

ORIGINAL ARTICLE

SOCIAL PARTICIPATION AND HEALTH-RELATED QUALITY OF LIFE BEFORE AND DURING THE SECOND WAVE OF THE COVID-19 PANDEMIC IN INDIVIDUALS WITH TRAUMATIC BRAIN INJURY: A FOLLOW-UP EXPLORATORY CORRELATIONAL STUDY

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Objective: Little is known about the effects of SARS-CoV-2 coronavirus disease (COVID-19) on quality of life and social participation in individuals with traumatic brain injury. We aimed to compare social participation and health-related quality of life (HRQoL) in a sample of individuals with TBI before and during the second wave of COVID-19 and explored the relationships between the perceived impacts of COVID-19, social participation, and HRQoL.

Patients and methods: Eighteen individuals with traumatic brain injury with a mean (standard deviation) age of 47.7 (17.0) years at 48.2 (10.5) months post-injury were administered a questionnaire on overall disability and participation (Mayo-Portland Adaptability Inventory-4th edition; MPAI-4), HRQoL (Quality of Life after Brain Injury Questionnaire; QOLIBRI), and the Coronavirus Impacts Questionnaire before and during the second wave of the COVID-19 pandemic at an interval of 6.4 (SD = 8.2) months.

Results: Compared with pre-pandemic levels, individuals with traumatic brain injury reported a statistically significant decrease in the QOLIBRI total score and its emotional subscale (with medium to large effect sizes), but without statistically significant differences in MPAI-4 scores. Increased difficulties with access to resources during COVID-19 were associated with increased adjustment problems on the MPAI-4, and with daily life and autonomy difficulties, emotional issues, and lower physical functioning on the QOLIBRI.

Conclusion: The relationships identified in this exploratory correlational study suggest that COVID-19 had a negative impact on quality of life in individuals with traumatic brain injury, but not specifically on their social participation.

Key words: social participation; health-related quality of life; SARS-CoV-2; COVID-19; pandemic; traumatic brain injury.

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LAY ABSTRACT

Little is known about the effects of SARS-CoV-2 coronavirus disease (COVID-19) on the lives of individuals with traumatic brain injury. This study compared social participation and health-related quality of life in individuals with TBI before and during the second wave of COVID-19 and explored relationships between the perceived impacts of COVID-19, social participation, and health-related quality of life, but not specifically on social participation in individuals with traumatic brain injury. Also, increased difficulties with access to resources during COVID-19 were associated with increased adjustment problems, daily life and autonomy difficulties, emotional issues, and lower physical functioning.

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Traumatic brain injury (TBI) contributes to worldwide death and disability: estimates of the case burden of TBI across World Health Organization (WHO) regions and World Bank income groups indicate that, every year, 69 million individuals worldwide sustain a TBI, with the vast majority being of mild (81%) or moderate (11%) severity (1). Estimates also indicate that the overall incidence of TBI was highest in North America, with 1,299 cases per 100,000 people for the region of the Americas (USA and Canada). As a cause of long-term disability, TBI leads to functional, psychological, cognitive, social, and physical difficulties that require rehabilitation needs that can remain unmet (2). With the arrival of coronavirus disease (COVID-19), a retrospective study including data from 2016 to 2020 indicated that the proportion of events resulting in neurotrauma decreased for motorcycle (4%) and motor

vehicle collisions (10%), bicycle accidents (3%), and ground-level falls (6%) (3). In addition, it translated into a subsequent reduction of 24.5% in TBI referrals between 2019 and 2020 (4). However, little is known about the effects of COVID-19 on quality of life and social participation in individuals with TBI.

