>15,16</sup> Cost of treatment to the patient may be important in determining whether the patient seeks medical service from a particular hospital, maintain a continuing relationship with the hospital and recommend the hospital to others.<sup>4</sup>

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The objective of this study is to determine the cost of acute phase of injury (ASCI) among spinal cord-injured patients managed conservatively at the University of Abuja Teaching Hospital Gwagwalada, Nigeria. In our setting, there had been no previous study to determine the cost of ASCI. Our hypothesis is that the cost of ASCI would be a burden to the spinal cord-injured patient, and that it would be more expensive to manage the tetraplegic patients compared with the paraplegic patients in our setting.

## Materials and methods

This is a prospective study of SCI patients at the University of Abuja Teaching Hospital Gwagwalada, Nigeria from 1 January 2009 to 31 December 2009. The spine unit of this institution was established in the year 2009, and because of unavailability of equipment and trained manpower all SCI patients were initially managed conservatively. A policy of 6-week in-patient care during the ASCI was adopted for all the spinal cord-injured patients managed conservatively in our institution before discharge to rehabilitation.

This study covers only the ASCI because it is easier to monitor the spending pattern of the patients, and a majority of the patients are usually lost to follow-up after discharge because of lack of institutional rehabilitation facilities in Nigeria.

Inclusion criteria were economically independent, uninsured patients because health insurance has just been introduced in Nigeria and it does not cover patients with SCI and also those who gave informed consent to participate in this study. Patients with other concomitant organ-system trauma were excluded from this study.

Cost-of-illness method<sup>4-9</sup> was used to carry out this study; it involves calculating the direct and indirect cost of treatment. The total injury cost to a patient is the sum of direct and indirect cost. Direct cost includes hospital bills that were paid on discharge and hospital charges that were paid for on a cash-and-delivery basis. The hospital bill includes the cost of nursing/medical care, accommodation and bed charges. Other charges that were paid for on cash-and-delivery basis included drugs, laboratory charges and operative procedures. Indirect cost is the sum of income loss (daily income multiplied by 6 weeks of admission) and the cost of vehicular/motorcycle replacement or repair. The total cost is converted to dollar equivalent by dividing by 155 Naira (exchange rate during the study period). The estimated financial hardship of the injury on each patient was calculated by dividing his total injury cost by his annual income.<sup>5,8</sup> The estimated financial hardship of injury was multiplied by 100 for cost income quotient.<sup>4</sup>

The conservative treatment for cervical spine injury involved keeping patients in bed with decompression and alignment maintained by longitudinal traction with skull traction using the Gardner–Wells, Crutchfield calliper or Cone’s traction for 3 weeks; patients are then mobilized gradually over 3 weeks onto a wheel chair with a Philadelphia collar applied for additional 3–6 months. For thoracic and lumbar fractures, the patients were managed with

thoracolumbar brace in bed for 6 weeks and then discharged on the brace for another 3 months irrespective of the neurological status.

Bedsore can be prevented by changing the position of the patient frequently by involving the patient’s relative who usually stays with the patient. Deep-vein thrombosis is prevented using enoxaparin and warfarin as prophylaxis. Chest physiotherapy is instituted early to prevent pneumonia, and when it does occur antibiotic therapy is instituted. Intermittent catheterization helps reduce urinary tract infection, and this is taught to the patient as part of the health education of the unit.

Data extracted into a predesigned proforma were age, occupation and pattern of SCI. One-tailed, unpaired *t*-tests were performed to determine the significance between the treatment of paraplegics and tetraplegics. The effect sizes (Cohen’s *d*) were calculated for all comparisons to reduce the risk of type I and type II error. Statistical Package for Social Sciences 17.0 (SPSS Inc., Chicago, IL, USA) was used; *P* < 0.05 is significant. We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during the course of this research.

