

Community integration, social support and life satisfaction in relation to symptoms 3 years after mild traumatic brain injury

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Abstract

Primary objective: To investigate the relation between psychosocial functioning (community integration, life satisfaction and social support) and symptoms (post-concussion, post-traumatic stress and depression) in persons with mild traumatic brain injury (MTBI) 3 years after the trauma.

Methods: Population-based follow-up study of 163 patients. At follow-up, an assessment of community integration, social support, life satisfaction and symptoms was made.

Results: Total score of Community Integration Questionnaire (CIQ) was negatively correlated to total score of the Rivermead Post-Concussion Symptoms Questionnaire (RPQ, $r = -0.270$, $p < 0.001$) and to total score of the Beck Depression Inventory (BDI, $r = -0.332$, $p < 0.001$). Life satisfaction (LiSat-11) was negatively correlated to the RPQ ($r = -0.459$, $p < 0.001$), to total score of the Impact of Event Scale (IES, $r = -0.365$, $p < 0.001$) and to the BDI ($r = -0.642$, $p < 0.001$). Low levels of life satisfaction were common at follow-up.

Conclusions: A large proportion of the individuals with MTBI experienced both psychosocial difficulties, with low levels of life satisfaction in particular and symptoms (post-concussion, post-traumatic stress and depression) 3 years after trauma. Since the possibility of pre-injury factors contributing to the condition at follow-up cannot be ruled out, the study indicates that all these factors should be taken into consideration in the management of persons with MTBI.

Keywords: *Traumatic brain injury, brain concussion, community integration, life satisfaction, post-concussion symptoms, depression, post-traumatic stress disorder*

Introduction

Traumatic brain injuries (TBIs) are very common, 98–235/100 000/year require hospitalization [1, 2] and a great majority (80–85%) are classified as mild traumatic brain injury (MTBI)/concussion [3]. The injuries constitute a major health problem due to the great number of people who experience TBI and because of their potential serious long-term consequences. A significant number of persons with TBI may suffer from symptoms, disabilities and a decrease in life satisfaction [4, 5] which frequently interferes with their possibilities of resuming former levels of occupational and leisure activities [6]. TBI is common among people in general and in

particular affects young adults who are in the process of completing education and establishing working careers. The natural course of recovery consists of the restitution of many symptoms over time while difficulties in psychosocial functioning with limitations in everyday life seem to persist and to dominate some time after injury [7]. However, traditional studies of outcome, especially after MTBIs, have primarily focused on post-concussion symptoms [8, 9], but these symptoms are not encountered in patients solely after TBI; they are also frequently reported by patients with depression [10] and post-traumatic stress disorder [11]. Recently, there has been a growing interest in different areas of

psychosocial functioning after TBI as these aspects are found to play an important role in the recovery of the patients [12, 13]. Among different psychological and well-being factors which are demonstrated to influence the prognosis, particular attention has been paid to the areas of community integration [13–15], quality of life/life satisfaction [14, 16, 17] and social support [18]. In several studies, persons with brain injury are shown to be less integrated into the community than people in the general population [17, 19]. Moreover, brain injury patients are found to report lower levels of life satisfaction in comparison with healthy people [17]. Social relationships are found to have a causal impact on individuals' health and well-being [20]. Previous studies of individuals with brain injury have reported an inferior social support network and a lower satisfaction with perceived available support in these patients in comparison with control persons [7, 21, 22]. The persons' ability to cope with environmental demands and to adjust to their everyday life situations after the injury seem to be crucial for their rehabilitation and successful recovery [6]. Despite the fact that several factors may act simultaneously and influence the outcome after TBI, only a few studies have investigated the relationships between symptoms (e.g. depression and post-traumatic stress related) and psychosocial effects such as community integration [11, 23], social support [18] and life satisfaction [24]. Moreover, in studies of individuals with less severe TBI the follow-up times have been rather short [25]. It was decided therefore to carry out a population-based follow-up study of persons with MTBI 3 years after the injury in order to assess the psychosocial variables: community integration, life satisfaction and social support and symptoms (post-concussion, post-traumatic stress and depression) and to investigate the relationships between these factors. Additionally, the study aimed to analyse differences in these variables regarding gender.

