

The economic divide in outcome following severe head injury

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ABSTRACT

Background: Socioeconomic status is an important determinant of the standard of living and health status of people.

Objectives: To assess the influence of economic status on the outcome following severe head injury.

Materials and Methods: Adult patients of severe head injury, whose guardians' volunteered information on family income, were enrolled for the study. The family per capita income was then calculated. They were studied prospectively in relation to various factors and followed-up.

Results: Among 99 patients, monthly per capita income of Rs. <500, 500-1000, 1000-2000, and >2000 were noted in 20, 43, 22, and 14 patients, respectively. The credibility of information on income was confirmed by positive correlation with patients' mid arm circumference measurements ($P < 0.001$). They were divided into two groups (family monthly per capita income \leq Rs.1000 and $>$ Rs.1000). The comparability of both groups based on age, Glasgow Coma Scale, systemic injury, and surgical intervention was confirmed ($P > 0.05$). Mortality at one month was 49% among patients whose monthly per capita income \leq Rs.1000 compared with 17% of the rest (Odds ratio [OR] 4.0, $P = 0.003$). Unfavorable outcome at three months was noted in 63% of patients whose monthly per capita income \leq Rs.1000, as compared with 35% of those with per capita income $>$ Rs.1000 (OR 4.1, $P = 0.01$). In multivariate analysis, family monthly per capita income \leq Rs.1000 emerged as an independent risk factor for unfavorable outcome at three months ($P = 0.02$).

Conclusion: In patients of severe head injury, lower economic status is significantly associated with unfavorable outcome at three months, independent of other factors.

Key words: Head injury, outcome, per-capita income, socio-economic status

Introduction

Head injury is a major cause of disability, death, and economic cost to our society.^[1-3] Due to the overwhelming focus of health investigators on biomedical research at the level of individuals, determinants of health inequities that lie outside the control of the individual have received only much smaller share of resources and attention.^[4] Despite being an important determinant of the standard of living and health status of individuals, the economic status has not been adequately

studied with respect to outcome, after head injury. This study was undertaken to assess the influence of economic status on the outcome following severe head injury.

Materials and Methods

Patients with severe head injury admitted to the Neurosurgery department of All India Institute of Medical Sciences, New Delhi, from July to December 2005, fulfilling the following criteria, were taken up for the study after appropriate ethics clearance.

Inclusion criteria

1. Head injury patients admitted within 12 hrs for treatment
2. Age 18-60
3. Glasgow Coma Scale (GCS) 4-8
4. No obvious clinical evidence of malnutrition
5. Guardians' volunteering information on family income.

The standard care consisted of ventilation, seizure prophylaxis with phenytoin; antibiotic prophylaxis with netilmycin, cefotaxime, or ceftriaxone; gastric ulcer prophylaxis with ranitidine; and urinary catheterization done in all patients.

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Mannitol was given to patients whose computed tomography (CT) scan showed an evidence of focal mass effect or diffuse edema. Frusemide was added to patients with midline shift (>5 mm). Fluid and electrolyte homeostasis was maintained. Decision regarding intracranial pressure monitoring and surgical decompression was taken according to the mass effect noted in CT and was individualized to each patient. Family monthly per-capita income was then calculated. The clinical and radiological data of the patients were collected prospectively, and outcome was assessed at one and three months, following trauma.

Outcome

The primary outcome was Glasgow outcome scale^[5] was assessed at three months, following injury, either directly or over the telephone. Good recovery or moderate disability was considered as favorable outcome, and severe disability, persistent vegetative state, or death was considered as unfavorable outcome. The secondary outcome assessed was mortality at one month.

Statistical analysis

Statistical Package for Social Sciences (SPSS) software (version 10, SPSS Inc, Chicago) was used for the statistical analyses. Continuous variables in two groups were compared by using independent-samples *T* test. Proportions were compared by using chi-square tests or Fisher's exact test, wherever appropriate. Multivariate analysis was conducted with logistic regression adjusting for age, admission GCS, systemic injury, surgical intervention, and family monthly per-capita income. Two sided significance tests were used throughout, and the significance level was kept at $P < 0.05$.

Results

A total of 99 adult patients that fulfilled the eligibility criteria were enrolled for the study. Of the 99 patients, 8 were female. Among these patients, monthly per capita income of Rs. <500, 500-1000, 1000-2000, and >2000 were noted in 20, 43, 22, and 14 patients, respectively [Figure 1]. The median value of patients' family monthly per-capita income was Rs. 875.

The credibility of information on income was confirmed by their positive correlation with patients' mid arm circumference measurements ($P < 0.001$) [Figure 2].

They were divided into two groups based around the near-median value (monthly per capita income \leq Rs.1000 and $>$ Rs.1000). The comparability of both groups based on age, GCS, systemic injury, and neurosurgical intervention was confirmed [Table 1].

