Factors That Lead to Successful Community Integration Following Severe Traumatic Brain Injury

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Objective: To assess and identify predictive factors of community integration of people 3 to 15 years after severe traumatic brain injury (TBI). Participants: Forty participants with severe TBI (an average of 8.8 years postinjury). Main Outcome Measures: The Community Integration Questionnaire, the Community Integration Measure, and the Sydney Psychosocial Reintegration Scale. Data related to factors that may predict community integration were also collected. Results: There was considerable variation in the level of community integration. Discriminant function analyses identified the following factors as predictive of the level of community integration: severity of injury, age at the time of injury, level of disability, and challenging behavior. Conclusion: Interventions that minimize challenging behavior and disability may make a significant difference to the level of community integration experienced by people with severe TBI. Key words: challenging behaviour, disability, participation, predictors, severity of injury.

Each year in Australia, an estimated 27,991 incidents of traumatic brain injury (TBI) occur, resulting in long-term disability for some 43,688 individuals. Increasingly, researchers see community integration as the ultimate outcome of TBI rehabilitation. In this study, a comprehensive definition of community integration was used, which is based on the theoretical model of community integration developed by McColl et al. Community integration includes (a) assimilation—being able to fit in with other people, knowing your way around, and being accepted; (b) social support—being part of a network of family, friends, and acquaintances; (c) occupation—having things to do for fun, and to do meaningful and productive activity during the main part of the day; (d) independent living—dependence in everyday tasks and in making everyday decisions and life choices. Few studies have examined factors that predict successful community integration. Studies are required to identify and quantify both the specific community integration difficulties faced and factors that predict outcomes, enabling therapists to develop more effective interventions and supports.

Most studies of community integration in the TBI population have found that people with TBI are generally less integrated into the community than are people in the general population. Sex differences have been reported—unlike males, females with TBI are integrated into home activities at a level similar to that for nondisabled samples. Overall,
women have a higher level of community integration both premorbidly and following their TBI, but they, more than men, report negative changes in their ability to fulfill social roles. Studies have consistently shown that TBI has a negative and long-term impact on employment and other productive activity. Younger people with a TBI tend to have a higher level of social integration, productivity, and overall level of community integration than do older people with TBI.

Community integration among people with severe TBI varies a great deal. Doig et al identified 3 groups from their sample: 38% who achieved a high level of productivity, 22% who had a balanced lifestyle, and 40% who were poorly integrated. Interestingly, the high productivity individuals were less integrated into home and social activities while the more balanced lifestyle group was involved in part-time work, study, and volunteer work and participated more in home and social activities. The more socially isolated, poorly integrated group tended to participate in social activities exclusively with family or friends with a brain injury. The relation between a high level of community integration and part-time work is supported by 2 other studies. Doig et al speculated that, for some individuals, the resumption of full-time work is paramount; however, the demands impede the ability to integrate into home and social roles. Although these studies provide information about general trends in community integration following severe TBI, they do not provide insight into the specific difficulties faced or include the persons' perception of their own integration.

All of these studies utilized the Community Integration Questionnaire (CIQ), despite its substantial weaknesses. While the CIQ measures the person's level of involvement in activities associated with community integration, low scores may not reflect actual failure to reintegrate as a result of TBI; rather, the scores reflect the distribution of responsibilities in the family preinjury or highlight personal choice or circumstances. The preinjury status for each CIQ item needs to be measured to determine the effect of TBI on community integration. Furthermore, any measure of community integration should include the person's level of satisfaction with participation to address individual differences and preferences. To provide a comprehensive measure of community integration, the CIQ, with its finite set of indicators of community integration, needs to be used in conjunction with other tools.

The constructs of community integration and participation, as defined by International Classification of Function, Disability and Health (ICF), are closely related, although currently there is little literature that compares and contrasts these concepts. Participation, a component of health, is defined as "involvement in a life situation." Community integration and participation are both concerned with "What life roles is the person involved in?" and "What activities do they do?" Life roles include being a family member, neighbor, schoolmate, friend, casual acquaintance, shopper, coworker, a club member, or a significant other. Both community integration and participation are about the social and physical inclusion of people in community life. Community integration as defined by McColl et al appears to place more emphasis on being accepted and belonging than the concept of participation. In this study, where the ICF model of health for the general population has been used to examine factors that predict community integration, the domain of participation and community integration are interchangeable.

