

The disablement experienced by traumatically brain-injured adults living in the community

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The disablement that occurs following traumatic brain injury (TBI) can be extensive and severe and consequently has been difficult to report on in a comprehensive and thorough manner. We were able to address this difficulty by analysing a sub group of data from the Canadian Health and Activity Limitation Survey (HALS) using the theoretical framework of disablement developed by the World Health Organization, the International Classification of Impairment, Disability and Handicap (ICIDH). There were 454 survey respondents (representing 12 290 in the Canadian population) with disability resulting from a TBI and a mean time post-injury of 13 years. Three handicaps identified in the ICIDH were the focus of the study: physical independence, work, social integration. The prevalence of long term handicap was very high with 66% of the sample reporting the need for ongoing assistance with some activities of daily living, 75% not working, and 90% reporting some limitations or dissatisfaction with their social integration. Multivariate regression analysis was used to investigate the determinants of the handicaps. The determinants included: age, gender, level of education, living alone, physical environment, and specific disabilities. The implications of these findings are discussed in relation to rehabilitation issues, the usefulness of the ICIDH as a model to investigate outcomes, and directions for future research.

Introduction

The need to explain more clearly the disablement experienced by the traumatic brain injury (TBI) population has been expressed by researchers, government-sponsored task forces, and consumer groups [1-4]. To plan services adequately for this population, accurate incidence and prevalence figures and a better accounting of the consequences of TBI are required. Indeed, a recent issue of *Brain Injury* (1993, vol. 7, no. 2) presented several articles addressing this very matter. There are many reasons for our lack of understanding [5, 6]: these include the nature of the subjects available for research, the variety and lack of consistency in outcome measures, and the cost of obtaining population-based estimates of these outcomes.

Most studies of the consequences and functional limitations associated with TBI have used convenience samples, such as injured people admitted to a particular rehabilitation centre [7, 8]. These reports have considerably advanced our understanding of the long-term outcomes of TBI. However, their findings cannot be generalized to the entire TBI population, as it is unlikely that these samples are representative of this larger population. To date, there are very few published data concerning the incidence or prevalence of disablement associated with TBI, primarily because such research is

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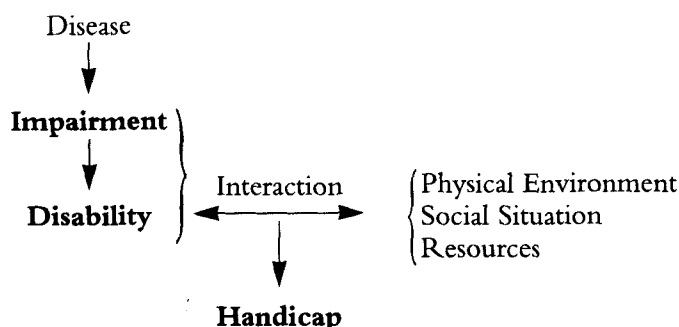


Figure 1. Adapted from the revised ICIDH model [19]

prohibitively expensive. Estimates of the incidence rates for disablement following TBI range from 3.3/100 000 [9] to 40/100 000 [10]. The first estimate was based on following a cohort of persons discharged from a regional hospital for 2 years post-injury. The latter figure was derived from the Scottish Head Injury Management Study data. The Missouri Trauma Registry data provided other estimates of disablement, with an incidence rate of 12/100 000 and a prevalence rate of 27/100 000 [6]. However, this registry includes only TBI persons identified as having moderate or severe disabilities, which are more likely to result from moderate or severe injuries. Injured persons with milder disabilities which are more likely to result from minor TBI were not included here. Thus, these figures are probably conservative as it is well known that some mild TBI persons have long-lasting problems [11–15].

Our limited information on disablement is compounded by another problem: the variety of methods used to assess outcome has made it difficult to achieve an accurate picture of the scope and magnitude of the long-term problems associated with TBI [16]. One remedy, suggested by several researchers [16, 17] is to use the *International Classification of Impairment, Disability, and Handicap* (ICIDH) [18] to investigate disablement. They have argued that this classification system provides a theoretically sound method of describing the experience of disablement associated with TBI, and reflects an understanding of how culture, values, and resources modify the impact of TBI. The endpoint of the ICIDH goes beyond the individual, and considers how that individual is affected in his/her own community. Thus, the model (see Figure 1) provides an excellent framework for examining the sequelae of TBI, and could serve as a common framework to discuss outcomes [19].