TBI has an important negative impact on quality of life and social participation. The WHO defines quality of life in a broad sense as: “An individual’s perception of his/her position in life in the context of the culture and value systems in which he/she lives, and in relation to his/her goals, expectations, standards and concerns” (5). As a subjective and multidimensional concept, quality of life includes the person’s physical health, psychological state, level of independence, social relationships, and the relationship with salient features of their environment. Health-related quality of life (HRQoL) focuses on an individuals’ perception of how disease and its treatments affect the physical, mental, and social aspects of their life, with individuals with TBI showing large HRQoL deficits in the 12 months following the injury compared with population norms (6). Regarding injury severity, 22% of individuals with mild and 27% with moderate and severe TBI had HRQoL physical problems at 12 months post-injury, while 24% of individuals with mild and 35% with moderate and severe TBI had HRQoL mental health difficulties (7). One-third of individuals with TBI indicated, in another study, that their brain injury has made coping with the pandemic more difficult, particularly because of mental health challenges and social isolation (8). Also, one-third of individuals with TBI showed unsatisfactory HRQoL 10 years post-injury, with limited autonomy and cognition contributing to the unsatisfactory outcome and an increased risk of anxiety and/or depressive disorders (9). This indicates that a subgroup of individuals with TBI may experience physical and mental health issues negatively impacting the quality of their lives after TBI, and that those difficulties may be exacerbated by COVID-19. Paradoxically, preliminary evidence suggests that individuals with TBI reported fewer pandemic-related changes to their mental and physical well-being, their ability to plan for the future, and more stable daily habits since the start of the pandemic than individuals without a history of TBI (8).

According to the International Classification of Functioning, Disability and Health (ICF), participation is defined as “involvement in a life situation, and participation restrictions are problems an individual encounters in a life situation” (10). Individuals with TBI experience lower activity participation compared with controls, and levels of activity and participation are significantly related to age, time since injury, and HRQoL (11, 12). That is, participation is limited in

many aspects of the life of individuals with TBI, especially in social activities, high-demand leisure activities, and household activities. Also, in particular, high levels of depressive symptoms are associated with diminished HRQoL, regardless of current levels of activity participation. The results of a study conducted during the COVID-19 pandemic showed that approximately half of respondents with TBI reported staying in touch with the same number of people as before the pandemic compared with individuals without a history of TBI (8). However, it is not known whether COVID-19-related restrictions (e.g. social isolation, confinement) also contribute to the difficulties in participation that individuals with TBI frequently experience.

Among widely used and comprehensive tools developed specifically for measuring social participation and HRQoL after TBI, and which reflect core sets of ICF taxonomy, are the Mayo-Portland Adaptability Inventory (MPAI-4) (13–16), and the Quality of Life after Brain Injury Questionnaire (QOLIBRI) (17), respectively. Also recommended is the Common Data Elements for measuring social participation (18).

To our knowledge, internationally, no published study has compared social participation and HRQoL before and during the COVID-19 pandemic in individuals with TBI. It is important to consider the pandemic’s differential effects on individuals with TBI and other forms of chronic disability, in order to better tailor service delivery and care. Also, these effects could vary according to the severity of COVID-19 impacts and restrictions in various regions and countries of the world, as well as according to the healthcare and social services systems in place. Thus, the current study aimed to compare social participation, as measured with the MPAI-4, and HRQoL, as measured with the QOLIBRI, in a sample of individuals with TBI before and during the second wave of the COVID-19 pandemic. This study also explored the relationships between the perceived impacts of COVID-19, using the Coronavirus Impacts Questionnaire, social participation, and HRQoL. It was hypothesized that, compared with pre-pandemic levels, individuals with TBI would show reduced participation and lower HRQoL. In addition, it was anticipated that individuals with TBI reporting more negative impacts of COVID-19 would also report diminished social participation and quality of life.

MATERIALS AND METHODS

Participants

A convenience sample of 36 individuals with TBI was recruited as part of a longitudinal study on social participation and HRQoL following TBI in a major neurorehabilitation centre in Montreal. Clinical coordinators

and rehabilitation professionals invited individuals with TBI to participate in the study based on the following inclusion criteria for the Glasgow Coma Scale (GCS): (i) individuals with a diagnosis of mild (GCS score 13–15), moderate (GCS score 9–12) or severe TBI (GCS score 3–8), according to the guidelines put forward by the Institut national d'excellence en santé et en services sociaux and Ontario Neurotrauma Foundation (INESSS-ONF) Clinical Practice Guideline for the Rehabilitation of Adults with Moderate to Severe Traumatic Brain Injury (19); (ii) 18 years of age or older; (iii) having completed an interdisciplinary comprehensive rehabilitation programme following their TBI; and (iv) reporting being able to read and speak French.

The pre-pandemic sample for the current study consisted of 36 individuals with TBI with a mean age of 54.3 (SD = 18.5) years and 31.5 (SD = 8.6) months post-injury. The majority were men (52.8%), white (69.4%), and married (56.6%). Most participants reported having a high level of education with a university degree (71.8%). Most participants were working full-time or part-time before the pandemic (46.7%). They reported an annual income of 52,955.5 (SD = 50,870.6) Canadian dollars before the pandemic. Most of the participants had sustained a moderate TBI (41.7%). The most frequent causes of injury were falls (41.6%) and motor vehicle accidents (27.8%).