Factors that predict community integration

Numerous factors affect community integration. One study specifically examined several factors predicting community integration, but other studies examined predictors of other TBI outcomes such as disability and quality of life. In a study by Zafonte et al of 276 people with TBI, the duration of posttraumatic amnesia (PTA) and age at the time of injury significantly predicted scores on the Disability Rating Scale and the Functional
Independence Measure at admission and discharge. Dawson et al.23 examined early signs of injury severity in a study involving 42 participants to determine whether they predicted quality of life at 4 years postinjury. Multivariate regression revealed that only the length of PTA was a significant predictor of quality of life.

Fleming et al.6 investigated the usefulness of measures of functional status, disability, memory, and cognition, together with demographic and clinical characteristics, for predicting community integration of 446 Australians with TBI 2 to 5 years postinjury. The predictor variables were cognition, memory, activities of daily living, functional disability, and fine motor skills. The outcome variables of community integration and vocational activity were measured by the CIQ and employment status, respectively. Using multiple linear regression, Fleming et al.6 explained nearly 28% of the variance associated with community integration as measured by the CIQ finding that factors contributing to the prediction of community integration included age, length of PTA, length of acute stay, functional disability (Disability Rating Scale),24 cognition (as measured on the Barry Rehabilitation Inpatient Screening of Cognition),25 and activities of daily living (as measured on Modified Barthel Index).26

Fleming et al.6 also found that younger people with TBI had a higher level of social integration, productivity, and overall community integration, a finding replicated in other studies,8,11,12 revealing a positive relation between youth and community integration. They also6 found that the patients' premorbid occupational status was a significant predictor of the CIQ productivity score and their return to work status.6 This supports previous studies that have found a significant relation between premorbid occupational status and employment at follow-up.27,28

While possible predictors of community integration identified in the literature include severity of injury, demographic variables, age and sex, premorbid factors, such as employment status and living situation, and current level of disability, financial status, and time since injury, a number of other factors may prove to be predictors of community integration including premorbid factors, such as intelligence quotient, challenging behavior, and community resources. Although much more difficult to measure, the level of acceptance, support, and resources available in the local community are also likely to have a significant effect on community integration.

The aims of this study were 3-fold. The first aim was to measure the level of community integration of 40 people at 3 to 15 years postinjury. The second aim was to identify subgroups within the sample with a similar level of community integration. The third aim was to identify factors that predict membership in these subgroups. Factors that were chosen as potential predictors of community integration included age, sex, years of education, premorbid intelligence quotient, premorbid employment status, premorbid level of community integration, length of PTA, length of hospital stay, activity limitations, challenging behavior, financial resources, and social support.

METHODS

Participants

Forty people with severe TBI were recruited via 2 brain injury rehabilitation services in Melbourne, Australia: Bethesda Rehabilitation Centre and Osborn, Sloan and Associates. Given the small sample size, and the broad range of community integration outcomes usually experienced by people following TBI, the selection criteria aimed to ensure that the participants were as homogenous a group as possible. Individuals included in the study had a primary diagnosis of TBI with a PTA length of more than 3 weeks, were between 17 and 62 years of age at the time of their injury, had their accident between 1987 and 1999, and resided within the Melbourne metropolitan area. Individuals excluded were those with a significant medical history (eg, psychiatric or previous brain injury), those residing in a setting without access to the local
community (eg, nursing home or hospital), and those whose receptive or expressive language abilities rendered them unable to understand or respond to interview questions.

A total of 177 potential participants were sent letters inviting them to take part in the study, with 40 finally participating (see below for recruitment procedure). In the absence of a power analysis, a sample size of 40 was considered adequate to determine which factors might predict community integration. A priori power analyses are particularly difficult to conduct in clinical environments where measures of many of the variables required in the equation are not known. Tabachnick and Fidell recommend that where there are only 5 or fewer predictors, the smallest group should have 20 cases.

Participants were 3 to 15 years postinjury with primary TBI etiologies, including motor car accidents (53%), pedestrian accidents (23%), and motor cycle accidents (13%). Men comprised 65% of the sample. The mean age at injury was 28 years (range = 17–62) and the mean age at the time of the study was 36.77 years (range = 23–68). The mean number of years of education was 12.83 years (SD = 3.16). The mean length of PTA was 65.18 days (SD = 55.05, range = 25–157), indicating that all participants had sustained very severe to extremely severe brain injuries.