Methods

Patients and procedure

The present study was based on an epidemiological study of MTBI in the Umeå district of Northern Sweden during the year 2001. Of the 214 adult patients (15–61 years) with MTBI, 126 were men and 88 were women. One woman had been involved in two different injury events, each accounted for. To be included in the study, the injured should have arrived to the Emergency Department (ED) at the Umeå University hospital within 24 hours after the trauma. The Glasgow Coma Scale (GCS) [26] on arrival to the emergency department was 13–15 and

patients had a diagnosis of concussion/commotion cerebri/mild head injury/MTBI resulting in hospitalization for observation. Information about trauma history, symptoms and signs were collected from the ongoing injury and trauma register, ambulance records and hospital records.

Follow-up

A follow-up was carried out by mail 3 years after the trauma. Out of 214 persons (aged 18–64 years), a set of questionnaires was sent to 201 subjects eligible for the study (three persons had deceased during the follow-up time because of reasons other than TBI; for 10 subjects addresses could not be obtained or data was insufficient)

Altogether 163 individuals (81%, 68 women and 95 men) responded (see Table I). The mean age of the respondents was 30.6 ± 14.4 at the time of injury. The respondents were compared with the non-respondents. No significant difference was found between respondents and non-respondents on demographic information, amnesia, loss of consciousness, external cause of injury, etc. except clinical signs of alcohol ingestion at the time of trauma ($p=0.006$) which were more frequently found in the non-respondent group.

Instruments

For the assessment of psychosocial variables (community integration, social support and life satisfaction) the instruments the Community Integration Questionnaire [27], the social support scales, the Availability of Social Interaction (AVSI), the Availability of Attachment (AVAT) [28] and the LiSat-11 were used [29].

- *The Community Integration Questionnaire.* Community integration was measured using the Community Integration Questionnaire (CIQ) [30] which primarily was developed to assess the outcome for patients with TBI. The instrument is a 15-item scale which was specially designed to quantify an individual's functional independence in the home and community. The CIQ has a total score (range 0–29) and three sub-scales, social integration (range 0–12), home integration (range 0–10) and productivity (range 0–7). Higher scores indicate more integration. The social integration sub-scale is composed of items related to socialization with others and activities engaged in outside the home that are rated according to frequency of activity and companionship during the activities. The home integration sub-scale includes items related to activities in the home, rated on whether the individual performs the activity independently, with another person or

Table I. Demographic and injury characteristics.

	<i>n</i>	%
Gender		
Male	95	58.3
Female	68	41.7
Age (years)	30.8 ± 14.3	
Education in years		
9	19	11.7
10–12	90	55.2
13–21	54	33.1
Occupational situation at time of follow-up		
Working	80	49.1
Student	64	39.2
Unemployed-seeking work	5	3.1
Sick-leave	12	7.4
Working/sick leave part time	2	1.2
Employment type of the working group		
Professional	7	4.3
Manager/administrator	25	15.3
Tradespersons	19	11.7
Operatives/services	25	15.3
Labourer	6	3.7
Marital status		
Married, cohabitating	110	67.5
Single, divorced or widowed	53	32.5
Pre-injury history of psychiatric problems		
Depression (treated at psychiatric clinic)	2	1.2
Depression (treated in primary health care)	5	3.1
Previous head trauma		
Yes, once	44	27.0
Yes, more than once	24	14.7
No	79	48.5
Unknown	16	9.8
Cause of injury		
Indoors fall	16	9.8
Outdoors fall	33	20.3
Falls from height	10	6.1
Bicycle	25	15.3
Horseback riding	5	3.1
Assault	9	5.5
Vehicle-related	37	22.7
Sports-related	23	14.1
Other	5	3.1
Alcohol ingestion	43	26.3
Duration of loss of consciousness	4.0 ± 7 min (range: 0–30)	
Duration of post-traumatic amnesia	41 ± 118 min (range: 0–720)	
Days spent in hospital	1.6 ± 2.7	