A unique opportunity to address these issues arose with the Canadian Health and Activity Limitation Survey (HALS), a post-censal survey conducted in 1986–87 [20]. This survey was designed to describe and measure disablement in the general population. Its data can be used to calculate accurate prevalence rates and frequencies that apply to people with TBI in the general population. In addition to addressing the issue of non-representative samples, the HALS addressed the inconsistency in disability outcomes measures. The survey (as discussed in the Methods section) reflects the WHO model of disablement.

The present study focuses on disablement among TBI adults living in the community, and specifically on the handicap level of disablement, describing its characteristics and predictors, and measuring its prevalence.

Methods

Subjects

The target population for the HALS was all disabled persons living in Canada at the time of the 1986 census. The survey was conducted in two parts: an institutions survey and a household survey of persons living in the community from which the subjects for this study were selected.

The household survey was effected using a two-stage stratified survey design [21]. The strata were developed based on population projections, by age group, in specific geographical areas. The first stage of the survey was an activity limitation question contained in the 1986 long census form delivered to every fifth household. Stage two was the administration of the HALS to a total of 71 900 persons living in households.

Persons with TBI are a subgroup of all respondents to the HALS, and were identified by one question which asked about memory or learning problems. Four hundred and fifty-four adults (aged 15 +) living in the community reported a memory or learning problem of at least 6 months duration related to a brain injury not present at birth or caused by a stroke, disease or illness (e.g. brain tumour), Alzheimer's disease, ageing, developmental delay (mental retardation), or other unstated cause.

The record of each respondent to the HALS was individually weighted, based on the sampling design, to allow the calculation of population disability estimates. Thus, the 454 respondents reporting TBI in the HALS survey represent 12 290 persons in the Canadian population.

These subjects can be described by age, sex, marital status, education, and income. However, the HALS obtained no information on details of the TBI such as the nature and severity of the injury, nor did it obtain information on length of hospitalization or any treatments provided.

Data collection

The HALS questionnaire has nine sections in total [20]. The first consists of 23 screening questions asking about the nature and severity of an individual's disability, and the remaining eight sections were designed to identify limitations in, and barriers to, carrying out day-to-day activities. Thus, the first section focuses on the WHO concept of disability and the remaining sections encompass the WHO concept of handicap [22]. Questions cover use of special aids, use of social services in relation to activities of daily living, employment, education, transportation, accommodation, recreation and lifestyles, and economic characteristics. The survey is comprehensive, containing 552 variables including responses to the HALS questions and corresponding census data.

In most cases the HALS was administered in person by trained interviewers. A 90% response rate was achieved [20]. Proxy respondents were used only when the nature of the disability prevented a personal interview. Approximately 12% of the interviews were conducted by proxy.

Data analysis

The analytical strategy utilized in this study was based on the WHO model of disablement (see Figure 1). Various factors (sociodemographic, environmental, condition-related, disability) were operationalized using the HALS data. Their associations, separately and together, have been analysed using the scheme shown in Figure 2.