The total follow-up sample, recruited during the second wave of COVID-19, consisted of 18 individuals with TBI with a mean age of 47.7 (SD = 17.0) years and 48.2 (SD = 10.5) months post-injury. The majority were men (55.6%), white (83.3%), either married (55.6%) or single (33.3%). Most participants reported having a minimum of high-school education (88.9%). Most of them were working full-time or part-time during the second wave of COVID-19 (55.5%). They reported an annual income of 65,627.8 (SD = 59,344.4) Canadian dollars during the second wave of the pandemic. Most of the participants had sustained a mild or moderate TBI (38.9% each). The most frequent causes of injury were motor vehicle accidents (44.5%), followed by falls or sports injuries (22.2% each). Individuals with TBI were followed at 6.4 (SD = 8.2) months, between the first assessment preceding the pandemic and the second assessment during the second wave of COVID-19. Demographic characteristics and injury-related variables of the sample are shown in Table I.

Procedure

The Research Ethics Board (REB) of the Center for Interdisciplinary Research in Rehabilitation of Greater Montreal of the CIUSSS du Centre-Sud-de-l'Île-de-Montréal (CIUSSS-CCSMTL) approved the current study, and participants gave verbal and written informed consent.

Table I. Demographic and injury-related characteristics of individuals with traumatic brain injury (TBI) before and during the COVID-19 pandemic

Variables	Total TBI sample before COVID-19 (N = 36)	Follow-up TBI sample during the second wave of COVID-19 (N = 18)
Sex, n (%)		
Male	19 (52.8)	10 (55.6)
Female	17 (47.2)	8 (44.4)
Age, years, mean (SD)	54.3 (18.5)	47.7 (17.0)
Annual income (Canadian dollars), mean (SD)	52,955.5 (50,870.6)	65,627.8 (59,344.4)
Race/ethnicity, n (%)		
White	25 (69.3)	15 (83.3)
Arabic/West Asian	2 (5.6)	1 (5.6)
Latin American	1 (2.8)	0 (0)
Southeast Asian	2 (5.6)	0 (0)
Other	2 (5.6)	2 (11.1)
Missing	4 (11.1)	0 (0)
Work status, n (%)		
Full-time	8 (26.7)	7 (38.8)
Part-time	6 (20)	3 (16.7)
Student	1 (3.3)	1 (5.6)
Unemployed	11 (36.7)	6 (33.3)
Retired	3 (10)	1 (5.6)
Homemaker	1 (3.3)	0 (0)
Cause of the injury severity, n (%)		
Motor vehicle accident	10 (27.8)	8 (44.5)
Violence	4 (11.1)	2 (11.1)
Fall	15 (41.6)	4 (22.2)
Sports injury	5 (13.9)	4 (22.2)
Work accident	2 (5.6)	0 (0)
Injury severity, n (%)		
Mild TBI	12 (33.3)	7 (38.9)
Complicated mild TBI	4 (11.1)	2 (11.1)
Moderate TBI	15 (41.7)	7 (38.9)
Severe TBI	5 (13.9)	2 (11.1)
Glasgow Coma Scale, mean (SD)	12.5 (3.8)	12.1 (4.2)
Time post-injury (months), mean (SD)	31.5 (8.6)	48.2 (10.5)
Time to follow-up (months), mean (SD)		16.4 (8.2)
Education, n (%)		
Primary school	1 (3.1)	0 (0)
High school	2 (6.3)	0 (0)
College	6 (18.8)	2 (11.1)
University	23 (71.8)	16 (88.9)
Relationship status, n (%)		
Single	5 (16.7)	6 (33.3)
Married	17 (56.6)	10 (55.6)
Separated	1 (3.3)	0 (0)
Divorced	5 (16.7)	2 (11.1)
Common-law partner	2 (6.7)	0 (0)

SD: standard deviation.

Individuals with TBI were contacted for a telephone interview as part of a longitudinal study on social participation and quality of life. Prior to the interview, participants received an informed consent form and interview guide by mail or e-mail.