not at all. The productivity sub-scale is composed of items related to time spent outside the home per week and includes employment and school activities. In studies of the psychometric properties of CIQ [27, 30–33], test–re-test reliability has been shown to be adequate, $r=0.91$ for the total score of the CIQ, $r=0.93$ for the sub-scale home-integration, $r=0.86$ for the sub-scale social

integration and 0.83 for the sub-scale productivity [30]. High internal consistency for the sub-scales has been demonstrated, with coefficients ranging from 0.73–0.84 [30]. The validity of the CIQ has been examined, revealing a statistically significant difference between individuals with TBI and those without TBI as well as between persons with different levels of independence after TBI [34, 35].

- *The social support scales.* Social support was assessed using the social support short-form scales which consist of two sub-scales: Availability of Social Interaction (AVSI) and Availability of Attachment (AVAT) [28]. Each sub-scale comprises three items (range 0–3). The scales have been found to measure both quantity and quality of social support [28]. Psychometric test results for the short-form social support scales have shown satisfactory psychometric properties with adequate validity (internal consistency coefficients ranging from 0.77–0.78) and test–re-test reliability (coefficient 0.65 for AVSI and AVAT, respectively) [28].
- *LiSat-11.* Life satisfaction at follow-up was assessed using the LiSat-11 questionnaire which comprises 11 items, with one item concerning life as a whole and 10 other items concerning vocation, economy, leisure, contacts, sexual life, ADL, family life, partner, somatic health and psychological health [29]. Levels of satisfaction are estimated on a six-grade scale (from 1 = very dissatisfied to 6 = very satisfied), higher scores indicating higher levels of life satisfaction. A total score can be calculated (range: 0–66). LiSat-11 is an extension of the LiSat-9 (with the addition of two items, namely somatic and psychological health) [36]. The instrument has been widely used for measuring life satisfaction in a range of rehabilitation contexts including multiple trauma with brain affections [37] and has been documented to have acceptable reliability for mailed responses in a general vocational rehabilitation population [36]. Internal consistency analysis has shown coefficients ranging from 0.57–0.79 [29].

Symptoms (post-concussion, post-traumatic stress and depression) were assessed by using the Rivermead Post-Concussion Symptoms Questionnaire (RPQ) [38], the Impact of Event Scale (IES) [39] and the Beck Depression Inventory (BDI) [40].

- *The Rivermead Post-Concussion Symptoms Questionnaire.* The Rivermead Post-Concussion Symptoms Questionnaire (RPQ) [38] presents 16 of the most commonly encountered post-concussion symptoms (headache, dizziness, nausea and/or vomiting, noise sensitivity, sleep disturbance,

fatigue, etc.) and asks the patient to rate the extent to which these symptoms have been any more of a problem over the previous 24 hours compared with the pre-morbid levels, using a rating scale with values 0–4, from no problem at all to a severe problem. A total symptom score can be calculated as a sum of all scores (possible score 0–72). The RPQ has been documented to have adequate reliability and validity whether used as a self-administered or clinician-administered instrument early or late after head injury. Test–re-test reliability appears to be high, coefficient ranging from 0.87–0.91 for the total score of the RPQ [38].