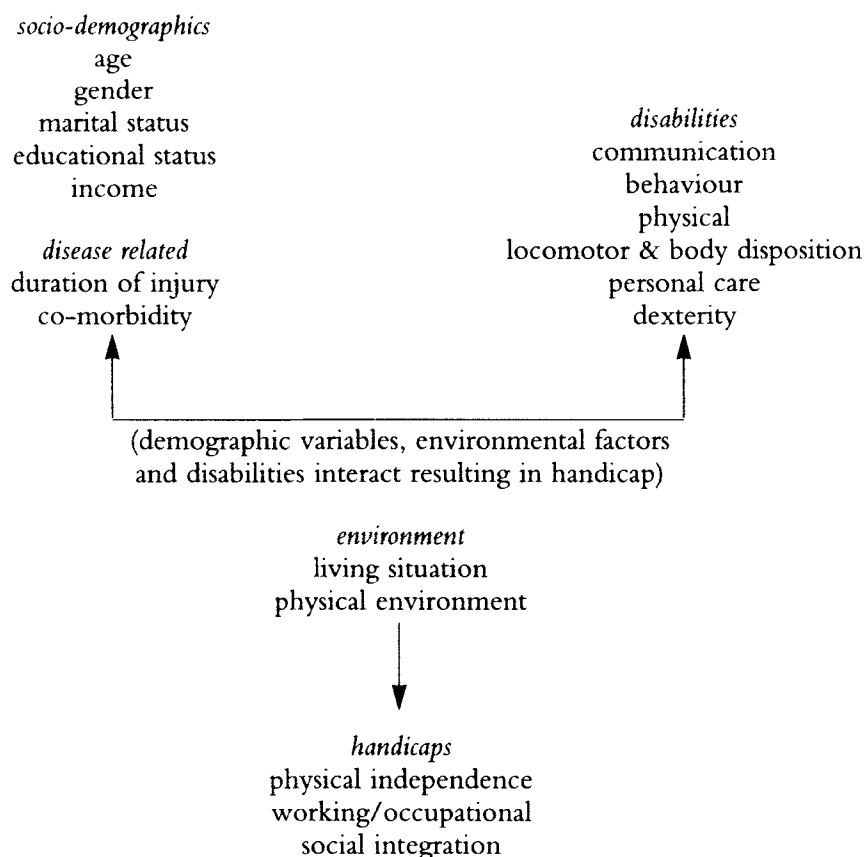


Figure 2. Overview of the variables used and associations examined.

Some definitions of these variables are necessary to understand the scope of the analysis. The sociodemographic variables and the environmental variable 'living situation' (defined as living alone or with others) were specific questions used by the HALS. The other variables were constructed using more than one HALS question.

The second environmental variable, 'physical environment', was derived from four HALS items that ask about barriers to mobility within and outside the home. Six disability variables (shown in Figure 2) were derived from 20 activity limitation questions included in the HALS, each of which used a three point scale (independent, partial ability, dependent performance). It was thus possible to develop aggregate scales for each disability by summing the scores on the related questions, following an approach used in the development of other disability measures [23–25].

Three handicap variables provide the focus for this study as for much of the TBI literature: physical independence, occupation, and social integration. Each handicap variable was based on a number of HALS questions and their scaling is shown in Tables 3–5. These scales are similar to those developed previously by other investigators [26–28]. Details concerning the development of these scales are available on request [29].

To explore their determinants, the handicaps were set as outcome variables in multivariate regression models, with sociodemographic, environmental, time post-injury, and disability categories used as explanatory variables. Thus, each handicap model used the following format:

Handicap = sociodemographic variables + time post-injury + environmental variables + disability variables

All variables were included in each model and eliminated in a stepwise fashion using an alpha value of 0.05.

The unweighted survey data were used for all analyses except the calculation of overall prevalence rates. This decision was based on the results of Korn and Graubard [30]. The use of weights could present a biased picture of the data, possibly minimizing the profile of disablement.

Results

The demographic profile of these subjects is as follows. Their median age was between 45 and 49, the male:female ratio was 2.2:1, 35.5% were married and 46.5% were single, 69% had not completed high school, and 34.4% had incomes below the poverty line. The mean time since injury was 13 years.

The distributions of specific disabilities, environmental barriers, and handicap-related difficulties were examined to estimate the prevalence of these problems among the respondents to the survey. These results are shown in Tables 1 and 2. The prevalence of reported disabilities ranged from 21% for diagnosed learning disability to 76% for motor disability. Concerning the prevalence of handicap, only 15% of the subjects reported needing assistance with personal care, whereas more than 80% reported never participating in certain social integration activities such as going to clubs.

The definitions for each level of handicap and the distribution and severity of each handicap among the TBI subjects are shown in Tables 3–5. Sixty per cent of the TBI subjects had a physical independence handicap, 95% a working handicap, and 90% a social integration handicap.

A correlation analysis was done between the three handicap variables and the sociodemographic, environmental, and disability variables to determine whether there was any association between them (see Table 6). The associations found are modest (0.134–0.408) but real ($p < 0.01$).