**Measures**

In addition to collecting demographic and injury data, a total of 7 measures were administered. Community integration was measured using the CIQ, the CIM, and the Sydney Psychosocial Reintegration Scale (SPRS). Although the CIQ is the most widely used and thoroughly researched measure of community integration, it only measures participants' level of involvement in tasks associated with community integration. Given the multifaceted nature of community integration, the CIM and SPRS tools were added to measure community integration from different perspectives. The CIM examined participants' perception of their integration and the SPRS looked at participants' perception of change as a result of their TBI.

The CIM was developed following a literature review and qualitative study, asking people with TBI for their perspective on community integration. Nine themes related to community integration emerged and questions were developed to measure these themes. Data are collected on the participant’s level of involvement in tasks associated with home, socializing, and work (as with the CIQ), but the CIM covers additional aspects of integration, such as belonging, acceptance, diffuse relations, and independent living, and yields a single score, ranging from 10 to 50.

The SPRS recently developed in Australia, aims to measure psychosocial disabilities that occur after TBI. It is a 12-item questionnaire measuring 3 domains of everyday living commonly disrupted after TBI: work and leisure, interpersonal relationships, and independent living skills. Initial studies have examined the psychometric properties of both the CIM and the SPRS with encouraging results, but further studies are required.

The Lambeth Disability Screening Questionnaire (LDSQ) designed to screen adults living in the community for physical disability, has 22 items requiring “yes” or “no” responses and usually takes 2 or 3 minutes to complete. The LDSQ was developed from a 139-item questionnaire called the Functional Limitations Survey, which is a version of the Sickness Impact Profile. Charlton et al compared the LDSQ and the Functional Limitations Survey and found that the LDSQ predicted both physical and psychosocial disability levels reasonably well, although it predicted the former better than the latter. The LDSQ was chosen because it is concise and assesses a wide range of activities of daily living compared with other measures, such as the Functional Independence Measure, Functional Assessment Measure, or Barthel Index. Although the Sickness Impact Profile may provide a more sensitive measurement of disability, it was not realistic.

*References 3, 6, 8, 10, 11, 14, 17, 18, 32, 33.*
to administer an instrument with 139 items to people with TBI, in addition to the other instruments utilized in this study.

The Current Behavior Scale (CBS), which aims to measure behavioral changes often observed in people with severe closed head injury, has 25 items, each with a 7-point visual analog scale. The significant other of the person with the TBI was asked to rate the behavior of the head-injured person over the past few weeks. Utilizing the CBS, Kinsella et al found 2 broad categories that described behaviors following a TBI: loss of emotional control (LEC) and loss of motivation. In a factor analytic study, items loading on LEC included impulsivity, aggression, irritability, and restlessness. Although a few studies with small samples have been conducted to demonstrate the reliability of the CBS, further studies are required to establish its psychometric properties.

The Medical Outcomes Study-Social Support Survey examines perceptions of the availability of different functional aspects of support rather than the actual support received and was found to be a valid and reliable measure of social support in a study of 2987 people with chronic medical conditions. The National Adult Reading Test is the most widely used tool for estimating premorbid intellectual ability in English-speaking countries. The test has been found to be highly correlated with the general intellectual level and is relatively resistant to the effects of brain injury.

**Procedure**

The project was granted ethical approval by the La Trobe University Faculty Human Ethics Committee, Bethesda Hospital Research and Ethics, and Osborn, Sloan and Associates. Osborn, Sloan and Associates provide occupational therapy and psychology services to people with TBI living in the community. Bethesda Hospital research staff identified 167 past inpatients who appeared to meet the criteria and had not been recently involved in another research project. Osborn, Sloan and Associates identified 10 people who met the inclusion criteria. To preserve the identity of their clients, each organization sent potential participants a return-addressed envelope inviting them to participate. Of the 177 people invited, 49 returned the permission form. Of these 49 people, 3 were excluded because of a previous brain injury or psychiatric history. 1 person from a non-English-speaking background was not able to understand the interview questions, and 5 people decided not to be involved. Of the final 40 participants, 33 were recruited through Bethesda Rehabilitation Centre and 7 were recruited through Osborn, Sloan and Associates.