- *The Impact of Event Scale.* The Impact of Event Scale (IES) is a self-report scale which was developed to assess anxiety and stress reactions as a result of a specific event [39]. It comprises seven statements regarding intrusive symptoms and eight regarding avoidance symptoms. Avoidance is characterized by such symptoms as staying away from reminders of the event. Intrusion includes strong waves of emotion related to the event. Items are scored on a 6-point scale, from 0–5 (with higher scores indicating a greater degree of distress), total scores ranging from 0–X [41]. The IES has been considered to be a standard measure of post-traumatic stress for a long time [42, 43] and it has been suggested as a screening tool for PTSD. The instrument has previously been used repeatedly for the assessment of post-traumatic stress in follow-up studies of subjects with TBI [44–46]. Studies of reliability of the IES have shown high internal consistency for intrusion with coefficients ranging from 0.72–0.92 and for avoidance with coefficients ranging from 0.65–0.90. The test–re-test reliability results have been stable with coefficients ranging from 0.87 for the total score, 0.57–0.94 for intrusion and from 0.51–0.89 for avoidance [39, 41].
- *The Beck Depression Inventory.* The Beck Depression Inventory (BDI) [40] is a 21-item self-report of depression that assesses symptoms over a 7-day period. There is a 4-point scale for each item ranging from 0–3 (with 3 indicating maximum distress). The total self-rated scores range from 0–63 and can be classified in four grades; asymptomatic (0–9), mild-to-moderate depression (10–18), moderate-to-severe depression (19–29) and extremely severe depression (30–63). The instrument has been used for 35 years to identify and assess depressive symptoms and has been reported to be highly reliable regardless of the population. The BDI has high internal consistency with coefficients ranging from 0.79–0.95 and the instrument has demonstrated

stability of ratings, with test–re-test correlations ranging from 0.60–0.90 [47, 48].

Statistical analysis

All statistical analysis was performed with SPSS, version 12.0.1 for Windows. Data are reported as means \pm standard deviations unless indicated otherwise. Evaluation was made with chi-square tests for analysis of category variables and non-parametric tests for independent (Mann-Whitney test) samples of variables as most measures were not normally distributed. Pearson's correlation coefficients were calculated for the analysis of bivariate correlations. Statistical significance level was set at 0.05.

The study was approved by the ethics committee of Umeå University.

Results

Community integration

Table II shows mean, standard deviation and range scores for community integration (CIQ) in all persons with MTBI. Total score for all individuals was 20.19 ± 4.57 out of a possible 29. Total score for females was statistically significantly higher (21.12 ± 4.15) than for males 19.52 ± 4.75 ($p = 0.036$). The three sub-scale scores of the CIQ (social integration, home integration and productivity) were analysed separately. Females reported significantly higher levels of home integration (6.61 ± 2.38) in comparison with males (5.15 ± 2.84) ($p < 0.001$), while no statistically significant gender difference was found on the sub-scales social integration and productivity.

To identify the relationships between CIQ and symptoms, social support and life satisfaction, Pearson's correlate coefficients were calculated. Community integration (total score of CIQ) was weakly negatively correlated to increasing age ($r = -0.199$, $p = 0.011$), post-concussion symptoms (total RPQ-score $r = -0.270$, $p < 0.001$) and depression (total BDI-score $r = -0.332$, $p < 0.001$) and was positively correlated to availability of social interaction (AVSI $r = 0.158$, $p = 0.045$) and availability of attachment (AVAT $r = 0.188$, $p = 0.016$). In contrast, no statistically significant correlation was found between community integration (total CIQ-score) and post-traumatic stress symptoms (total IES score $r = -0.143$, $p = 0.069$ or life satisfaction (total score of LiSat-11 $r = -0.129$, $p = 0.101$). The sub-scales social integration and productivity scores were correlated to the total score of LiSat-11 (social integration: $r = 0.250$, $p = 0.001$, productivity: $r = 0.354$, $p < 0.001$) and to the scores of the social support scales, see below. They were

Table II. Community Integration Questionnaire (CIQ).

