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Volunteering and its association with participation and life satisfaction following traumatic brain injury

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Abstract

Background: Volunteering has been found to improve life satisfaction and participation in the general population, but its impact has not been thoroughly studied among those with traumatic brain injury (TBI). It is important to investigate whether volunteering is helpful in addressing participation and life satisfaction to inform future treatment.

Objective: To characterize those who volunteer after moderate-severe TBI and to investigate the association of volunteering with participation and life satisfaction after TBI.

Methods: Using data from a single site contributing to the TBI Model Systems National Database, a retrospective analysis of 725 individuals with TBI was conducted. General Linear Models were used to compare outcomes of those who volunteer and those who do not after controlling for important covariates.

Results: Volunteers were more likely to be employed/students, have better current functioning, be further post-injury, non-Hispanic white, and have more education. Significant relationships, after controlling for covariates, were found between volunteering and higher life satisfaction, more frequent community engagement, and greater social relations. No significant relationship between volunteering and productivity emerged.

Conclusions: Given the positive relationship between volunteer status with life satisfaction and aspects of participation, future research should investigate the barriers/facilitators of volunteering to improve well-being and participation after TBI.

Keywords

Brain injury; outcomes; volunteering; well-being; life satisfaction

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Disclosure of interest

The authors report no conflict of interest.

Introduction

Participation and subjective well-being are important indicators of functioning following traumatic brain injury (TBI). However, as a result of ongoing physical, emotional, and cognitive impairments, individuals with TBI may find that returning to a productive and satisfying life is elusive.

Participation occurs at the societal level (1) and encompasses activities related to productivity, relationships, and community involvement (2). Perhaps the most salient expression of productivity is employment, and as such, is one of the most important goals in recovery for an individual with TBI. Returning to work or returning to the same level of work may be challenging for some due to cognitive impairments involving memory, attention, and executive functioning (3). Nonetheless, attaining competitive employment is possible even for those with severe injuries (4). Many individuals, including those who return to work, experience reduced involvement in other areas of participation (5). Individuals with moderate to severe TBI often report having fewer friends, strained family relationships, and experiencing fewer opportunities for community involvement (6,7), so it is no surprise that these individuals are at an increased risk of social isolation and loneliness (7).

Life satisfaction, a component of well-being, refers to the subjective evaluation of one's overall quality of life based on the criteria that matter most to the individual (8). It has been well documented that following TBI, individuals report decreased life satisfaction compared to their uninjured peers (6,9–11). Because life satisfaction is based on criteria most relevant to the individual, there are likely multiple factors that contribute to this difference. For example, following moderate to severe TBI, life satisfaction is associated with age (12,13), driving status (14), disability (13,15,16), employment (12,13), and social participation (13,17,18). Limitations in participation, both socially and through employment, may in part explain poor life satisfaction among these individuals.

Participation and life satisfaction, while both important outcomes in and of themselves, are also related to other physical and mental health-related outcomes after TBI. For example, research demonstrates a relationship between reduced social activity and rehospitalizations (19), as well as relationships between poor life satisfaction and reduced participation with depression symptoms (13,14,20), and even mortality (21). It is important to identify factors that may increase participation and life satisfaction to potentially reduce associated negative outcomes.

Participating in a volunteer activity can be a way for a person to stay engaged socially and to feel productive. A 2016 report by the US Bureau of Labor Statistics (22) stated that 25% of Americans volunteered for an organization at some point during the previous year. People who were most likely to volunteer were aged 35 to 54, had at least some college education, and were employed. Also, women were more likely to volunteer than men. Though the majority of Americans who volunteer are middle-aged, most of the research on volunteering has focused on older adults (i.e., 50 years or older) (23). Perhaps this is because individuals in later life undergo a transition in major life domains resulting in a change of life-roles (i.e.,

retired, empty-nester, widow) (24). Volunteering is an activity that may be an alternative way to stay engaged and to provide a person with a sense of purpose driven by their ability to continue to contribute to society. In a randomized controlled trial (RCT) evaluating the efficacy of a structured volunteer program among older adults, Parisi and colleagues (25) found that individuals who received the full volunteer intervention reported a greater increase in social activity from baseline to 12 months compared to the control group. In a 2013 meta-analysis, Jenkinson and colleagues (23) found that volunteering had a favorable effect on life satisfaction among older adults. Similar positive findings have been found among individuals with disability who volunteer (26,27), though few studies have examined the association of volunteering on outcomes among those with TBI.