Participants were interviewed on 2 occasions by an occupational therapist or a psychologist and during the initial hour-long interview, the CIQ, CIM, and SPRS were administered. A family member or significant other nominated by the participant was also contacted and asked to complete the CBS and a retrospective CIQ. During the second hour-long interview, conducted 7 to 10 days after the first interview, the National Adult Reading Test, Medical Outcomes Study-Social Support Survey, and the LDSQ were completed. Participants were sent 2 movie tickets as a token of appreciation for their time and effort.

**Data analysis**

Demographic data and factors identified in literature as predictive of community integration were summarized using descriptive statistics. The factors identified as potential predictors of community integration and methods of measurement are outlined in Table 1. Cluster analysis identified subgroups of participants with similar levels of community integration using the quick cluster function on the SPSS. The 3 measures of community integration (CIQ, CIM, and SPRS) were the variables used for the cluster variate and 3 discriminant function analyses were then conducted, each producing a slightly different model to predict levels of community integration. Prior to these analyses, a series of t tests for independent groups determined which independent variables discriminated between
Table 1. Factors that potentially predict community integration

<table>
<thead>
<tr>
<th>Category</th>
<th>Factors</th>
<th>Methods of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic variables</td>
<td>Age at injury, Sex, Years of education</td>
<td>Medical record, Medical record, Semistructured interview</td>
</tr>
<tr>
<td>Preinjury variables</td>
<td>Intelligent quotient, Employment status, Employment type, Financial resources, Residence, Community integration</td>
<td>National Adult Reading Test, Semistructured interview, Semistructured interview, Semistructured interview, Semistructured interview, Retrospective preinjury Community Integration Questionnaire</td>
</tr>
<tr>
<td>Injury variables</td>
<td>Length of posttraumatic amnesia, Length of stay</td>
<td>Medical record, Medical record</td>
</tr>
<tr>
<td>Postinjury demographic variables</td>
<td>Activity limitations, Behavior, Financial resources, Social support</td>
<td>Lambeth Disability Screening Questionnaire, Current Behavior Scale, Semistructured interview, Medical Outcomes Study–Social Support Survey</td>
</tr>
</tbody>
</table>

the high and low community integration groups, and only variables that did so were entered into the discriminant function analyses.

RESULTS

Identification of community integration subgroups

Most previous studies of community integration have described the results in terms of the whole TBI sample. However, given the long-term variations in community integration within this population, measures of central tendency provide limited information. The use of mean scores for measures of community integration and their subscales masks the fact that some people are well integrated into their community while others are quite isolated from their community. This study explored subgroups within the population on the basis of the measures of community integration using cluster analysis, which requires that variates have normal distributions; the distributions of the CIQ, CIM, and SPRS scores were found to be relatively normal (see Table 2).

Table 2. Description of total scores on measures of community integration (N = 40)*

<table>
<thead>
<tr>
<th></th>
<th>CIQ total score</th>
<th>CIM total score</th>
<th>SPRS total score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>11.25</td>
<td>28</td>
<td>13</td>
</tr>
<tr>
<td>Maximum</td>
<td>28</td>
<td>50</td>
<td>72</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>18.35 (±4.59)</td>
<td>43.05 (±6.07)</td>
<td>45.25 (±16.66)</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.14</td>
<td>-0.06</td>
<td>-0.13</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-1.00</td>
<td>-0.48</td>
<td>-1.00</td>
</tr>
</tbody>
</table>

*CIQ denotes Community Integration Questionnaire; CIM, Community Integration Measure; and SPRS, Sydney Psychosocial Reintegration Scale.
Table 3. Distribution of scores on measures of community integration in high and low community integration groups

<table>
<thead>
<tr>
<th>Measure</th>
<th>Group</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>Unpaired t test</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIQ total score</td>
<td>High group</td>
<td>22</td>
<td>20.64</td>
<td>4.34</td>
<td>$t_{38} = 4.15$, $\rho &lt; 0.001^\dagger$</td>
</tr>
<tr>
<td></td>
<td>Low group</td>
<td>18</td>
<td>15.56</td>
<td>3.16</td>
<td></td>
</tr>
<tr>
<td>CIM total score</td>
<td>High group</td>
<td>22</td>
<td>46.00</td>
<td>5.08</td>
<td>$t_{38} = 4.00$, $\rho &lt; 0.001^\dagger$</td>
</tr>
<tr>
<td></td>
<td>Low group</td>
<td>18</td>
<td>39.44</td>
<td>5.26</td>
<td></td>
</tr>
<tr>
<td>SPRS total score</td>
<td>High group</td>
<td>22</td>
<td>57.73</td>
<td>9.26</td>
<td>$t_{38} = 9.49$, $\rho &lt; 0.001^\dagger$</td>
</tr>
<tr>
<td></td>
<td>Low group</td>
<td>18</td>
<td>30.00</td>
<td>9.10</td>
<td></td>
</tr>
</tbody>
</table>