	All persons with MTBI (<i>n</i> = 163)	Men (<i>n</i> = 95)	Women (<i>n</i> = 68)
Total score	20.19 ± 4.57	19.52 ± 4.75	21.12 ± 4.15
range	4–29	4–29	10–28
Home integration	5.76 ± 2.74	5.15 ± 2.84	6.61 ± 2.38
range	0–10	0–10	1–10
Social integration	9.26 ± 1.85	9.23 ± 1.89	9.29 ± 1.80
range	4–12	4–12	5–12
Productivity	5.24 ± 1.95	5.27 ± 1.83	5.18 ± 2.12
range	0–7	0–7	0–7

also correlated to symptoms: total RPQ score (social integration: $r = -0.347$, $p < 0.001$; productivity: $r = -0.322$, $p < 0.001$), total IES score (social integration: $r = -0.173$, $p = 0.028$; productivity: $r = -0.293$, $p < 0.001$) and to total BDI score (social integration: $r = -0.369$, $p < 0.001$; productivity: $r = -0.464$, $p < 0.001$). The productivity score was correlated to age ($r = -0.342$, $p < 0.001$). The sub-scale home integration was only correlated to life satisfaction (total score of LiSat-11 $r = -0.222$, $p = 0.005$) and not to the other variables (age, RPQ, IES, BDI, AVSI and AVAT).

Social support

Table III shows the social support scales. Females scored significantly higher (2.84 ± 0.53) than males (2.85 ± 0.38) ($p = 0.021$) on the AVAT scale. In contrast, no statistically significant difference on the AVSI was found between genders. The total score of the social support scales (AVAT and AVSI) was significantly correlated to the total score of life satisfaction (LiSat-11) (the AVSI: $r = 0.312$, $p < 0.001$, the AVAT: $r = 0.372$, $p < 0.001$). Both the social support scales (AVSI and AVAT) were correlated to the total score of community integration (CIQ), see above. Statistically significant correlations were also found between the social support scales and the CIQ-sub-scale social integration (AVSI: $r = 0.258$, $p = 0.001$, AVAT: $r = 0.298$, $p < 0.001$). The AVSI was statistically significantly correlated to the CIQ-sub-scale productivity ($r = 0.176$, $p = 0.026$) while no such correlation was found for the AVAT. Both scales were statistically significantly correlated to the total depression score (AVSI: $r = -0.276$, $p = 0.000$, AVAT: $r = -0.289$, $p < 0.001$).

Life satisfaction (LiSat-11)

Life satisfaction was assessed using the LiSat-11. The relative distribution of the persons with MTBI among the six different levels of life satisfaction is shown in Table IV. Altogether only 45% were either

Table III. Social support.

	All persons with MTBI (<i>n</i> = 163)	Men (<i>n</i> = 95)	Women (<i>n</i> = 68)
AVSI	2.85 ± 0.45	2.85 ± 0.38	2.84 ± 0.53
AVAT	2.66 ± 0.76	2.58 ± 0.81	2.78 ± 0.68

Availability of social integration (AVSI) 3-item; range 0–3; Availability of attachment (AVAT) 3-item; range 0–3.

very satisfied or satisfied with leisure, 60% with psychological health, 43% with somatic health and 25% with economy. The mean total score for all subjects was 46.4 ± 10.7 . No statistically significant difference was found when the total score of males was compared with that of females. The total score of LiSat-11 was statistically significantly correlated with the total RPQ-score ($r = -0.459$, $p < 0.001$), the total IES-score ($r = -0.365$, $p < 0.001$), the CIQ-sub-scales social integration and productivity, the AVSI and the AVAT (see above) and the total BDI score ($r = -0.642$, $p < 0.001$).