Outcome

Mortality at one month was 49% among patients whose monthly per capita income \leq Rs.1000 (31 out of 63) compared with 17% of the rest (6 out of 36) (OR 4.0, $P = 0.003$) [Figure 3].

Unfavorable outcome at three months was noted in 63% of patients whose monthly per capita income \leq Rs.1000 (36 out of 57), as compared with 35% of those with per capita income $>$ Rs.1000 (6 out of 17) (OR 4.1, $P = 0.01$) [Figure 4]. All 99 patients had follow-up at one month, whereas 25 patients were lost to follow-up at three months. Of those with outcome data at three months, multivariate analysis revealed lower monthly per capita income (\leq Rs.1000) as an

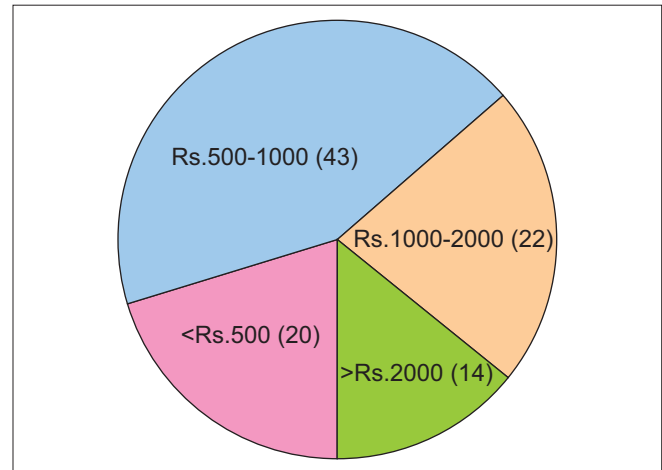


Figure 1: Family monthly per-capita income distribution

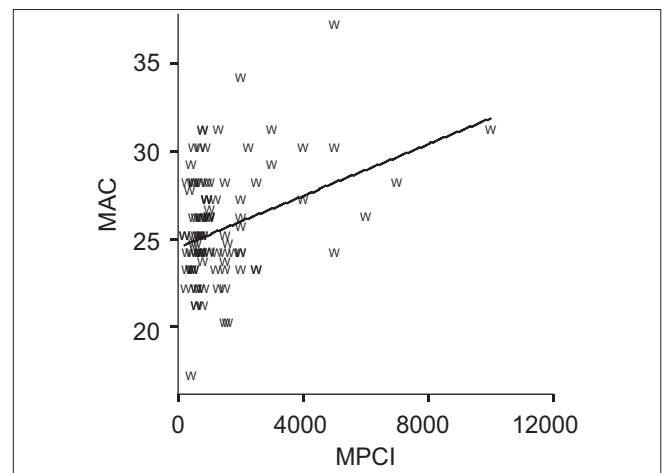


Figure 2: Mid-arm circumference vs Family monthly per-capita income

Table 1: Baseline comparability

Characteristic	Family monthly per-capita income		P value
	\leq Rs. 1000	$>$ Rs. 1000	
Mean age (yrs)	35.8 (\pm 11.6)	36.2 (\pm 13.2)	0.87
GCS			
4,5	21	12	1.0
6,7,8	42	24	
Systemic injury	38.9%	30.2%	0.38
Neurosurgical intervention	58.7%	66.7%	0.44
Mean hospital stay (days)	18	16	0.89