*CIQ denotes Community Integration Questionnaire; CIM, Community Integration Measure; and SPRS, Sydney Psychosocial Reintegration Scale.

$^\dagger\rho < 0.001$.

A 2-cluster solution (high and low community integration) divided the sample into more distinct groups than a 3-cluster solution, as used by Doig et al. This cluster analysis classified 22 participants into the high community integration group and 18 participants into the low community integration group. Using an unpaired t test, differences were found between the 2 groups in terms of their scores on the 3 community integration measures, as shown in Table 3.

**Differences between high and low community integration groups**

Fisher exact test for categorical data determined whether there were differences between factors such as sex, marital status, and discharge destination and membership in the high or low community integration groups. The variable discharge destination originally had 5 categories; these were reduced to 2 categories for this analysis: preinjury home and other. The “other” category included parents’ home, other home, group home, or other rehabilitation facility. Of the 6 categorical variables analyzed, only the discharge destination outcome variable was significantly different ($X^2_1 = 8.59$, $\rho = 0.004$) between the high and low community integration groups.

**Factors that predict community integration**

Discriminant function analysis was used to identify factors that predict membership in the high and low community integration groups. Data were first screened and multivariate outliers were identified by examining box plots of the distribution of scores of factors for both high and low groups. Outlier scores were replaced with the mean score of the group. Initially, a series of unpaired t tests sought variables that would discriminate between the high and low community integration groups. Of the 8 preinjury and injury variables examined (Table 4), only age at injury ($\rho = 0.019$) and length of PTA ($\rho = 0.004$) differed significantly between the high and low community integration groups. Of the 7 postinjury factors evaluated (Table 5), 1 approached significance while 2 were significant. These 3 postinjury variables were level of LEC ($\rho = 0.059$) (from the CBS), level of disability ($\rho < 0.001$) (from the LDSQ), and the number of close friends ($\rho = 0.047$) (from the Medical Outcomes Study-Social Support Survey).

**Model 1: Preinjury and injury factors**

The first discriminant function analysis using standard entry procedure was conducted to determine whether preinjury and injury data alone could predict membership in the high and low community integration groups. This information could be useful to clinicians wishing to predict community integration at the beginning of inpatient rehabilitation. The 2 preinjury and injury variables able to
Table 4. Preinjury and injury factors examined for discrimination between high and low community integration groups

<table>
<thead>
<tr>
<th>Factors</th>
<th>Methods of measurement</th>
<th>Unpaired t tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at injury</td>
<td>Medical record</td>
<td>( t_{35} = 2.45, \rho = 0.019 )(^\dagger)</td>
</tr>
<tr>
<td>Years of education</td>
<td>Semistructured interview</td>
<td>( t_{60} = 1.49, \rho = 0.146 )</td>
</tr>
<tr>
<td>Verbal IQ</td>
<td>NART(^{15}) and demographic regression equation(^{39})</td>
<td>( t_{37} = 1.19, \rho = 0.243 )</td>
</tr>
<tr>
<td>Performance IQ</td>
<td>NART(^{15}) and demographic regression equation(^{39})</td>
<td>( t_{37} = 1.36, \rho = 0.182 )</td>
</tr>
<tr>
<td>Preinjury community integration</td>
<td>Retrospective CIQ completed by significant other preinjury CIQ total</td>
<td>( t_{34} = -0.30, \rho = 0.770 )</td>
</tr>
<tr>
<td>Preinjury productivity</td>
<td>Retrospective CIQ completed by significant other preinjury CIQ productivity subscale</td>
<td>( t_{34} = 0.516, \rho = 0.609 )</td>
</tr>
<tr>
<td>Length of posttraumatic amnesia</td>
<td>Medical record</td>
<td>( t_{36} = -3.10, \rho = 0.004 )(^\dagger)</td>
</tr>
<tr>
<td>Length of stay</td>
<td>Medical record</td>
<td>( t_{36} = -1.15, \rho = 0.265 )</td>
</tr>
</tbody>
</table>

