Financial and Vocational Outcomes 1 Year After Traumatic Brain Injury

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Objective: To characterize financial and vocational outcomes among persons with traumatic brain injury (TBI) in terms of employment status, earned and private income, and public assistance received at the time of injury and at 1 year after injury.

Design: Nonexperimental, longitudinal study.

Setting: Inpatient TBI rehabilitation unit and participants' community of residence.

Participants: Thirty-five persons with new TBI from 1 national Traumatic Brain Injury Model Systems center.

Interventions: Not applicable.

Main Outcome Measures: Employment status, earned and private monthly income, and public assistance received monthly at the time of injury and at 1-year follow-up.

Results: From the time of injury until 1-year follow-up, the percentage of persons employed decreased from 69% to 31%; the percentage unemployed increased from 11% to 49%; the average earned monthly income declined 51% (from $1491 to $726); and the mean total public assistance received per month increased 275% (from $153 to $421).

Conclusion: Assuming that this study sample is representative of national statistics for TBI, during the first year after injury, TBI is associated with an estimated $642 million in lost wages, $96 million in lost income taxes, and $353 million in increased public assistance.

Key Words: Brain injuries; Cost of illness; Rehabilitation; Rehabilitation, vocational; Treatment outcome.

TRAUMATIC BRAIN INJURY (TBI) is a particularly expensive disability when one considers the significant number of individuals who survive it, the relatively young age at which persons incur it (highest incidence at 16–24y), and the chronic vocational and financial difficulties that individuals with TBI experience. For example, a consensus panel on TBI convened by the National Institutes of Health[1] (NIH) concluded that between 2.5 and 6.5 million individuals with TBI are living in the United States, with 1.5 to 2 million people incurring TBIs each year. Of these individuals, approximately 300,000 are hospitalized, and 70,000 to 90,000 experience a long-term, substantial loss of functioning. NIH has estimated that the total annual cost for acute medical and rehabilitation services for new cases of TBI in the United States is between $9 and $10 billion, with the average lifetime cost of health care for a person with severe TBI ranging from $600,000 to $1,875,000.[1]

Unfortunately, the long-term financial costs of TBI in terms of lost income and increased government assistance are not as well known. The NIH consensus panel concluded that its estimations of TBI-related costs "may grossly underestimate the economic burden of TBI to family and society because they do not include lost earnings, costs to social services systems, and the value of the time and foregone earnings of family members who care for persons with TBI."[1(p13)] The consensus panel recommended further economic analysis of TBI, including major determinants of costs.

How persons with TBI function vocationally is a primary area in which financial outcomes research is needed. Research has consistently indicated that individuals with TBI have significant difficulties returning to work after their injury.[2-4] In fact, only 22% of individuals with TBI in the National Institute on Disability and Rehabilitation Research (NIDRR) Traumatic Brain Injury Model Systems (TBIMS) have succeeded in returning to work at 1 year after injury.[5] Without employment, individuals with TBI are often unable to support themselves and their families and frequently must rely on the government for financial support. Unfortunately, few longitudinal studies to date have addressed the long-term consequences for persons with TBI in terms of lost income and increased government subsidies. Even the NIDRR TBIMS centers, the most comprehensive, collaborative studies of TBI to date, have not collected specific information about earned income or government assistance. Until recently, only information related to the earned income of the family (not the person with TBI) was obtained, and those data were recorded in ranges (eg, $0–$9999; $10,000–$19,999). Similarly, the Model Systems collected information regarding only the types of government assistance (eg, Supplemental Security Income [SSI], Social Security Disability Income [SSDI]) received by persons with TBI, but not the specific amount. However, the Model Systems provide an excellent platform from which to collect more specific financial data. Such information is essential for conducting accurate cost-benefit analyses and for making important decisions regarding resource allocation for persons with TBI.

As part of a pilot study, this study collected specific information about vocational outcomes, earned and private income, and the amount of public assistance received by participants (at the time of injury and at 1-y follow-up) in 1 of the NIDRR Model Systems.