Symptoms

At the time of the follow-up, 111 of the persons with MTBI (68%) reported at least one or more of the post-concussion symptoms. The total score of RPQ was 10.7 ± 13.2 out of a possible 72. Women reported statistically significantly higher scores on the RPQ (13.9 ± 14.5) in comparison with men (8.4 ± 11.7) ($p = 0.004$). The most common post-concussion symptoms at follow-up were headache (reported by 60%) followed by fatigue (reported by 53%) and poor memory (reported by 52%). The presence of one or more post-traumatic stress-related symptom was reported by 116 individuals (71%), total score of IES 9.6 ± 13.0 , out of a possible 75. Women reported statistically significantly higher IES-scores (13.0 ± 15.2) than men (7.1 ± 10.3) ($p = 0.005$). Depression symptoms (one or more) were reported by 124 patients (76%), total score of BDI was 6.88 ± 8.1 out of a possible 63. Females reported statistically significantly higher depression scores (8.4 ± 8.7) in comparison with males (5.8 ± 7.5) ($p = 0.017$). According to the depression levels of the BDI-scores [48], 25% of the individuals reported symptoms which were classified as being at least mild-to-moderate (grade 2–4) depression while moderate-to-severe depression symptoms were reported by 15% (grade 3–4).

Discussion

The strength of the present patient population-based follow-up study is that it is genuinely epidemiological and representative for people with MTBI in a

Table IV. Self-reported levels (%) of satisfaction with life as a whole and with 10 different life domains for persons with MTBI ($n = 163$), LiSat-11.

Satisfied with	Very satisfied (%)	Satisfied (%)	Rather satisfied (%)	Rather dissatisfied (%)	Dissatisfied (%)	Very dissatisfied (%)
Life as a whole	17.9	38.3	26.5	8.6	4.3	4.3
Vocation	13.6	28.4	25.9	13.0	9.3	9.9
Economy	7.4	17.9	30.9	18.5	14.2	11.1
Leisure	15.4	29.6	29.6	14.2	8.0	3.1
Contacts	21.6	32.1	26.5	11.7	6.2	1.9
Sexual life ($n = 156$)	19.9	26.3	26.9	13.5	7.7	5.8
ADL	76.5	13.6	4.9	2.5	1.2	1.2
Family life ($n = 126$)	39.7	41.3	13.5	3.2	2.3	0
Partner relationship ($n = 117$)	43.6	36.8	12.8	4.3	1.7	0.9
Somatic health	13.0	29.6	32.7	15.4	4.3	4.9
Psychological health	20.4	39.5	20.4	9.9	6.2	3.7

well-defined population and geographical area. The study shows that self-perceived limitations in psychosocial function with low levels of life satisfaction in particular were common in patients 3 years after MTBI. Post-concussion, post-traumatic, stress-related and depression symptoms were frequently reported at follow-up and the total score of each of the symptom categories was significantly correlated to the values of community integration and to life satisfaction.

Community integration

Community integration was assessed using the CIQ which has gained wide use in quantifying the measuring of rehabilitation outcomes in patients with TBI [49]. Higher scores indicate greater integration. Many studies of CIQ in patients with TBI are based on moderate and severe injuries. Interestingly, the CIQ-score of the persons with MTBI in the present study (20.19 ± 4.57) was in the same range as that reported for patients with severe TBI identified as a group with high community integration (20.64 ± 4.34) [50] and as reported for patients with severe TBI living independently (20.51 ± 4.63) [27]. However, it was clearly higher than patients with severe TBI identified with low community integration [50] and when compared with studies of patients with different severity levels of TBI (13.02–16.65) [27, 51]. Moreover, the CIQ sub-scale scores in the present study were in the same range as the values of MTBI-patients in a previous study by Paniak et al. [52] early after injury. The CIQ-sub-scale scores were also compared with sub-scale values from a non-brain-injured sample in the study by Hall et al. [53]. The largest difference was on the productivity sub-scale scores which were reported as being noticeably lower by the individuals in the current study. These results seem also to correspond well to the MTBI-study by