With the arrival of COVID-19, participants had to be contacted again by the rehabilitation centre to obtain their permission to participate in the follow-up study. Only half of the sample agreed to participate in the second part of the study and a list of individuals with TBI agreeing to follow-up during the second wave of the COVID-19 pandemic was sent to the research team.

A clinical neuropsychologist was responsible for the administration of the measures on the phone to avoid any risk of COVID-19 transmission. The same person administered the measures before and during the pandemic. Participants received financial compensation of 40 Canadian dollars (\$20 for each interview). Research assistants transcribed the data collected for the study for statistical analysis for scientific purposes.

Instruments

In addition to the use of the following instruments, individuals with TBI assessed their perception of their employment situation (e.g. “Has your job situation been affected by the confinement due to COVID-19?”) and the potential impact of the pandemic on social participation and HRQoL on a scale ranging from 0 (“Not at all”) to 3 (“A lot”).

Mayo-Portland Adaptability Inventory – 4th edition. Initially developed to estimate cognitive, behavioural, and social challenges following a brain injury (20), the Mayo-Portland Adaptability Inventory – 4th edition (MPAI-4) is a 35-item instrument to estimate overall disability and social participation. The MPAI-4 is used to assess individuals in the post-acute period following a brain injury, to help in the evaluation of rehabilitation programmes for individuals with brain injury, and to better understand the long-term outcomes of brain injuries. As a measure of brain injury outcome, this measure is supported by almost 20 years of research and development. The MPAI-4 has solid psychometric properties including satisfactory internal consistency, construct validity, and predictive validity, in particular at the outpatient rehabilitation level for TBI and stroke (for specific psychometric data, see 21–26). The MPAI-4 has been demonstrated to be sensitive to changes during rehabilitation interventions (27–29). As such, it can be considered a gold standard measure to evaluate disability and the progress of rehabilitation. Higher scores indicate the presence of a greater level of disability. Conversely, lower scores indicate lesser impairment and limitations.

The MPAI-4 consists of 3 subscales: (i) 12 scored items for the Ability Index addressing physical and cognitive abilities that are often affected by a brain injury; (ii) 9 scored items for the Adjustment Index evaluating emotional and interpersonal problems; and (iii) 8 scored items for the Participation Index assessing the involvement in social, community and productive activities. The MPAI-4 also contains 5 items addressing pre-existing and associated conditions, but not contributing to the total score (e.g. alcohol and drug abuse, legal problems, comorbid physical and cognitive disabling conditions). For the Ability and the Adjustment Indices, each item is rated on a 5-point scale using the following criteria: (i) 0 = no problem;

(ii) 1 = mild problem, but does not interfere with activities and may use assistive devices or medication; (iii) 2 = mild problem that interferes with activities 5–24% of the time; (iv) 3 = moderate problem that interferes with activities 25–75% of the time; and (v) 4 = severe problem that interferes with activities more than 75% of the time. For the Participation Index, some of the items use the same scoring system, except for the employment category with variations (e.g. paid employment and other employment).

The MPAI-4 has been used successfully to track progress in the rehabilitation of individuals with TBI (27). In addition, it has been used as a measure of concurrent validity with instruments developed to assess participation (30). The time of administration is 15–20 min. It can be used free of charge, and can be administered by different rehabilitation professionals. It has been validated in different languages. MPAI-4 versions in Spanish, German, Italian, Portuguese, Swedish, Dutch, Danish, and the French-Canadian version including the manual, used in the current study (31–33). Clear scoring criteria are available on the Center for Outcome-Based Measurement in Brain Injury website (14). The MPAI-4 can be completed by the individual with a brain injury, the healthcare professional or by consensus of professional staff, or the family caregiver. The MPAI-4 is used in the process of translating a systematic, standardized, comprehensive assessment into a rehabilitation plan (34). For the current study, the total score was included in the analyses. The internal consistency of the MPAI-4 for this study was excellent at admission (Cronbach’s $\alpha = 0.95$) and follow-up (Cronbach’s $\alpha = 0.95$), according to general guidelines (35).