Ouellet and colleagues (28) compared three groups of individuals with TBI on psychological outcomes: those who were working/studying, those volunteering, and those who were inactive (not working, studying, or volunteering). The authors found that compared to the inactive group, those who volunteered reported fewer depressive symptoms and cognitive disturbances, less fatigue, and fewer problems with reduced activity and motivation, after controlling for age, education, injury severity, and time since injury. Further, those in the volunteer group did not differ significantly from those in the working/studying group on the psychological outcomes, even though the former group had a larger proportion of individuals with a more severe injury.

In a recent two-armed RCT, Payne et al. (29) investigated the impact of a 12-week structured volunteer intervention on life satisfaction among unemployed individuals with TBI. After controlling for a variety of factors, individuals assigned to the treatment group demonstrated significantly greater improvements in life satisfaction from baseline to the end of the study (42 weeks) as compared to individuals in the control group. Together, the results of these studies provide preliminary evidence of a positive association between volunteering and psychosocial outcomes among people with TBI. Still, much more research is needed to elucidate this relationship.

As previously noted, following moderate to severe TBI, individuals are at an increased risk of reduced participation and poor life satisfaction, even among those who are employed. Among those with TBI, no study has investigated the association between volunteering and participation, and only one study has examined its association with life satisfaction, but the sample was limited to individuals who were not working. However, in the general population, volunteering has been found to be positively associated with these particular outcomes. Therefore, it is important to investigate whether volunteering could be helpful in addressing participation and life satisfaction among those with TBI.

The primary objectives of this study were twofold: 1) to characterize those who volunteer after TBI; and 2) to investigate the association of volunteering with participation and life satisfaction after TBI. In line with national statistics regarding volunteering, we hypothesize that individuals with TBI who are more likely to volunteer will be female, employed or in school, and have more education compared to those who do not volunteer (22). In the general population, most individuals who volunteer are between the ages of 35 and 54 (22); given that the majority of individuals with TBI are injured between the ages of 20 and

29 (30), we hypothesize that in our sample, those who volunteer will be older than those who do not. Because current functioning and driving status have been reported as barriers to volunteering (31), we hypothesize that those who volunteer will be less impaired in those areas as well. Finally, we hypothesize that volunteering will be associated with more community participation (as defined by engagement in community activities, social relations, and productivity) and greater life satisfaction among individuals with TBI.

Methods

Study design

To address these hypotheses, a retrospective analysis of data from a single site contributing to the Traumatic Brain Injury Model System (TBIMS) National Database (NDB) was conducted (32). Funded by the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR), this longitudinal database contains acute, rehabilitation, and follow-up data for 25 TBIMS Centers funded between 1988 and 2019. Eligible participants for inclusion to the NDB present to a TBIMS acute care hospital within 72-hours of injury and receive both acute hospital care and comprehensive brain injury rehabilitation at a designated TBIMS Center. Enrollees have a penetrating or non-penetrating TBI (33) and present with the following characteristics: (1) moderate to severe TBI as defined by meeting one of the following criteria: post traumatic amnesia > 24 hours, trauma-related intracranial neuroimaging abnormalities, loss of consciousness greater than 30-minutes, or emergency department Glasgow Coma Scale score < 13; (2) age 16 or older; (3) provide (or have a proxy provide) informed consent to participate. Telephone, mail-out, or in-person follow-up interviews are conducted with the participant or proxy at 1-, 2-, and 5-years post injury as well as every 5-years thereafter.