\(^\dagger\rho < 0.05.\)

\(^\dagger\rho < 0.01.\)

discriminate between the high and low community integration groups using \( t \) tests were used in this model: age at accident and length of PTA. This function was significant (\( \chi^2 = 9.41, \rho = 0.009 \)) and showed that there was a strong association between groups and predictors. Together, age at injury and length of PTA predicted 72.7% of the variance associated with the high community integration group and 62.5% of the variance associated with the low community integration group. Overall, 68.4% of the participants were correctly classified, which is considered very good.\(^{29}\)

**Model 2: Postinjury factors**

A second discriminant function analysis using standard entry procedure was conducted

Table 5. Postinjury factors examined for discrimination between high and low community integration groups

<table>
<thead>
<tr>
<th>Factors</th>
<th>Methods of measurement</th>
<th>Unpaired t tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity limitations</td>
<td>LDSQ</td>
<td>( t_{36} = 4.14, \rho &lt; 0.000 )(^\dagger)</td>
</tr>
<tr>
<td>Behavior</td>
<td>CBS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loss of emotional control</td>
<td>( t_{44} = -1.96, \rho = 0.059 )</td>
</tr>
<tr>
<td></td>
<td>Loss of motivation</td>
<td>( t_{56} = -0.89, \rho = 0.402 )</td>
</tr>
<tr>
<td>Current income</td>
<td>Semistructured interview</td>
<td>( t_{28} = 0.549, \rho = 0.588 )</td>
</tr>
<tr>
<td>Social support</td>
<td>MOS-SSS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of close friends</td>
<td>( t_{54} = 2.06, \rho = 0.047 )(^\dagger)</td>
</tr>
<tr>
<td></td>
<td>Number of close relatives</td>
<td>( t_{32} = 1.13, \rho = 0.266 )</td>
</tr>
<tr>
<td></td>
<td>MOS total score</td>
<td>( t_{52} = 1.67, \rho = 0.105 )</td>
</tr>
</tbody>
</table>

\(^\dagger\rho < 0.001.\)

\(^\dagger\rho < 0.05.\)

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using only postinjury factors to predict membership in either the high or the low community integration group. This model could assist rehabilitation clinicians to identify factors that may contribute to community integration and benefit from intervention, to direct postdischarge community outreach services. The 3 postinjury variables that discriminated between the high and low community integration groups were used in this model: level of LEC; level of disability; and the number of close friends. This function was significant \( (\chi^2 = 16.60, \rho = 0.001) \) and analysis revealed that the number of close friends did not make a unique contribution to predicting group membership. This was shown by the \( \chi^2 \) transformation of Wilks' \( \lambda \), which was used to test the equality of group means for each variable: level of LEC (\( \Lambda = 0.897, \rho = 0.038 \)) and level of disability (\( \Lambda = 0.678, \rho < 0.001 \)) were significant, but the number of close friends (\( \Lambda = 0.996, \rho = 0.706 \)) was not. Another discriminant function analysis was run only with level of LEC and level of disability. This function was also significant \( (\chi^2 = 16.78, \rho = 0.001) \) and showed a strong association between groups and predictors. Together, LEC and disability predicted 81.8% of the variance associated with the high community integration group and 66.7% of the variance associated with the low community integration group. Overall, 75.0% of the participants were classified correctly.

**Model 3: All (preinjury, injury, and postinjury) factors**

A third discriminant function analysis using standard entry procedure was then conducted using all variables used in the first 2 models. The number of close friends was not used as a variable in this model because it did not contribute to prediction of variance in the model with postinjury factors. The purpose of the all-factors model was to predict as much of the variance associated with the high and low community integration groups as possible using all available information. The preinjury and injury variables entered were age at injury and length of PTA, and the postinjury variables were level of LEC (from the CBS) and level of disability (from the LDSQ). This function was significant \( (\chi^2 = 21.82, \rho < 0.001) \). Together, these variables predicted 86.4% of the variance associated with the high community integration group and 61.1% of the variance associated with the low community integration group. Overall, 75.0% of the participants were classified correctly with 2 additional variables included, only slightly increasing the prediction of variance compared to the previous model, which employed only 2 variables. Although more successful at predicting variance in the high community integration group, this model was less accurate at predicting variance in the low community integration group. Overall, the percentage of participants classified by the second and third models was the same (75%).