Quality of Life after Brain Injury Questionnaire. The QOLIBRI is a 37-item multiple-choice self-report questionnaire specifically developed to assess HRQoL of individuals after TBI. The QOLIBRI measures 6 dimensions of HRQoL in areas frequently affected after TBI, including “Cognition” (7 items), “Self” (7 items), “Daily Life and Autonomy” (7 items), “Social Relationships” (6 items), “Emotions” (5 items), and “Physical Problems” (5 items). Participants are asked to report their levels of satisfaction (Part 1) or the extent to which they have been bothered by each symptom (Part 2) in 37 statements since their TBI. Each symptom can be rated as: (i) Not at all; (ii) Slightly; (iii) Moderately; (iv) Quite; (v) Severely. Scores are calculated with a maximum possible range of 1–5, with higher scores indicating better functioning on a specific dimension. The QOLIBRI has been used successfully to measure HRQoL symptoms in individuals with TBI (36–40). Also, it has demonstrated high internal consistency and temporal stability (for specific psychometric data, see 41, 42). The QOLIBRI has

been translated and used in several languages including French (43). The QOLIBRI can be completed in 7–10 min. The total score and the scores by dimension were used in this study. The internal consistency of the QOLIBRI for the current study was excellent at admission and follow-up (Cronbach's $\alpha = 0.96$), according to published guidelines (35).

Coronavirus Impacts Questionnaire. This is a 9-item multiple-choice self-report questionnaire to measure the financial, resource access, and psychological impacts of COVID-19 (44). Participants assess the extent to which each statement represents their experience with COVID-19. Each statement can be rated on a 7-point scale, with 1 representing “not true of me at all” to 7 indicating “very true of me”. Individual item scores are added to obtain a total score ranging between 9 and 63, with higher scores representing a more important negative impact of COVID-19. The internal consistency of the Coronavirus Impacts Questionnaire for the current study was very good (Cronbach's $\alpha = 0.83$), according to published guidelines (35).

Statistical analyses

Statistical analyses were conducted with IBM SPSS® version 25 (45). To compare social participation and HRQoL in a sample of individuals with TBI before and during the second wave of COVID-19, paired samples *t*-tests were used to compare MPAI-4 and QOLIBRI scores at both measurement time-points in the subset of individuals who responded at follow-up. Pearson product-moment correlation coefficients were calculated between the Coronavirus Impacts Questionnaire total score and subscale scores with the MPAI-4 and QOLIBRI scores. Correlation coefficients were interpreted using the following guidelines for the behavioural sciences (46): (i) small ($r = 0.1$ – 0.29), (ii) medium ($r = 0.3$ – 0.49), and (iii) large ($r = 0.5$ – 1). Statistical significance was set at an alpha level of 0.05. Kolmogorov–Smirnov statistics confirmed normality of all subscale and total scores.

RESULTS

Compared with pre-pandemic levels, individuals with TBI did not show any significant differences in age, sex, employment, race/ethnicity, relationship status, or income levels (all p 's > 0.05). The 2 groups were also comparable in terms of the severity of the injury, as seen in Table I.

Perceived impacts of COVID-19

Regarding the perception of the negative impact of COVID-19 on employment, 50% of individuals with TBI did not report any change, 5.6% reported slight

changes, 27.8% moderate changes, and 16.6% reported a lot of changes during the second wave. When asked about their perception of the negative impact of COVID-19 on social participation, 27.8% of individuals with TBI did not report any change, 33.3% reported slight changes, 16.7% moderate changes, and 22.2% a lot of changes during the second wave. For the impact of COVID-19 on quality of life, 22.2% of individuals with TBI did not report any change, 50% endorsed slight changes, 22.2% reported moderate changes, and 5.6% reported a lot of changes during the second wave.

Social participation during the second wave of COVID-19

The results of a paired-samples *t*-test comparing MPAI-4 total scores of individuals with TBI before the pandemic and during the second wave of COVID-19 did not show a statistically significant difference between the 2 time-points ($p > 0.05$). The comparison between pre-pandemic levels and ratings during the second wave of COVID-19 for the MPAI-4 Ability, Adjustment, and Participation Indexes did not show any significant differences ($p > 0.05$).

Health-related quality of life during the second wave of COVID-19

As seen in Table II, the results of a paired-samples *t*-test to compare individuals with TBI before and during the second wave of COVID-19 showed a statistically significant difference in HRQoL. There was a statistically significant decrease in the QOLIBRI total score from Time 1 – pre-pandemic ($M = 3.6$, $SD = 0.6$) to Time 2 – Second wave of COVID-19 ($M = 3.4$, $SD = 0.7$), $t(17) = 2.2$, $p < 0.05$ (2-tailed), with a medium effect size (Cohen's $d = 0.52$).