METHODS

Participants

Participants included 45 individuals in an NIDRR-funded TBIMS center program, which had approval of the University of Missouri's institutional review board. All participants had

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Table 1: Participant Demographics at the Time of Injury

Variable	Data
Mean age ± SD (y)	36.00±17.57
Gender (%)	
Male	77
Female	23
Race (%)	
White	94
Black	3
Hispanic	3
Marital status (%)	
Married	31
Single	40
Divorced	20
Separated	3
Widowed	6
Education (%)	
<High school degree	17
High school degree/GED	46
Completed trade school	17
Completed some college	17
College degree	3

Abbreviations: GED, General Educational Degree; SD, standard deviation.

histories of new TBI, for which they received both inpatient acute and rehabilitation services. Subjects were excluded from the research program if they had any history of other medical conditions that could account for their impairments (eg, stroke, multiple sclerosis, progressive dementia). Eight of the participants chose not to provide specific financial information at the time of injury, at 1-year follow-up, or both. Of the 37 participants, 2 earned disproportionately greater monthly salaries (ie, $50,000, $6200) than the other participants, because they owned successful businesses both at the time of the injury and at the 1-year follow-up. Because they were not believed to be representative of a typical TBI population (range of average monthly income of other participants, $0–$3200), their data were excluded from the analyses; data are reported on the remaining 35 participants. Table 1 shows demographic characteristics of the sample.

Regarding injury severity, 11 (31%) participants were initially rated by the Glasgow Coma Scale (GCS), with a mean score ± standard deviation of 11.5±3.27. The GCS score was not reported on 15 participants who were listed as chemically paralyzed or had chemically induced coma, 8 participants who were listed as intubated, and 1 who was listed as unknown. The mean length of total hospitalization was 54.2±53.3 days, with an average of 17.0 days in acute care and 37.2 days in rehabilitation. Blood alcohol level (BAL) at the time of injury was negative for 54% of the sample (n=19). Twenty-three percent (n=8) of the participants were legally intoxicated (BAL, ≥.10), and 9% (n=3) had alcohol in their systems but were not legally intoxicated (BAL, <.10) at the time of injury. Eleven percent (n=4) of the participants were not tested for BAL, and 3% (n=1) had unknown BAL. Vehicular crashes were the leading cause of TBI (66%), followed by falls (23%), assaults (3%), and other etiologies (8%).

The mean charge for total hospitalization was $137,211± $107,425 per person. The mean charge for acute medical hospitalization was $90,205±$62,638, and the average charge for rehabilitation hospitalization was $47,006±$67,516. The average per diem charge was $5297 for acute care and $1262 for rehabilitation. Thirty-seven percent (n=13) of the participants had government-sponsored financial assistance (ie, Medicaid, Medicare) as their primary payer source, both at the time of injury and at 1-year follow-up.

Measures

Vocational outcome was determined according to the employment variables used by the TBIMS database, that is, categorizing the participant as employed, unemployed, student, retired, or "other." Specific financial data were obtained as part of a pilot study for persons in the national TBIMS centers. Specifically, information was obtained by self-report for each participant regarding (1) the mean monthly total private income (including earned income, financial assistance from family, and other private income) and (2) the mean monthly total public assistance received (including SSI, SSDI, Temporary Assistance for Needy Families [TANF]/Aid to Families with Dependent Children [AFDC], general welfare, and/or other public assistance). As part of the standard data collection of the national TBIMS, participants were also asked whether they received any financial assistance from the following programs: unemployment benefits, workers' compensation, private insurance, and/or settlement income. However, no participants reported receiving income from any of these sources at the time of injury or at 1-year follow-up.

RESULTS

Table 2 lists the summary statistics for employment status, mean earned and private income per month, and mean monthly public assistance at the time of injury and 1-year follow-up. Figure 1 shows the average earned income and public assistance at baseline and follow-up.