Participants

For the current analysis, data were limited to NDB participants who were enrolled by a single TBIMS Center, the Rocky Mountain Regional Brain Injury System (RMRBIS). Additionally, the dataset only included individuals who were not lost to follow-up, incarcerated, or deceased, and who completed a 1-, 2-, or 5-year post-injury follow-up interview between October 1, 2007 and September 30, 2018. Data captured prior to October 1, 2007 did not include the outcome variables of interest, therefore interviews prior to this date were excluded from the analysis. If a person completed more than one follow-up interview between October 1, 2007 and September 30, 2018 the most recent interview was selected for analysis to ensure independence among observations. Finally, only participants who responded to the interview question regarding volunteering and who had complete data on study outcome measures and covariates (described below) were included.

From the RMRBIS cohort there were a total of 975 individuals eligible for a 1-, 2-, or 5-year post-injury follow-up interview, of those, 829 individuals were eligible to be interviewed between October 1, 2007 and September 30, 2018 (see Figure 1). A total of 769 (93%) completed a follow-up interview. After excluding individuals who did not respond to the volunteer question or who did not have complete outcome or covariate information, the final sample included 725 individuals used for analysis of the participation outcomes. Due to the

subjective nature of life satisfaction, only persons with TBI (not proxies) responded to the life satisfaction questions. Therefore, a total of 667 individuals were included in the final sample assessing the life satisfaction outcome. Analyses were performed to compare the demographics of those who were included and those who were not for the participation ($n = 725$ vs. $n = 250$, respectively) and life satisfaction ($n = 667$ vs. $n = 311$, respectively) outcomes.

Measures

Demographic and injury characteristics—Sex was abstracted from the participant's medical record and used as a covariate in the analysis. Current age, level of education, and employment/student status were collected at the time of the most recent follow-up interview and were also used as covariates in the current analysis. For level of education, participants were grouped into three categories: less than high school (grades 1–11), high school diploma/GED equivalent, or greater than high school (some college, Associate's degree, Bachelor's degree, Master's degree, or Doctoral degree). Primary employment/student status was dichotomized into "Employed/student" (working for minimum wage or greater, full-time or part-time student) or "Not employed/not student" (special education, taking care of house or family, special employed [sheltered workshop], retired, unemployed, hospitalized without pay, on leave from work without pay, other). Follow-up period (1-, 2-, or 5-years post-injury) was also used as a covariate in the models.

In addition, information on race/ethnicity and initial injury severity were used to characterize the study sample. Race/ethnicity was obtained by self-report or proxy during the inpatient rehabilitation stay and was categorized into four groups: Hispanic, non-Hispanic (NH) white, NH black, and NH other. Glasgow Coma Scale (GCS) (34) total score and duration of post-traumatic amnesia (PTA) were abstracted from the participant's medical record to characterize initial injury severity. Emergency Department admission GCS scores were grouped into one of five categories: mild (13–15), moderate (9–12), severe (≤ 8), intubated, or chemically paralyzed or sedated. If an individual was still in PTA at the time of rehabilitation discharge, the exact duration of PTA was unknown, therefore it was estimated by adding one day to the total number of days from injury to rehabilitation discharge (35).

Current functional status—Additional covariates were chosen to characterize current functioning and were also used as covariates in the analysis; specifically, the Cognitive and Motor subscales of the FIMTM (36), the Supervision Rating Scale (SRS) (37), the Glasgow Outcome Scale Extended (GOS-E) (38), and a single item regarding primary method of motorized transportation (drives independently or rides with someone else), all of which were obtained at the most recent follow-up interview. The FIMTM (36) is an 18-item measure comprised of two subscales that assess physical and cognitive independence, where higher scores represent greater independence. The FIMTM is widely used in the rehabilitation setting and is a valid tool to measure functional independence for persons with TBI (39). The SRS (37) measures the level of caregiver supervision a person with TBI receives and is rated on a 13-point ordinal scale. For this study, ratings were grouped into three categories (independent, overnight or part-time supervision, full-time indirect or direct supervision). The GOS-E (38) is a widely used global outcome measure to assess individuals