The analysis of the QOLIBRI dimensions of HRQoL areas frequently affected after TBI indicated a statistically significant decrease in the emotional domain from Time 1 – pre-pandemic ($M = 3.7$, $SD = 0.8$) to Time 2 – Second wave of COVID-19 ($M = 3.4$, $SD = 0.9$), $t(17) = 3.1$, $p < 0.05$ (2-tailed), with a large effect

Table II. Results of subscales and total scores of the Quality of Life after Brain Injury Questionnaire (QOLIBRI) in individuals with traumatic brain injury (TBI) before and during the second wave of the COVID-19 pandemic

QOLIBRI Subscales	Before COVID-19			During the second wave of COVID-19		
	Mean	SD	IQR	Mean	SD	IQR
Cognition	3.6	1.1	1.5	3.4	0.8	0.9
Self	3.3	1	1.9	3.2	1	1.8
Daily life & autonomy	3.6	1.1	1.8	3.6	0.9	0.9
Social relationships	3.7	0.8	1.1	3.5	0.7	1
Emotions	3.7	1	1.6	3.4	0.9	1.4
Physical problems	3.5	1.1	2	3.5	1.1	1.8
Total score	3.7	0.8	1.4	3.4	0.7	0.9

IQR: interquartile range.

size (Cohen's $d = 0.73$). On the contrary, the areas of Cognition, Self, Daily Life and Autonomy, Social Relationships, and Physical Problems did not show any statistically significant differences (all $p > 0.05$).

Relationships between perceived impacts of COVID-19, social participation, and quality of life

The exploration of the relationship between the MPAI-4 total score and the 3 domains of the Coronavirus Impacts Questionnaire subscale scores during the second wave of COVID-19 did not reveal statistically significant associations with the Financial, Resource, or Psychological subscales (all $p > 0.05$). However, there were statistically significant associations between the Adjustment scale of the MPAI-4 with the Resource subscale of the Coronavirus Impacts Questionnaire ($r = 0.47, p < 0.05$), but not between the Ability or Participation subscales with any of the subscales of the Coronavirus Impacts Questionnaire (all $p > 0.05$).

There were statistically significant associations between the QOLIBRI total score with the Resource subscale of the Coronavirus Impacts Questionnaire ($r = -0.54, p < 0.05$), but not with the Financial or Psychological subscales (both $p > 0.05$). Also, there were statistically significant associations between the Resource subscale of the Coronavirus Impacts Questionnaire with the Daily Life and Autonomy ($r = -0.64, p < 0.01$), Emotional ($r = -0.52, p < 0.05$), and the Physical Problems subscales of the QOLIBRI ($r = -0.58, p < 0.01$), but not with the Self and Social scales of the QOLIBRI (both $p > 0.05$). No statistically significant association was found between the Financial or Psychological subscales with any of the subscales of the QOLIBRI (both $p > 0.05$).

DISCUSSION

The current study reports exploratory evidence of the relationships between perceived COVID-19 impacts, social participation, and quality of life in individuals with TBI during the second wave of the pandemic. Unsurprisingly, almost one-third of the sample of individuals with TBI reported moderate to significant changes in the quality of their lives and 38.9% indicated a negative impact on social participation. In contrast, the use of standardized instruments to measure HRQoL and social participation in individuals with TBI indicated that individuals with TBI experienced more emotional difficulties and lower HRQoL compared with pre-pandemic levels, but similar levels of functioning in terms of social participation. This study is compatible with populational data showing that compared with pre-COVID-19 population norms in Canada, HRQoL was lower during the COVID-19 pandemic, with anxiety/depression and usual activities

dimensions mostly affected (47). In consequence, it is possible that the current findings also reflect a general trend in the population.

Notably, 44.4% of individuals with TBI reported moderate to important changes in employment, even when their employment situation or their income did not significantly change compared with pre-pandemic levels. This could be explained because of work-related adjustments, such as remote working, but not by job loss. COVID-19 has transformed the way people work, and remote working was adopted in Canada during the second wave of COVID-19. As a result, the proportion of workers able to carry out their tasks from home increased globally, providing flexibility, saving costs, and reducing commuting (48). As hybrid and remote work are still common in Canada since the second wave of COVID-19, individuals with TBI can still work, avoiding outbreaks and new infections.