## Results

A total of 368 patients were admitted because of trauma and 52 (14.1%) of these patients sustained SCI. Six (11.5%) of these were dependants, four (7.7%) left against medical advice, eight (15.4%) died during the study period, with only 34 (65.4%) patients who satisfied the inclusion criteria recruited to this study. The mean age of the patients was 35.4 ± 12.8 years. A total of 22 (64.7%) patients have tetraplegia, whereas the other 12 (35.3%) are paraplegic.

Table 1 shows the occupational distributions and the estimated average daily income of the patients. The estimated average daily income of these patients was \$2.15 ± \$0.9 (range \$0.8–4.2). Road traffic injuries were responsible for 26 (76.5%) cases of SCI, falls for 4 (11.8%), penetrating injuries for 2 (5.9%), assault for 1 (2.9%) and others causes for 1 (2.9%). Complications observed are shown in Table 2.

The breakdown of the expenses incurred during the 6 weeks of conservative treatment of spinal cord-injured patients was depicted in Tables 3 and 4. Table 5 shows the cost income quotient of the patients recruited into this study. The cost income quotient ranged from 6.4 to 232.8%,

**Table 1** Occupation distribution and the estimated average daily income

Occupation	No. (%)	Estimated average daily income (\$)
Civil servant	6 (17.7%)	2.74
Commercial bus driving	8 (23.5%)	4.19
Trading	12 (35.3%)	2.23
Farming	4 (11.8%)	1.60
Cattle rearing	3 (8.8%)	1.37
Pensioners	1 (2.9%)	0.77

A full colour version of this Table is available at the *Spinal Cord* Journal online.

**Table 2** Complications

Complications	No. of patients (%)
Muscle spasm	31 (91.2)
Neurogenic pain	28 (82.4)
Bladder distension	24 (70.5)
Paralytic ileus	19 (55.9)
Constipation/faecal impaction	8 (23.5)
Urinary tract infection (para-catheter discharge)	21 (61.8)
Hypostatic pneumonia	17 (50.0)
Hypotension	20 (58.8)
Bedsore	12 (35.3)
	(grade I-7, II-2, III-2, IV-1)
Hyperpyrexia	12 (35.3)
Depression	6 (17.6)

A full colour version of this Table is available at the *Spinal Cord* Journal online.

**Table 3** Direct cost of spinal cord injury in this study

Parameter	No.	Value (\$)	Mean (\$)
Hospital bill	34	3948.00	116.13
POP/body jacket	12	309.68	25.81
Skull traction	10	2727.27	96.77
Direct cost	34	6984.95	238.71

A full colour version of this Table is available at the *Spinal Cord* Journal online.

**Table 4** Indirect cost of spinal cord injury in this study

Parameter	No.	Value (\$)	Mean (\$)
Income loss	34	4935.48	145.16
Replacement cost	8	41 290.32	5161.29
Indirect cost	34	46 225.81	1359.58
Total injury cost	34	53 210.76	1598.29

A full colour version of this Table is available at the *Spinal Cord* Journal online.

**Table 5** Cost income quotient

Cost income quotient (% total treatment cost/patient's annual income $\times 100$ )	Frequency, n = 34	%	Cumulative (%)
201–300	1	2.9	2.9
151–200	2	5.8	8.7
101–150	1	2.9	11.6
76–100	4	11.9	23.5
51–75	6	17.6	41.1
25–50	8	23.5	64.6
0–25	12	35.4	100.0

A full colour version of this Table is available at the *Spinal Cord* Journal online.

with a mean of  $63.9 \pm 36.5\%$ . In 41.1% of the SCI patients, the total cost of the treatment represented  $>50\%$  of the annual income of the patient.

The mean cost of treating tetraplegic (an average sum of hospital bill, skull traction, income loss and replacement cost =  $\$1700 \pm 551.2$ ) patients was higher compared with that for paraplegic patients (an average sum of hospital bill, Plaster of Paris (POP), income loss and replace-

ment cost =  $\$1164 \pm 308.8$ ). This was statistically significant ( $t = 1.82$ ,  $P = 0.01$ , Cohen's  $d = 0.65$ ).