Paniak et al. [52] who also found lower scores for productivity than the other sub-scales. Since the productivity sub-scale includes occupational items, the low scores might depend on a factor influencing the ability to work or study which is reported to be decreased after MTBI [5, 54]. The effects of gender on community integration were analysed in this study, females reporting a significantly higher total score of CIQ and higher sub-score of home integration than males. However, gender-dependent changes on the CIQ with women reported as being more integrated in the home and men reported as being more integrated in productivity have been described in a review by Dijkers [55]. This gender sensitivity may depend on the general social patterns of gender roles which may also have contributed to the significant difference between men and women on the home integration scale in the current study. In contrast to the reviewed studies no difference was found between men and women on the productivity sub-scale. In the present study, a negative correlation was found between age and total score of CIQ, indicating that community integration decreases with increasing age. This finding is consistent with previous results of Fleming et al. [15] and Corrigan et al. [51], who have shown that age affects the level of community integration after TBI, younger persons having a higher level of community integration than older persons. Moreover, Rothweiler et al. [56] have shown that ageing affects psychosocial outcome in general in patients after TBI. In their study, increasing age was associated with increasing levels of psychosocial limitations [56].

Relations to life satisfaction

Community integration includes several areas such as adjustment within society, e.g. fitting in with other people and being accepted, belonging to a network of people and occupational items, working full-time

or part-time or being unemployed, which all may be associated with the subjective experience of life satisfaction [16, 57, 58]. The results of significant relationships between the social integration and productivity sub-scales and life satisfaction ($r=0.250$, $p=0.001$; $r=0.354$, $p<0.001$) in the present study are therefore not surprising and are in accordance with previous results which have also documented connections between the sub-scales social integration and productivity and life satisfaction in persons with TBI [16, 57].

Social support

Social support includes particular characteristics, e.g. number of supportive persons and sufficiency of support [28]. The present study assessed the quantity of social support (availability of social integration) and the quality of social support (availability of attachment). These results revealed a significant difference between male and female patients on the AVSI. Males reported a lower score than females, indicating that they perceived a lower number of potential supportive persons. In a previous study by Tomberg et al. [21], patients with TBI were shown to report a lower total number of supportive persons and lower satisfaction with support than the control group. The authors suggested that the patients' lower self-reported satisfaction with support was a sign of a malfunctioning supportive network which did not correspond to the patients' needs [21]. However, in this study no difference was found between genders on the AVAT, which implies that the size of the supporters' group does not reflect the attachment of support. Instead it might depend on the quality of social contacts and relationships. Both the AVSI and the AVAT scales were correlated to community integration and to life satisfaction. In a previous study by Kalpakijan et al. [19] a relationship between social support, CIQ and LiSat-11 was also shown.

These results might reflect that the quality and sufficiency of available social support in patients with TBI have an essential effect on the patients' subjective feeling of health.

Life satisfaction

Altogether only 43% were either very satisfied or satisfied with somatic health. Other items with low ratings of satisfaction were economy (25%), life as a whole (46%), vocation (42%), leisure (43%) and psychological health (60%). These ratings of life satisfaction were generally lower than those of a large population-based Swedish reference group (2533 individuals) described by Fugl-Meyer et al. [29], i.e. life as a whole (72%), vocation (54%),

leisure (58%). These items of LiSat-11 were also lower than the scores in a previous follow-up study of patients with MTBIs 1 year after the trauma (somatic health 64%, economy 36%, psychological health 64%) [5]. One possible reason for the lower level of life satisfaction for several items of LiSat-11 in participants in the present study in comparison with the persons with MTBI in the previous study 1 year post-injury [5] could be that the consequences of the long-term residual effects of brain injuries may be more fully realized some time after the injury. Moreover, in a previous follow-up study by Johansson and Bernspang [59], no significant difference in life satisfaction for persons with TBI between 3–6 years after admittance to a rehabilitation programme [59] was shown.