To gain insight into the determinants of handicap, the handicap variables were treated as dependent variables in three separate multivariate regression analyses using the model depicted earlier. The explanatory or independent variables—that is the disabilities and the sociodemographic, injury-related, and environmental variables—accounted for 26.8% of the variance in the physical independence handicap score, 15.6% in the working handicap score and 14.0% in the social integration handicap score (see Tables 7–9).

Several sociodemographic variables helped explain the variance in the three handicap scales. Physical independence handicap is more likely among females, those with no

Table 1. Prevalence of disability
(n = 454)

Disability	Percentage
Communication	61
Personal care	41
Motor	76
Dexterity	34
Learning	21

Table 2. Proportion of subjects reporting environmental barriers and handicap-related circumstances

Variable	Proportion	Percentage
<i>Physical environment barriers</i>		
Needs aids to move inside residence	34/431	8
Needs aids to enter or leave residence	21/432	5
Needs special bus to take short trips	53/432	12
<i>Physical independence handicap items</i>		
Assistance needed with personal care	69/454	15
Assistance needed with meal preparation	131/454	29
Assistance needed with shopping	164/454	36
Assistance needed with housework	160/454	35
Assistance needed with personal finances	142/454	31
Assistive devices used or needed	83/454	18
<i>Working handicap items</i>		
Employed	83/333	25
Employed competitively with pay	47/83	63
<i>Because of condition . . .</i>		
Unemployed	20/333	6
Not in labour force	219/333	66
Limited in kind or amount of work	94/131	72
Been refused a job	29/125	23
Among employed: changed job	43/83	52
Among employed: difficulty changing jobs	68/83	82
Among employed: working for wages	47/83	63
<i>Social integration handicap items</i>		
Never participates in physical leisure activity	217/454	48
Would like to do more physical leisure activity	210/454	46
Never talks on the telephone	202/454	45
Never socializes at home with family or friends	123/454	27
Never visits friends or relatives	88/454	19
Never attends sporting or cultural events, films	344/454	76
Never takes courses or attends seminars	422/454	93
Never shops	113/454	25
Never attends religious events or volunteers	259/454	57
Never goes to bingo, clubs, or plays cards	377/454	83
Would like to do more activities outside the home	198/454	44

schooling, those who live in larger households, and among those who reported the presence of physical environmental barriers. Working or occupation handicap is more common among older persons, those who have not attended university, and those who reported the presence of physical environmental barriers. Social integration handicap is more common among males, those with no schooling or having lower income.

Table 3. Prevalence of physical independence handicap

Physical independence handicap scale	Proportion	Percentage
No aids or assistance needed	172/454	40
Independent with the use of aids (w/c, crutches, etc.)	18/454	4
Requires assistance < 1/week	23/454	5
Requires assistance 1-6/week	63/454	15
Requires assistance daily	131/454	30
Requires assistance twice daily	25/454	6

Table 4. Prevalence of occupation/working handicap

Working handicap scale	Proportion	Percentage
No difficulties working or unemployed/not in the labour force for reasons other than health	19/358	5
Working with one or more limitations or stated disadvantage	77/358	22
Unemployed due to health	40/358	11
Completely prevented from working due to health	222/358	62

Table 5. Prevalence of social integration handicap

Social integration scale	Proportion	Percentage
Participates in 20+ activities/month and is satisfied with this	47/454	10
Participates in 20+ activities/month but is dissatisfied with this	46/454	10
Participates in 10-19 activities/month and is satisfied with this	130/454	29
Participates in 10-19 activities/month but is dissatisfied with this	103/454	23
Participates in 5-9 activities/month	87/454	19
Participates < 5 activities/month	41/454	9

Mean number of activities/month: 13.1.