## Discussion

As it has been noted in many reports<sup>1–5,17</sup> from developing countries, our study confirmed that a majority of the SCI patients are young adults who contribute to the economic well-being of the society, and that road traffic injury remains the most common cause of SCI in Nigeria. The indirect cost of acute phase of SCI in this study was significantly higher than the direct cost of the injury. This corroborated the findings by Oluwadiya *et al.*<sup>4</sup> that shows that indirect cost is higher than the direct cost of trauma treatment in developing countries. These findings were also observed by Miller *et al.*<sup>13</sup>

The government in Nigeria pays the hospital staff in the centre of this study, including the physicians, and procures medical equipment, which forms a large percentage of the overhead cost of many hospitals thereby reducing direct cost. Hence, the major burden of the direct cost of the illness is borne by the society.

The average cost of the acute phase of SCI in this study was  $\$1598.29$ . This is a huge sum for the patients in this study whose average daily income was  $\$2.15$  and 56% of the population<sup>16</sup> lives on  $<\$1$  a day. The peculiarity of this study is the high cost of treating the acute phase of SCI in the hospital in a developing country, such as Nigeria, where the level of poverty is high. This was reinforced by the findings that the cost income quotient was  $>62\%$  in more than three-fifth of the patients in this study. In a study by Oluwadiya *et al.*,<sup>4</sup> the cost income quotient of caring for limb trauma following motorcycle injury is similar to the cost income quotient of ASCI noted in our study. This finding may be explained by the nature of the structure of the health-care delivery system in Nigeria where the government directly funds the hospital, which subsequently affects the direct cost of the injury. This reason may be appropriately projected to deduce the cost of treatment of other severe traumas such as chest trauma, head injury, severe abdominal trauma and so on.

Bradbury *et al.*<sup>17</sup> noted that the average cost to complete SCI rehabilitation was  $\$130\,773$ – $\$190\,630$  for a patient with SCI only. Although our study focused on the cost of acute phase of SCI, the average cost of treatment in Nigeria is still higher compared with that reported by Bradbury *et al.*<sup>17</sup> when the cost of rehabilitation was excluded from its average total cost and also cost per average daily income was considered.

The mean cost of hospitalization was 13.1% of the total cost in this study. This was because of the policy of short hospital stay during the ASCI and subsidy by the government. A large proportion of the cost results from lost wages and productivity, and also personal loss resulting from the injury. This is a burden to the society where gross domestic product is low and the level of poverty is high. Complications noted in this study have a direct relationship to the cost of ASCI. There is an increase in direct cost of treatment from complications, and this is ultimately transferred as a burden to the society.

In this study, it is more expensive to treat patients with tetraplegia compared with paraplegia. This may be due to the severity of the injury, which informed the additional treatment offer that added to the cost of treatment.

The burden of treatment of the spinal cord-injured patients in Nigeria is enormous; there is a need to assist the patient by reducing the cost of treatment. Third party may also be brought in to alleviate the burden.<sup>3</sup> These are the payers who, in the developed countries, are insurance companies or employers of labour.<sup>14</sup> Although a small minority of people are presently covered by the National Health Insurance Scheme in Nigeria, its effect on coverage and lowering the cost of SCI is yet to be documented.

It would be cheaper and more economical from the societal perspective to place emphasis on the prevention of SCI through education on the factors that cause road traffic injuries. Enforcing laws that would save lives on roads in the developing countries, improving social infrastructure such as good roads, efficient and alternate, cheap and environmentally friendly transport system and provision of emergency transport services would help reduce the financial burden of SCI on the society. Investment in health care and training of personnel would lead to operative care of SCI patients with shortened hospital stay and fewer complications because of early mobilization and rehabilitation. This would ultimately reduce the cost of SCI and its burden on the society.

## Conclusion

In Nigeria, the cost of treating spinal cord-injured patients is very high and remains a burden to the patients and their families, considering the fact that a majority of the patients are in the low-income group. This study identified the cost of SCI in Nigeria to assist clinicians in planning treatment that could reduce financial burden on the patients but optimize patients' care.

## Conflict of interest

The authors declare no conflict of interest.

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