Relationships with symptoms

Depression after TBI is the most frequent secondary condition of TBI and has consistently been shown to affect a number of other areas several years after the injury [16]. In accordance with some previous studies [14, 16, 23, 24, 51], the present study shows significant relationships between depression scores and the psychosocial measures. A strong correlation was found between depression and life satisfaction ($r=0.642$, $p<0.001$), which reveals that the level of life satisfaction decreases with increasing scores of depression. Moreover, both the scores of RPQ and IES were significantly correlated to the scores of LiSat-11 and the RPQ-scores were significantly correlated to the total scores of community integration, which indicate that patients with MTBI are affected by post-concussion and post-traumatic stress symptoms which contribute to the total experience of psychosocial outcome and of life satisfaction in particular. Interactions between symptoms have been shown in previous studies, e.g. symptoms of depression, post-traumatic stress and post-concussion are found to act simultaneously [11, 18] and have been associated with reduced community integration [11]. Additionally, some studies have shown that MTBI-patients experience increased stress if they are not able to cope with environmental demands and that stress and poor psychological adjustment may contribute to the persistence of symptoms [60, 61]. It can, therefore, not be ruled out that such consequences might have had implications for the results in the present study and that psychosocial factors could possibly have contributed to the high frequencies of symptoms which were in the same range or slightly higher than in previous studies of patients with post-concussion symptoms after MTBI [5, 62–64] and clearly higher than previous results of post-traumatic stress-related symptoms in MTBI-patients [46]. The effects of

gender on symptoms were analysed in the present study and women reported significantly higher total scores for all categories of symptoms than men. These findings are in accordance with studies which have shown that female gender appears to be associated with a higher incidence of post-concussion [9] and depression [10] symptoms after MTBI.

Study limitations

Several objections may be raised concerning the findings of this study. Even though the study population is well-defined with a high response rate (80%), it should be noted that, due to the demographic structure of the geographical area, the generalizability of the study is limited. Some information about the study population's social history, etc. (Table I) was collected from hospital records, but there was a lack of information about the pre-injury characteristics which might have influenced the results. Moreover, as the variables (symptoms and psychosocial measures) were investigated 3 years after the brain injury, one cannot rule out systematic distortions as other factors might have influenced the patients' results. However, as the participants referred their symptoms to the MTBI and the instruments in the present study are validated [27–29, 38–40] and commonly used for patients with TBI, the patients' self-experienced situation 3 years after the trauma would therefore seem to be reliable. Yet, criticism has been raised regarding the CIQ and some of the limitations which have been outlined by Dijkers [55] including the lack of norms and age and gender effects on the home integration and productivity sub-scales. Nevertheless, future prospective studies are needed to elucidate factors of importance for the consequences of the psychosocial outcome after MTBI.

Clinical significance

Despite the limitations of the study, the finding of significant relationships between the psychosocial variables community integration, life satisfaction and social support and symptoms (post-concussion, post-traumatic stress and depression) has implications for rehabilitation clinicians. Although some of the items of the instruments CIQ, social support scales and LiSat-11 partly overlap and assess similar factors (e.g. the CIQ-social support scale and the social support scales), the results may support a multifactor model of brain injury rehabilitation which integrates biological and psychosocial factors. However, to achieve effective MTBI rehabilitation and to enhance patients' subjective well-being, it is essential to optimize the affected individuals' re-integration into the community and participation

in life roles as well as management of physical sequelae. The use of accurate measurements for the planning and assessment of patients' treatment and outcome is therefore of great importance. It appears as a consequence of the results that variables representing both psychosocial functioning (for the evaluation of community integration, social support and life satisfaction) and symptoms (post-concussion, depression and post-traumatic stress) should be included in regular examinations of patients with MTBI.

In conclusion, the results of the current study indicate that a proportion of individuals with MTBI experience both psychosocial difficulties, especially regarding life satisfaction, and symptoms several years after the injury. These aspects should be taken into consideration in the management of patients with MTBI.

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