Table 6. Correlations† between sociodemographic, environment, and disability variables and handicaps

	Physical independence	Working	Social integration
<i>Sociodemographic</i>			
Age		0.216 (0.0001)	0.176 (0.0002)
Sex	-0.144 (0.002)		
Education		-0.205 (0.0001)	-0.150 (0.001)
<i>Environment</i>			
Living situation	0.138 (0.003)		
Physical barriers	0.258 (0.0001)	0.252 (0.0001)	
<i>Disabilities</i>			
Communication			0.134 (0.004)
Motor	0.366 (0.0001)	0.255 (0.0001)	0.257 (0.0001)
Personal care	0.408 (0.0001)	0.187 (0.0004)	0.264 (0.0001)
Dexterity	0.185 (0.0001)		

†Pearson correlation coefficients are shown; *p*-values are in parentheses. Only correlations with *p*-values less than 0.01 are given.

Table 7. F-statistics for the full model prediction of physical independence handicap

R^2 : 0.268					
Source	d.f.	SS	MS	F	p
Model	5	406.5	81.3	31.25	0.0001
Error	426	1108.2	2.6		
Corrected total	431	1514.7			

Explanatory variables	Coefficient	Standard error	p-Value
Intercept	1.21	0.13	0.0001
Gender (female)	0.59	0.17	0.0005
Education (primary)	0.57	0.16	0.0004
Living situation (alone)	-0.88	0.22	0.0001
Physical environment	0.53	0.14	0.0002
Personal care disability	0.46	0.05	0.0001

The disabilities which explained the variance in different types of handicap were limited to two: personal care disability was related to both physical independence and social integration; motor disability made a working handicap more likely.

The variables marital status, time since injury, communication disability, behavioural disability, and dexterity disability were not significant ($p > 0.05$) in any of the regression models for the three handicaps.

Population prevalence of disablement

The prevalence of disablement among the general population was calculated using the HALS weighted data. The prevalence of morbidity or disablement associated with TBI is 63.1 per 100 000 of the adult population living in the community. It should be noted that this figure does not include persons disabled or handicapped by TBI who were residing in institutions at the time of the survey.

Table 8. F-statistics for the full model prediction of working handicap

R^2 : 0.156					
Source	d.f.	SS	MS	F	p
Model	4	53.4	13.4	16.3	0.0001
Error	353	289.6	0.8		
Corrected total	357	343.0			

Explanatory variables	Coefficient	Standard error	p-Value
Intercept	2.43	0.16	0.0001
Age	0.33	0.10	0.0014
Education (primary)	0.28	0.10	0.0057
Physical environment	0.32	0.10	0.0010
Motor disability	0.04	0.01	0.0031

Table 9. F-statistics for the full model prediction of social integration handicap

R^2 : 0.1404					
Source	d.f.	SS	MS	F	p
Model	4	127.1	31.8	18.33	0.0001
Error	449	778.0	1.7		
Corrected total	453	905.1			

Explanatory variables	Coefficient	Standard error	p-Value
Intercept	1.94	0.15	0.0001
Age	0.04	0.02	0.0407
Sex (female)	-0.39	0.13	0.0037
Education (primary)	0.53	0.13	0.0001
Personal care disability	0.24	0.04	0.0001

Discussion

The considerable disability and handicap experienced by persons with TBI is substantiated by this study. The time post-injury was not associated with the severity of handicap, affirming the chronic nature of the handicap associated with TBI. This study should spur efforts directed at preventing and minimizing the serious and chronic nature of the disability and handicap for this population.

The profile of TBI subjects surveyed by the HALS is very similar to that in other epidemiological studies; i.e. single males with limited education and limited income [31, 32]. However, the HALS provided no details regarding the severity and extent of the injuries sustained. Future population surveys of disabled persons should be designed to provide data on the underlying condition(s) resulting in disability and handicap.

One further omission in the HALS data should be noted. The HALS contains very limited data on either behavioural dysfunction or cognitive impairment, both common sequelae of TBI [33–38]. The only behavioural dysfunction identifiable is learning disability, and the only cognitive impairment is memory difficulty. This limitation in the HALS is not due to problems with the WHO classification of disablement, but with the choice of questions used in the HALS. As the TBI population is known to have a range of behavioural disabilities the omission of other aspects of the behaviour disability means that the findings of this study may describe only part of the spectrum of disability experienced by the TBI population.

Handicap

The large proportion of persons with TBI continuing to experience handicap many years post-injury illustrates their incapacity to live in a 'typical' manner in the community, whether it be carrying out routine day-to-day activities, pursuing leisure and social activities, or being employed. In addition to reporting the prevalence of three separate handicaps (physical independence, working, social integration), the results of this study provide additional information about the determinants of these handicaps.