Employment Outcomes

At the time of injury, 69% of the participants were employed, 11% were unemployed, 11% were students, and 9% were retired, were homemakers, or were categorized as other. At 1-year follow-up, 31% of the participants were employed, 49% were unemployed, 6% were students, and 14% were retired or were categorized as other. Of the 24 persons who were working at the time of their injury, only 10 (42%) were

Table 2: Employment and Financial Outcomes (N=35)

Variable	Baseline	1 Year After TBI
Employment status		
Employed	69% (n=24)	31% (n=11)
Unemployed	11% (n=4)	49% (n=17)
Student	11% (n=4)	6% (n=2)
Retired/homemaker/other	9% (n=3)	14% (n=5)
Average earned and private income (per month)		
Earned income	$1491	$726
Family support	$50	$55
Other private income	$29	$29
Total private income	$1570	$810
Average government financial assistance (per month)		
SSI	$0	$30
SSDI	$46	$166
TANF/AFDC	$0	$20
Welfare	$0	$1
Other public assistance	$107	$204
Total public assistance	$153	$421

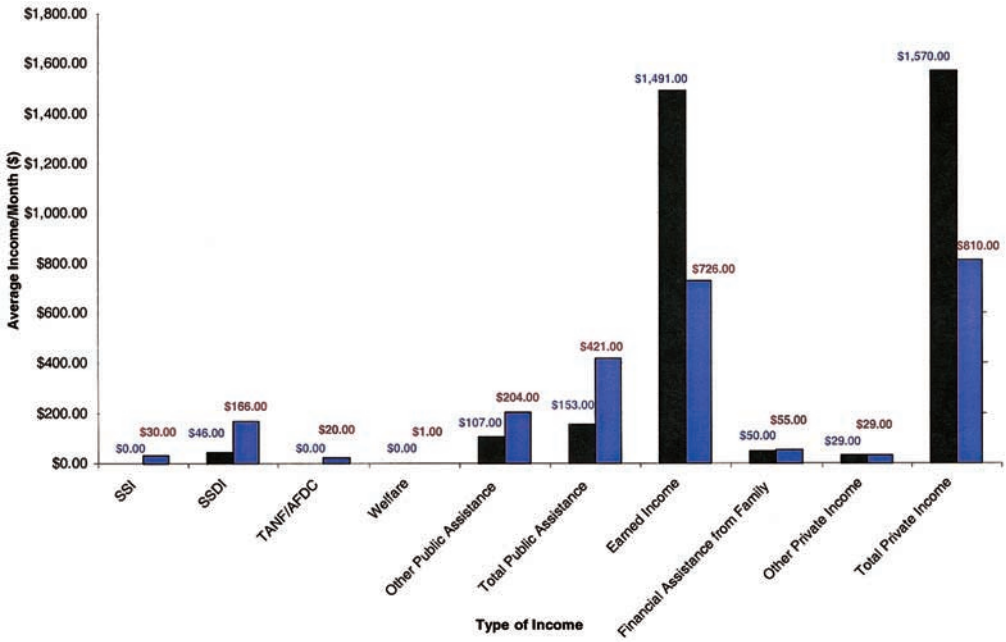

Fig 1. Average monthly income at the time of injury and at 1-year follow-up. Legend: blue bars, time of injury; black bars, 1y post-TBI.

working at 1-year follow-up. Of note, 100% (n=4) of the individuals who were unemployed at the time of injury remained unemployed at 1-year follow-up.

Earned and Private Income

The total mean private income (ie, earned income plus other private income) of the sample declined 48% per month, from $1570 at initial assessment to $810 at 1-year follow-up. The average earned monthly income declined 51%, from $1491 at baseline to $726 at 1-year follow-up. The average amount of financial support provided by family members increased 10%, from $50 to $55, although only 3 families were reportedly providing additional financial assistance at 1-year follow-up. Other private income remained stable at $29 per month at both baseline and follow-up (fig 1).

Public Financial Support

Results indicated that 40% of the participants received public assistance at 1-year follow-up. The average total public assistance received per month increased 275%, from $153 (n=4) to $421 (n=14). Specifically, at baseline assessment no person reported receiving SSI, but at 1 year after injury, the average SSI payment was $30 per month (n=3). The average SSDI payment at the time of injury was $46 per month (n=2), which increased to $166 (n=8) at 1-year follow-up. No one reported receiving TANF or AFDC at the time of injury, although the average support was $20 per month (n=2) at follow-up. No participant reported receiving welfare at the time of injury, although the average amount of welfare received at follow-up was $1 (n=1) per month. Other public assistance increased from an average of $107 (n=4) per month to $204 (n=6) at 1-year follow-up (fig 1).