with TBI (40). The structured interview covers the following areas: 1) consciousness; 2) independence inside and outside of the home; 3) resumption of normal social roles (work, social activities, relationships); and 4) residual symptoms interfering with daily life. Based on their responses, participants receive an overall rating from one of eight categories, with a higher score corresponding to greater global functioning. For this study, scores were dichotomized into favorable (5 = Lower moderate disability, 6 = Upper moderate disability, 7 = Lower good recovery, 8 = Upper good recovery) and unfavorable (2 = Vegetative state, 3 = Lower severe disability, 4 = Upper severe disability) outcomes (41).

Volunteer status—Current participation in volunteer activity was quantified using a single item from the original 24-item Participation Assessment with Recombined Tools-Objective (PART-O) (42) measure. Collected at the most recent follow-up interview, participants indicated the number of times in a typical month they engage in volunteer work; responses were dichotomized into “Some” or “None”.

Outcome measures

Life satisfaction.: To assess global life satisfaction, the 5-item Satisfaction with Life Scale (SWLS) (8) was used and collected at the most recent follow-up interview from the individual with TBI (not by proxy). Each item is rated on a 7-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree) where higher scores represent greater life satisfaction. The SWLS has well established psychometric properties (43) and is widely used in TBI research (9).

Participation.: To assess various aspects of participation, the 17-item PART-O (2,42) measure was used and collected at the most recent follow-up interview from the individual with TBI or their proxy. The scale was originally comprised of 24-items but was subsequently shortened to include 17-items that cover three domains (Out & About, Productivity, Social Relations), none of which include the item used to determine volunteer status as it was not retained for scoring in the 17-item version but was still asked at the follow-up interview. For this study, each subscale was analyzed separately. The *Out & About* subscale is comprised of seven items that measure how often a person engages in activities outside of one’s home (e.g., eating at a restaurant, shopping, exercising, number of days outside of the house). The *Productivity* subscale consists of three items that measure the number of hours in a typical week spent working for money, in school working toward a degree or in a technical training program, and the amount of time actively engaged in homemaking activities. The *Social Relations* subscale is comprised of seven items that measure the frequency with which an individual engages with other people (e.g., socializing with friends and family, providing emotional support to others). Each item is scored on a scale from 0 to 5 where higher scores are indicative of greater participation. This measure was designed specifically to assess long-term outcomes of individuals with TBI and has demonstrated strong psychometric properties (44).

Statistical methods

Statistical analyses were conducted using JMP v14 Pro (45) and all tests assumed a significance level of 0.05 unless otherwise stated. Demographic and injury characteristics as

well as current functioning indicators were summarized using means and standard deviations (SD) for normally distributed continuous variables and medians and interquartile ranges (IQR) for continuous variables with skewed distributions. Counts and percentages were used to summarize nominal variables. These factors were compared between those who volunteer and those who do not volunteer using *t*-tests for continuous variables, Wilcoxon ranked sum tests for skewed continuous variables, and chi-square tests for categorical variables.

Next, the unadjusted relationship between volunteering and each outcome (SWLS, PART-O Out & About, Productivity, and Social Relations subscales) was assessed using two sample *t*-tests.

Preliminary analyses were conducted to assess the linearity of continuous covariates (age, FIMTM Motor, FIMTM Cognitive) with each continuous outcome (SWLS, PART-O Out & About, Productivity, and Social Relations subscales). Results of these preliminary analyses indicated that age and FIMTM Motor have a nonlinear (quadratic) relationship with SWLS. Preliminary analyses also indicated that age, FIMTM Cognitive, and FIMTM Motor have a nonlinear (quadratic) relationship with PART-O Productivity. Therefore, to address these nonlinear relationships, both the linear term and the quadratic term of each covariate will be used in the subsequent adjusted models either predicting SWLS or PART-O Productivity.