**DISCUSSION**

The 3 community integration perspectives measured in this study were the participants' level of involvement in tasks associated with community integration, the participants' perception of their own integration, and the participants' perception of change in integration as a result of the injury. Considerable variability in total scores for all 3 community integration measures indicates that some participants had a high level of community integration while others did not.

**Identification of high and low community integration groups**

A cluster analysis procedure divided the sample into high and low community integration groups. Unlike the sample of Doig et al., this sample did not separate into 3 distinct subgroups; the difference in findings probably relates to the different variables used in the cluster variate. Doig et al utilized subscale scores of the CIQ, whereas we utilized the total scores of the CIQ, CIM, and SPRS. The 3 clusters identified by Doig et al highlight differences in participants' involvement in community integration tasks, whereas 2 cluster of this study reflect
participants' perception of their community integration (CIM), changes in integration as a result of the injury (SPRS), and involvement in tasks associated with community integration (CIQ). No other studies reviewed reported a division of participants according to the level of community integration.

**Personal factors**

Eight personal factors were examined to determine whether they differentiated between the high and low community integration groups; 7 of these were not significantly different in the 2 groups (sex, partner status, preinjury living situation, estimated preinjury intelligence quotient, estimated preinjury community integration, preinjury level of productivity, and years of education). The sole significantly different variable was age at time of injury. In contrast to the findings of previous studies that younger people have a higher level of community integration than older people, this study reveals that the low community integration group consists mainly of younger people. Unlike previous studies, the current study found little difference in the community integration of men and women. The finding of Bruzy and Corrigan that people residing with parents prior to TBI were more likely to remain at home with parents long-term postinjury was also not supported.

Other personal factors affecting community integration include personality, coping style, habits, and upbringing. Given the complexity of these constructs, and difficulties measuring individual differences, the effect on community integration may never be known. However, some studies have begun to examine the relationships between factors such as adjustment and coping styles and community integration.

**Severity of injury**

The high community integration group had a shorter PTA, indicating less severe injury, than did the low community integration group. Length of hospitalization, an indicator of injury severity in other studies, did not differentiate between the 2 groups. The only area of impairment examined was challenging behavior, using the CBS to measure 2 factors: LEC and loss of motivation. Only one factor, LEC, differentiated between the high and low community integration groups.

**Level of disability**

The LDSQ revealed a significant group difference in activity limitations. A previous study also found fewer activity limitations associated with higher level of community integration. The discharge destination finding is consistent with that regarding activity limitations, in that high community integration group members, who tended to return to their preinjury home, had fewer activity limitations at the time of discharge. The low community integration group members, who tended to go to another hospital, group home, or the home of a relative, may have experienced more activity restrictions. The current study found a significant group difference in discharge destination, confirming this as a significant predictor of community integration.

**Predicting community integration**

Three discriminant function analyses were conducted to identify factors that could predict high or low community integration group membership. The first utilized preinjury and injury data only to determine whether community integration could be predicted during inpatient rehabilitation. Clearly, the nature and extent of a disease or disorder has an impact on the extent of community integration. As indicated in previous studies, a more severe injury, as measured by length of PTA, was a significant predictor of lower community integration.

In contrast to a previous study, we found that greater community integration (using the CIQ) was associated with youth. The difference in findings may relate to differences in ages of the sample, methods of measuring community integration, or the fact that the current study examined age at injury while Fleming et al examined age at follow-up as www.headtraumarehab.com
a predictor of community integration. The inclusion of participants older than 70 years in the sample of Fleming et al.\(^6\) may also account, in part, for the difference in findings.

The preinjury and injury data prediction model could be useful to inpatient rehabilitation clinicians by helping them identify people with TBI who are at risk of very poor community integration outcomes. Rehabilitation professionals planning inpatient discharges may need to ensure that progress of younger clients with longer PTA is more closely monitored to ensure that adequate client and family supports are in place.