Physical independence handicap. The proportion of respondents to the HALS reporting needing assistance with basic activities of daily living and/or instrumental activities of daily living is comparable to that reported elsewhere [7, 38, 39]. As well, these data further validate the hierarchical relationship between the basic and more complex activities which has been reported elsewhere [40–42]; that is, only 15% of subjects reported needing assistance with personal care (basic activities of daily living) and more than 30% reported needing assistance with more difficult activities such as shopping and managing personal finances. However, what is more interesting is the determinants of this handicap. First, it is notable that 26.8% of the variance in the handicap score was explained by the independent variables, particularly when these did not include injury severity variables. Other studies [43] have been able to account for only 10% of the variance in a similar measure of physical independence, despite including injury severity measurements as possible explanatory variables in the model.

In this study the variables found to be significant determinants of physical independence handicap include gender (female), level of education (primary school or less), living with greater numbers of people, the presence of physical environmental barriers, and personal care disability. The cross-sectional nature of this survey data means that cause-and-effect relationships must be inferred cautiously, and each variable evaluated separately. Physical independence may have been associated with the female gender due to the traditional roles played by men and women. Women may have reported more handicap because homemaking was part of their pre-injury role that they had trouble fulfilling post-injury: men would be less likely to have played this role. The finding that the variable 'living situation', that is living with others (vs. alone), is positively associated with physical independence handicap may be explained by suggesting that persons who have less disability are more likely to live alone and/or that persons who are living with others become dependent on them. For the variable 'level of education' it is more logical to understand physical independence handicap as a barrier to receiving education, rather than a lack of education as enhancing the handicap. The only caveat to this logic is that one of the factors associated with physical independence handicap is 'assistance needed with personal finances'. Education can easily be understood as being associated with the ability to take care of personal finances. Finally, this analysis confirms our understanding that disabilities in personal care and barriers in the physical environment are inextricably linked with physical independence handicap. Logic suggests that persons reporting difficulty with personal care activities, or with moving around inside their dwelling, would probably also report needing another's assistance with these activities. The handicap is identified according to the assistance needed.

Unfortunately, the survey does not provide information about whether adequate assistance is available. Certainly, necessary resources must be available for persons to remain in the community. There is at least one standardized assessment available that identifies handicap only if adequate resources are not available [44]. Such instruments are more useful than the HALS in clinical work and research, partly due to the importance of social support and physical resources for enabling people to accomplish their day-to-day tasks.

Working handicap. The working handicap experienced by the TBI population is striking. Not only is the percentage of employed subjects small (25%, see Table 2) but of these more than 30% are employed in sheltered workshops or in situations where they are not paid. As well, 80% of those employed reported one or more employment disadvantages related to their health. These figures echo those from a survey by the Iowa Head Injury

Association, where fewer than 10% of respondents were employed full time and competitively [45].

Working handicap, in this study, was more common among older, or less educated respondents experiencing physical environmental barriers and/or motor disability. It is logical to assume that each of these factors makes it more difficult for respondents to obtain or maintain employment. In particular, the association between age and working handicap has been noted elsewhere [46, 47].

This study has explained less of the variance in working handicap (15.6%) than other studies which explained between 28% [43] and 38% [47]. However, working handicap is quantified differently in this study, in relation to the WHO definitions. The scaling in this study resulted in people who were disadvantaged in relation to their work being identified as handicapped. Thus, someone who was employed but reported being able to do less work because of his/her condition would be classified as handicapped (see Table 2). However, someone who was unemployed but did not relate this to his/her condition was not classified as handicapped. Distinguishing between those disadvantaged at work because of their condition and those disadvantaged for other reasons has not previously been done in scaling handicap for multivariate analyses. However, it is well recognized that many of those TBI persons returning to work have condition-related difficulties in their employment settings.