As expected, individuals with TBI with more difficulties accessing resources during the pandemic also reported diminished HRQoL. More specifically, individuals with TBI experiencing more problems accessing basic resources were also those who endorsed daily life and autonomy difficulties, emotional problems, or physical limitations. These results are complementary to those of a study showing that 51% of individuals with TBI reported that the pandemic affected their sense of mental and physical well-being, and 18% experienced a decrease in life satisfaction, mental health challenges, a sense of isolation, and inability to go to the gym or exercise since the start of the pandemic (8). This study also complements data indicating that 21% of individuals with mild and 33% with moderate or severe TBI had impaired QOLIBRI scores at 12 months before COVID-19 (7). The current study highlights the importance of the combined long-term negative effects of TBI with the deleterious effect on HRQoL associated with sustained stress caused by the constant threat of being exposed to COVID-19, as well as the social isolation and restricted activities during that period.

Notably, the results indicate that the psychological or financial impact of the pandemic was not associated with diminished quality of life in this sample of individuals with TBI. Previous preliminary data has shown that the abrupt loss of income during the pandemic was associated with increased overall anxiety and depressive symptoms (49). Different governments adopted mechanisms to compensate for financial loss during the pandemic. For instance, the Canadian government created the Canada Emergency Response Benefit to provide financial support to employed and self-employed Canadians who were directly affected by COVID-19 (up to 2,000 Canadian dollars per month). Consequently, the government of Canada adopted a

policy to prevent growing concerns about economic recession and its implications for mental health. These policies could offer a potential explanation for the fact that financial issues and psychological concerns did not seem to have a negative impact on the quality of life of this sample of individuals with TBI.

Although this study showed that 38.9% of individuals with TBI subjectively reported moderate to important changes in social participation, social participation scores, as measured by the MPAI-4, were similar before and during the second wave of COVID-19. The increased use of communication technology could be a potential explanation. The results of another study showed that individuals with TBI reported an increase in virtual social visits (53.1%), although this was less frequent compared with non-injured individuals (72.5%) (8). This tendency was reversed in terms of in-person contacts, with 51.06% of individuals with TBI reporting staying in touch with the same number of people as before the pandemic compared with 43.1% of uninjured individuals. It is also possible that post-TBI limitations in social participation were so important (11, 12, 50) that they did not significantly differ from pre-pandemic levels or were masked by the confinement related to COVID-19. There is evidence suggesting that 76.4% of non-injured individuals reported that the pandemic had significantly affected their daily lives, compared with 57.4% of individuals with TBI suggesting that their lives were negatively impacted to a lesser extent (8).

Study limitations

The current study has several limitations. First, there was a high rate of drop-out; half of the initial sample could not be contacted for the follow-up assessment. This could be explained by changes in address and reduced availability to participate in research during the rapid changes imposed by the pandemic. Individuals who were unavailable to participate could have faced more important challenges than those who participated in the follow-up study. Also, the study did not enquire about the COVID-19 status of participants, as this was not part of the objectives of the study. Furthermore, the fact that measures were obtained by phone could have increased attrition, since it has been shown that there is higher attrition when data is collected by phone or post rather than during face-to-face contact (51). With a small, highly educated, and homogenous sample, the generalizability of the findings to other TBI samples is limited, including individuals with low educational levels, other countries, and different races/ethnicities. In this sense, the results must be considered exploratory. However, as COVID-19 continues to affect our lives, changes in quality of life could be long-lasting. For that reason, rehabilitation professionals should consider the

emotional difficulties having a negative impact on the quality of life of individuals with TBI. As mental health needs have become a major issue in the context of the COVID-19 pandemic, access to individual or group psychological interventions in the community, either virtually or in person, could generally help prevent negative emotional impacts in individuals with TBI, and even more so during a pandemic.

CONCLUSION

This study presents exploratory evidence regarding reduced HRQoL, but not social participation specifically, in a small sample of individuals with TBI during the second wave of the COVID-19 pandemic compared with before the pandemic. To a certain extent, social participation and HRQoL challenges could have been overshadowed by the effects of the confinement, without significant changes in social participation, but with diminished quality of life in the emotional domain. Also, access to resources during COVID-19 was associated with adjustment, autonomy, emotional, and physical problems in individuals with TBI. On the contrary, the financial or psychological aspects related to COVID-19 were not associated with HRQoL or social participation. More longitudinal research is needed to fully understand the combined relationships between COVID-19, quality of life, social participation, and TBI.

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