Finally, the adjusted relationship between volunteering and each outcome (SWLS, PART-O Out & About, Productivity, and Social Relations subscales) was evaluated by conducting general linear models (GLM) controlling for sex, age, education, employment/student status, transportation, SRS, GOS-E, FIMTM Motor and Cognitive subscales, and follow-up period. Current employment/student status was not included as a covariate in the Productivity model since employment and school activities are already captured concurrently in the Productivity subscale score. For both the unadjusted and adjusted models, the total amount of variance explained by each model was quantified using the adjusted r^2 statistic. The adjusted relationship between volunteering and each outcome was quantified as the estimated mean difference in outcome between those who volunteer and those who do not and tested with a *t*-statistic; uncertainty in the estimates were quantified with a 95% confidence interval (CI). Effect size (ES) was computed as the mean difference divided by the root mean square error from the model. ES of 0.2, 0.5, and 0.8 are typically interpreted to be small, medium, and large effect sizes, respectively (46). In addition, for each adjusted model, the ranked significance of each covariate was characterized by the F-statistic and its corresponding *p*-value.

Results

Sample description

Characteristics of the sample are described in Table 1 for the whole sample and separately by volunteer status. This sample was comprised mostly of NH white males, with a mean age of 39, who completed a 5-year follow-up interview. Individuals included in the PART-O analyses ($n = 725$) did not differ on sex, race/ethnicity, age at injury, education, or duration of PTA compared to those who were excluded ($n = 250$). Similarly, individuals included in the SWLS analysis ($n = 667$) did not differ on sex, education, or age at injury compared to

those excluded ($n = 311$), however individuals included in the SWLS analysis had a shorter duration of PTA and were more likely to report race/ethnicity as NH white (as opposed to not NH white) compared to those who were excluded.

Overall, 31% of the sample reported volunteering. Individuals who volunteered were more likely to be NH white, competitively employed or a student, drive independently, not require caregiver supervision (SRS), have favorable global outcome (GOS-E), have greater physical and cognitive independence (FIMTM Cognitive and Motor), have a higher level of education, and shorter duration of PTA (indicating less severe TBI) compared to individuals who reported no volunteering. Age, sex, and GCS score did not differ between those who volunteered and those who did not.

Unadjusted analyses—The unadjusted model for each outcome and the differences in outcomes between those who volunteered and those who did not volunteer are presented in Table 2. Without controlling for covariates, results indicated that people who volunteered had significantly greater SWLS ($ES = 0.38$), PART-O Out & About ($ES = 0.67$), PART-O Productivity ($ES = 0.21$), and PART-O Social Relations ($ES = 0.38$) scores compared to people who did not volunteer (all p 's < 0.05).

Adjusted analyses—Table 3 summarizes the adjusted model for each outcome, the adjusted differences in outcomes between those who volunteered and those who did not volunteer, and the model effects.

Life satisfaction.: The results of the adjusted model for SWLS indicated those who volunteered had significantly greater SWLS scores (indicating greater life satisfaction) compared to those who did not volunteer ($ES = 0.29$). In addition, the most significant predictor of SWLS was FIMTM Cognitive, such that higher FIMTM Cognitive scores (indicating greater independent functioning) was significantly associated with higher SWLS scores. Being employed and having favorable global outcomes (GOS-E) were also significantly associated with higher life satisfaction. Finally, age and FIM MotorTM were significantly related to SWLS such that the relationship between age and SWLS was negative for those younger than approximately 42 and positive for those older than 42. Similarly, the relationship between FIMTM Motor and SWLS was negative for those with scores less than approximately 48 and positive for those with scores greater than 48.

Participation.: The results of the adjusted model for *PART-O Out & About* indicated those who volunteered had greater Out & About scores (indicating more frequent community involvement) than those who did not volunteer ($ES = 0.50$). Volunteering was the greatest significant predictor of Out & About. In addition, higher FIMTM Motor scores, greater education, younger age, and the ability to drive independently were also significantly related to Out & About.