DISCUSSION

Overall, the results must be interpreted with caution, because they are based on the self-report of only 35 individuals with TBI from 1 region in the United States. However, these results are generally consistent with previous studies, which indicate that persons with TBI have significant difficulties finding employment during the first year after their TBI. The results also indicate that many individuals with TBI have very limited financial resources to begin with and that these resources significantly decrease over the first year after their TBI. As a result, these individuals require substantially more public assistance.

Employment Outcomes

These results support previous studies that indicate that persons with TBI have significant difficulties finding and/or maintaining employment after TBI. In this study, there was a 55% decrease in the number of participants who were working at follow-up, although the number of individuals who were unemployed increased 425%. Of the few persons who were unemployed at the time of injury (n=4), none was employed at follow-up. Not surprisingly, it seems that persons who have difficulties working before a TBI have persisting difficulties finding employment after their TBI.

Decreased Earned Income

The poor financial outcomes experienced by persons with TBI raise concern from both personal and societal perspectives. On an individual level, the results indicate that persons with TBI earned relatively limited annual incomes before their injury ($17,894) and that their earnings declined by more than 50% at 1-year follow-up. Even if one combines the annual private income ($8709) and public assistance ($5052) received at the 1-year follow-up, these individuals, on average, received only $13,761 annually to support themselves (and their families, if necessary). Many of these individuals are likely living below the poverty line and are probably experiencing difficulties supporting themselves (ie, paying rent and mortgage, groceries, utilities), particularly considering the additional health care costs typically associated with TBI (eg, medical expenses, rehabilitative therapies, psychologic counseling). The need for these individuals to find and maintain employment is obvious.

Besides the many personal problems caused by the loss of regular income, there are also significant societal implications. For example, the estimated total lost wages during the first year

after injury for these 35 individuals was $321,481. Taking the lowest tax rate of 15%, it is conservatively estimated that $48,222 was lost in income tax revenues during the first year after TBI for these individuals. Assuming that these 35 individuals are representative of the 70,000 individuals annually who experience long-term residual impairments from TBI (lower end of the NIH consensus panel's[1] estimate), we estimate that the total loss nationally in earned income in the first post-TBI year is $642,961,200, with an associated annual loss of $96,443,900 in income taxes.

Increased Public Assistance

The results also hold important societal implications when one considers the significant increase in public assistance that is needed to support persons with TBI. Two of the most significant findings of the study were (1) that there was a 350% increase in the number of individuals with TBI receiving public assistance and (2) that there was a 275% increase in the amount of public assistance received by the sample 1 year after TBI. For the 35 individuals in this study, the estimated total amount of public assistance received during the first year after TBI was $176,833. Assuming that these 35 individuals are representative of the 70,000 individuals per year who experience long-term impairments,[1] it is estimated that the total amount of public assistance received by persons in the first year after TBI is $353,665,200. Multiply this by the average life expectancy for persons with TBI (who are relatively young), and it is apparent that TBI is very costly for government assistance programs. This analysis is particularly true given that 37% of the participants received Medicaid and Medicare at both the time of injury and 1-year follow-up.

CONCLUSIONS

This study was limited in its small sample and short time frame (ie, 1-y follow-up), although it provides information on the personal and societal financial costs associated with TBI. In addition to the estimated $9 to $10 billion spent on TBI acute and rehabilitation services on an annual basis, this study indicates that TBI may cost an additional $1 billion per year in lost wages ($642 million), lost income taxes ($96 million), and increased public assistance ($353 million). This information can be used to educate insurers, government agencies, and health policy administrators regarding the significant personal and societal financial difficulties experienced by persons with TBI, so that appropriate services and resources can be developed to return individuals with TBI back to work and financial independence.

Future TBI outcomes research should routinely collect specific information regarding earned income and public assistance received: only by collecting such data can accurate cost-benefit analyses be conducted and determinations made regarding the most appropriate and efficient allocation of resources. Additional longitudinal studies (ie, greater than 1y after injury) using the national TBIMS database will enable investigators to determine the long-term financial consequences of TBI, including whether employment rates, earned income, and the need for government financial assistance increase or decline over longer time periods.

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