Social integration handicap. The data on participation in social activities by these TBI subjects present a picture of a very isolated group of people (see Table 2). Twenty-seven per cent reported never socializing with family or friends at home, and almost 20% reported never visiting family or friends. Other communication is even rarer: 47% reported never talking on the telephone

This study identified social integration as participation in activities and satisfaction with this participation. This is used as a measure of a persons ability to participate in customary social relationships, the WHO definition of social integration [17]. The TBI literature uses a wide variety of measurements to get at the construct social integration. Similar to the HALS, some studies report limits in participation in leisure activities and level of satisfaction with activities. Other studies look at social contacts and marital relationships as part of the construct social integration.

Reported prevalence of limitations in leisure activities varies in the literature from 22% [34] to 38% [48]. However, in studies that have followed subjects for 5–10 years, the proportion of persons reporting some kind of difficulty with social relationships generally is reported as being close to 40% [7, 34, 38]. The results of this study are within these ranges for individual activity items. However, when participation and satisfaction are considered together, only 10% of this sample were identified as 'socially integrated' (see Table 5). The mean number of activities per month (13) was far below the mean of 29 reported elsewhere [49].

The wide variety of definitions (for this construct) may explain the low number of attempts made to identify the determinants of 'social integration'. This study found that older men with less education and a personal-care disability were more handicapped in this area. In other populations, age and gender have also been reported as being associated with leisure interests [50, 51], part of social integration. Specifically, leisure interests have been found to narrow with increasing age, while satisfaction with activity has been found to increase.

That social integration handicap is greater among those with less education and more personal-care disability may reflect deficiencies in the social network of people with these

disabilities, a network normally enhanced by the education system. Personal-care disabilities indicate very basic limitations which may also affect the ability to develop and maintain social contacts.

These results provide only clues to understanding the determinants of social integration handicap as an outcome of TBI. The high prevalence of this handicap, and the small proportion of variance explained by these determinants, provides a challenge for further study.

Handicap summary. In comparing the three handicaps, as has been reported previously, the prevalence of working and social integration handicaps is much greater than that of a physical independence handicap. This is undoubtedly related to the cognitive and behavioural demands of these various activities. Although the common determinants of the three handicaps are clear, and validate other reports in the literature, there is a great deal of unexplained variance. That the reported disabilities did not explain more variance in the three handicaps may have important clinical implications. Community reintegration clearly does not depend simply on remediating disability.

Although some additional variance in the handicap scores would probably be explained by injury severity, there are certainly other associated factors. For example, social support factors have rarely been considered in relation to the outcomes described in this study as handicaps. The impact of a supportive social network, and ways of facilitating this through community groups, must be studied. This study was not able to work at this factor, due to limitations in the available data. Another important factor may be the physical environment. This study has made a first attempt at looking at physical environmental barriers in relation to outcome, but much more work is needed in this area. The variance in outcome related to various rehabilitation interventions also needs to be studied. Examining these factors has the potential to have enormous clinical relevance.

The WHO model

This study found that using the WHO model facilitated examination of the chronic disablement associated with TBI. Although the HALS data were not as comprehensive as the ICIDH in terms of disability and handicap scales, their use with the WHO model produced some interesting results.

This model encourages looking at disablement in a very broad manner, highlighting the importance of various aspects of life (work, self-care, social integration) and the important role of the environment in our ability to function in society. In contrast, the medical model of health care focuses concern on 'fixing' the person who is injured [52]. The medical model considers only disability and impairment to explain handicap. However, this study found that, although some disabilities were associated with handicap, they accounted for very little of the variance in the measures of handicap. Instead, environmental factors were significant in explaining the variance of two of the three types of handicap. This study provides some empirical validation for the attention paid by health-care professionals to the injured person's environment: home, family, work and friends. It also supports a shift away from considering the injured person as the only place where we as health-care professionals intervene.

Implications for future research

This study investigated a number of disability and environmental variables and their contribution to the handicap experienced by the TBI population. Despite this, there was a great deal of variance in the handicap scales that was not explained. This unexplained variance compels us towards examining other factors, environmental, social, cultural and so on, that may well contribute to the handicap or social disadvantage experienced by this population. Further efforts directed towards a deeper understanding of the determinants of this handicap should include measures of these factors. Ultimately such work will provide useful insights and enable us to focus our interventions in ways which will reduce the long-term disablement experienced by this population.

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