GCS – Glasgow coma scale

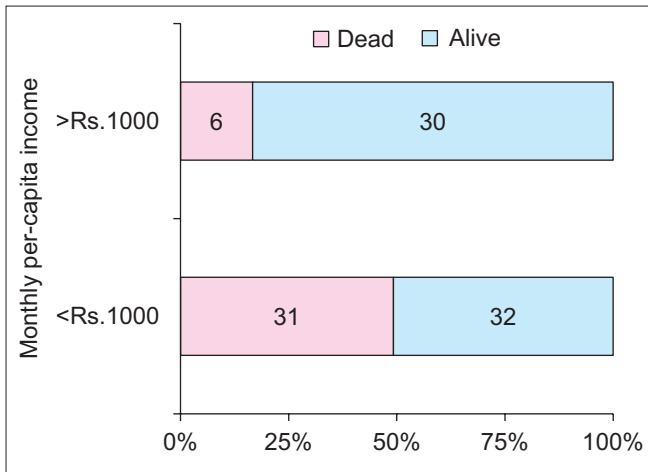


Figure 3: Economic status vs mortality

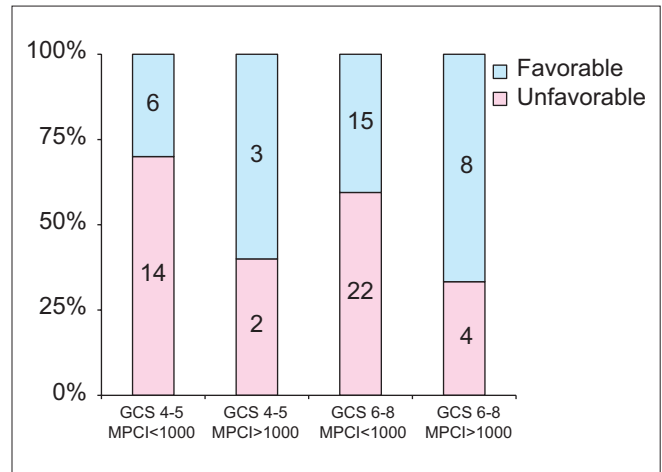


Figure 4: Economic status vs neurological outcome

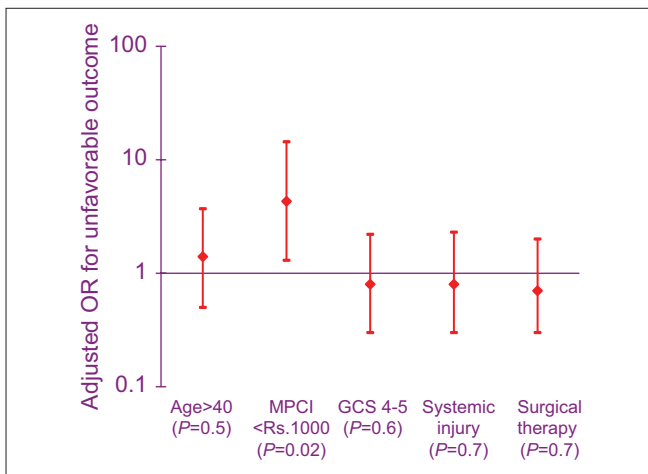


Figure 5: Logistic regression analysis

independent risk factor for unfavorable outcome ($P=0.02$) [Figure 5].

Discussion

Severe head injury is the commonest cause of death and disability in young people.^[3] Outcome prediction following severe head injury has been a daunting task due to various factors such as heterogeneous pathophysiology, inequity among different centers, and unidentified prognostic factors. Among the various factors influencing outcome after head injury, the socioeconomic status has only caught attention recently.

As early as 1973, Kitagawa and Hauser demonstrated evidence of an increase in the differential mortality rates according to socioeconomic level in the United States between 1930 and 1960.^[6] They found that mortality rates for most causes were higher for persons in lower social classes. The findings could have been due to differences in medical facilities, smoking, nutritional status, and type of employment, accident rates, or living conditions. In the famous Whitehall II study, Marmot *et al.*,

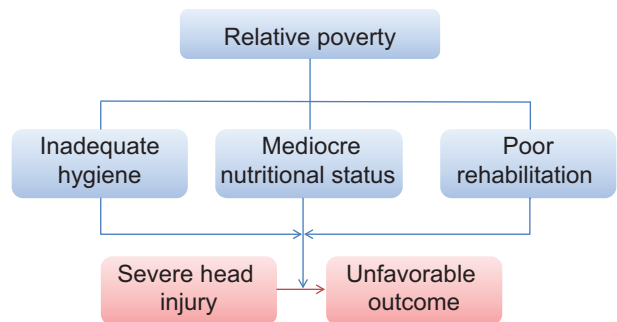


Figure 6: Effect of relative poverty

noted mortality rates in lower grade employees three times higher across all disease groups in a relatively homogeneous population of office-based civil servants, in London.^[7]

In children with head injury, Keenan *et al.*, noted low socioeconomic status to be one of the risk factors for poor developmental outcome, probably due to poor rehabilitation.^[8] In a similar study by Hoofien *et al.*, social status indicators were found to be effective predictors of long term vocational and social functioning after head injury. But their financial status was not assessed.^[9]

Haider *et al.* noted insurance status and race to have strong association with mortality, in general trauma patients.^[10] Gary *et al.* found ethnic minorities to have worse functional outcome and community integration, after head injury.^[11] Alban *et al.* noted insured severe head injury patients to have improved outcomes compared with their uninsured counterparts.^[12] Heffernan *et al.* found income to variably affect mortality, after head injury.^[13]

Though it was regarded that outcome is poorer in patients of lower economic status, predominantly due to inaccessibility to good medical facilities, our study was conceived to assess the economic divide in outcome for patients with severe head injury treated in a government institute, wherein all patients were given similar treatment.

As the study of relative inequality in economic status is more meaningful than the definition of absolute poverty,^[14] especially in a small set of patients, we chose to categorize them based on the median value (\approx Rs. 1000) of patients' family monthly per-capita income. Our study clearly reveals that, in spite of patients getting uniform treatment, those from a lower economic status tend to have poorer outcome, independent of other factors. This probably is due to mediocre nutritional status, inadequate hygiene, and poor rehabilitation with resultant deficient healing processes and recovery [Figure 6].

Conclusion

In patients of severe head injury, low family per capita income appears to be associated with higher mortality at one month, and unfavorable outcome at three months, independent of other factors.

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