The second model utilized postinjury factors alone to predict high and low community integration group membership. A component of challenging behavior, called “loss of emotional control” characterized by disinhibition, impulsivity, frequent mood changes, and irritability, predicted low community integration. Other behaviors measured on the CBS relating to lack of arousal or lack of motivation did not predict community integration. Although other studies document changes in behavior following TBI, including the consequences for the person’s social network, using challenging behavior as a predictor of community integration has not been explored elsewhere. Before generalizations can be made to the wider TBI population, this finding needs to be replicated with a larger sample. Potential implications include the need for clinicians to focus on behavior management to maximize community integration. Behavior management intervention involves providing structured education and intervention to individuals with TBI and their caregivers in home, work, or school environments.\(^5\) Only one variable from the domain of body structures and function, outlined in the ICF,\(^20\) was examined in this study (i.e., challenging behavior). Future studies may find that some measures of cognitive and/or physical functions are also useful predictors of community integration.

The ICF “activity” domain,\(^20\) measured using the LDSQ, was a useful predictor of community integration. Heinemann and Whiteneck\(^12\) also found a predictive relation between disability and community integration, although the tool utilized to measure disability was not standardized. Future research may identify the specific activity limitations most predictive of community integration to determine the most effective use of rehabilitation resources. Findings suggest that interventions directed at increasing emotional control and reducing disability may have a significant impact on a person’s level of community integration following TBI.

Frequently, environmental factors present barriers to community integration for people with severe TBI,\(^3\) including the physical and social features of the individual’s immediate environment at home, work, and school, as well as the services and systems in the wider environment. These services and systems include the formal and informal support structures, services, attitudes, beliefs, cultures, transport, laws, regulations, and informal rules affecting individuals.\(^20\) Environmental factors are generally more complex and difficult to measure than the other domains of the ICF\(^20\) and are likely to have an impact on community integration. However, in this study only social support was examined to determine its ability to predict community integration. Some environmental factors were controlled for in this current study—for example, all participants resided in the greater metropolitan area and generally had access to similar levels of funding and community and rehabilitation services.

The purpose of including all factors in the third model was to predict as much of the variance as possible between the high and low groups, using all available information. Although the all-factors model was more successful than the postinjury factors model at predicting variance in the high community integration group, it was less accurate at predicting variance in the low community integration group. Clinically, it seems more important to identify clients at risk of poor outcomes than to identify clients likely to integrate successfully. For rehabilitation clinicians, the model using postinjury factors only appears to be more useful in directing intervention.
Study limitations

Limitations of this study include the sample selection method, sample size, and the tools utilized. The sample is likely to be a biased one. Of the 177 people invited to participate, only 40 finally did so, and those who could be contacted and chose to participate may have differed from the others. This sample also differs from the wider TBI population, as all participants had access to comprehensive inpatient and community outreach rehabilitation services and lived in a metropolitan area with access to a range of community and transport services. Similar to previous TBI studies, we aimed to ensure that the sample was as homogenous as possible, resulting in a small sample size, which limits the generalizability of the findings. The sample was, however, adequate to develop strong predictive models.

Another limitation concerns the use of concise instruments to measure factors that may predict community integration. Tools that could be administered quickly were selected because of the number of factors to be measured within two 1-hour interviews. Future studies may use more extensive tools and overcome the time restrictions by either completing more interviews with each participant or reducing the number of factors examined. For example, future studies might examine disability, challenging behavior, and/or friendship networks in more detail and identify specific aspects of these factors that present barriers to or enhance community integration. Only a portion of the many factors that may influence community integration were examined. Given that the ICF emphasizes the environment as a contributor to health status and participation, future research should focus on measuring the environment and interventions directed at the environment that maximize community integration.

SUMMARY

This study extends knowledge about the level of community integration experienced by the TBI sample in relation to productivity, leisure, and social isolation. It also supports findings of the previous studies that severity of injury and disability predict community integration but contrasts with the finding of Fleming et al that younger people tend to have a higher level of community integration. The finding that challenging behavior was a significant predictor of community integration requires replication in studies with larger samples before it can be generalized to the wider TBI population. Clinical implications of our findings include increasing resources for interventions that manage behaviors related to LEC. An increased focus on behavior management education and strategies for the person with TBI, family, friends, and carers may meaningfully enhance community integration. In addition to replicating the findings of the current study, future studies may also test the utility of the classification functions derived in this study through cross-validation on another sample of people with severe TBI.

REFERENCES


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Factors Leading to Successful Community Integration Following Severe TBI