The results of the adjusted model for *PART-O Productivity* indicated no significant difference in Productivity scores between those who volunteered and those who did not volunteer indicating no difference in employment, school, and/or homemaking activities ($ES = 0.10$). The ability to drive independently emerged as the greatest significant predictor in

this model. Being female and not requiring caregiver supervision were also significantly related to Productivity. Finally, age and FIMTM Cognitive were significantly related to Productivity such that the relationship between age and Productivity was positive for those younger than approximately 28 and negative for those older than 28. Conversely, the relationship between FIMTM Cognitive and Productivity was negative for those with scores less than approximately 20 and positive for those with scores greater than 20.

The results of the adjusted model for *PART-O Social Relations* indicated those who volunteered had significantly greater scores (indicating more frequent social contact) compared to those who did not volunteer (ES = 0.23). Additionally, FIMTM Cognitive was the greatest significant predictor of Social Relations such that those with higher FIMTM Cognitive scores (indicating greater cognitive independence) had higher Social Relations scores. Older age and the ability to drive independently were also significantly related to higher Social Relations scores.

Discussion

This study examined the characteristics of people who volunteer after TBI and the association of volunteering with life satisfaction and participation (as defined by engagement in community activities, social relations, and productivity). In line with our hypotheses, we found a positive significant relationship between these outcomes and volunteer status, with the exception of productivity, which was not significantly associated with volunteering. The characteristics of those who volunteer were similar to the characteristics we hypothesized.

We found that almost a third of the sample reported volunteering. This is higher than the national average but similar to what Ouellet and colleagues (28) found in their study of individuals with TBI. As hypothesized, people in the current study who volunteered were more likely to be employed or a student and have higher education compared to those who did not volunteer. It is likely that people who are employed or who go to school are able to do so because they experience fewer limitations than people who do not engage in these activities, thus they are also more able to engage in volunteering.

Supporting our hypothesis, those who drove independently and reported better current functioning were also more likely to volunteer. Both driving status and current functioning are commonly reported barriers to volunteering in other disability populations (31). It is important to investigate whether individuals with TBI also report these factors as barriers precluding volunteer participation so that targeted strategies addressing these barriers can be developed. We hypothesized that individuals in our sample who volunteered would most likely be female and older, however we did not find sex or age differences between those who did and those who did not volunteer.

The results of this study suggest that those who volunteered had significantly higher life satisfaction than those who did not volunteer after controlling for important covariates. Similar to older adults who undergo a transition when they enter retirement, individuals with TBI also experience a shift in major life roles through changes in employment (47) or community involvement (6). Given that both employment (12,13) and social participation

(13,17,18) contribute to life satisfaction after TBI, it is possible that volunteering provides an alternative way to engage socially and to feel productive, thereby increasing life satisfaction. It is also possible that people who have higher life satisfaction are more likely to participate in volunteer activity. Studies that have attempted to tease apart this relationship have found evidence that volunteering does indeed lead to greater life satisfaction (29,48); this study, however, cannot determine causation.

After controlling for all covariates, volunteering was also found to be positively associated with aspects of participation, such as engaging in one's community and socializing with other people, but volunteering was not found to be significantly associated with productivity (as defined by work, school, and/or homemaking activities). Notably, a medium effect size was observed for the relationship between volunteer status and community engagement; further, volunteering was the most significant factor for getting out in one's community, above and beyond important factors such as current functioning, education, age, and transportation. It is possible that engaging in volunteer work opens up additional opportunities or motivation for community involvement. Simply, once a person is out of the house, they may be more apt to do other activities like run an errand or attend a movie before they return home. Again, we cannot determine causation from this study, however this finding is similar to results of an RCT where social activity increased following a volunteer intervention (25).

Volunteering was also associated with more frequent engagement with other people. Engaging in volunteer activity may expand a person's social network thereby increasing the number of opportunities for socialization. It is also possible that the social relationships gained by volunteer activity mediates the relationship between volunteering and getting out in one's community. Future studies should identify mechanisms that underlie the relationship between volunteering and outcomes.

Finally, contrary to our hypothesis, we did not find a relationship between volunteer status and productivity. Given that productivity was defined as the number of hours spent working, in school, and/or in homemaking activities, it is not entirely surprising that a relationship did not emerge. The more hours a person is engaged in these productive activities, the less time they have to take part in other activities, such as volunteering. In the future, it may be of interest to investigate the relationship between volunteer status and productivity utilizing a subjective measure of productivity instead. Notably, the ability to drive independently emerged as the most significant factor contributing to productivity and it also emerged as a significant factor in each of the other participation models. The ability to drive independently may play a key role in obtaining a productive and engaged life after TBI. This factor and its association with participation outcomes after TBI should be explored further.

Limitations

This study was limited to individuals from a single TBIMS Center, thus the results may not be representative of all individuals with moderate to severe TBI who received inpatient rehabilitation. Only individuals with follow-up data from 1-, 2-, or 5-years post-injury were included. It is possible that those with missing data or those who were greater than 5-years

post-injury differ on outcomes from those who were included in the study. Involvement in volunteer activity and its association with outcomes may vary across time, so it will be important to investigate these relationships longitudinally.

Another limitation of this research is the cross-sectional study design which does not allow us to infer the direction of the relationship between volunteering and each of the outcomes. Additional studies using RCT and longitudinal designs are needed to further investigate the direct relationship between volunteering and outcomes.

While we found statistically significant differences in life satisfaction and social relations based on volunteer activity, this was likely due to the large sample size. The magnitude of these differences were small and thus may not represent clinically meaningful differences in SWLS or Social Relations scores when comparing groups by volunteer status.

This study cannot speak to the reasons why a person volunteers or does not volunteer. Likewise, from these data we cannot ascertain the type of volunteer positions people held, the duration spent in those positions, nor the satisfaction with the volunteer position itself. These additional factors likely play important roles in outcomes. To inform the development of a TBI-specific measure of volunteering, qualitative studies may be necessary to elucidate which components of volunteering are most important to an individual with TBI.

Finally, there are other important variables that may be related to life satisfaction or participation that were not controlled for in the current study. For example, depression and anxiety are common sequelae of TBI (7,49–51) and they are also associated with diminished social participation among people in this population (49). It is likely that these psychological factors moderate the relationship between volunteering and outcomes. As previously mentioned, future studies should incorporate additional factors in mediation and moderation models to identify the mechanism by which volunteering impacts outcomes after TBI.

Conclusions

Volunteering is a mutually beneficial activity that has the potential to improve outcomes for persons with TBI as well as to benefit the community at large. This study found a positive relationship between aspects of participation and life satisfaction with volunteer status adding to the scant body of research on the topic. Future research should investigate the barriers/facilitators of volunteering to improve well-being and participation after TBI.

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Figure 1.
Sample flow chart.

Table 1.

Summary of sample characteristics ($N = 725$).

Continuous Variables	Overall			Volunteer			No Volunteer			Comparison [†] <i>p</i> -value
	<i>N</i>	Mean (SD)/Median (IQR)	<i>N</i>	Mean (SD)/Median (IQR)	<i>N</i>	Mean (SD)/Median (IQR)	<i>N</i>	Mean (SD)/Median (IQR)	<i>N</i>	
Age at Follow-up	725	38.9 (14.8)	222	39.5 (15.0)	503	38.7 (14.7)				.4621
FIM™ Cognitive	725	33 (30–34)	222	33 (31–35)	503	32 (30–34)				.0006
FIM™ Motor	725	91 (89–91)	222	91 (90–91)	503	91 (87–91)				< .0001
Length of PTA (days)	710	23 (10–46)	219	22 (10–40)	491	24 (9–51)				.0172

Nominal Variables	Overall			Volunteer			No Volunteer			Comparison [†] <i>p</i> -value
	<i>N</i>	Percent		<i>N</i>	Percent		<i>N</i>	Percent		
Sex										.3420
Female	173	23.9	58	26.1	115	22.9				
Male	552	76.1	164	73.9	388	77.1				
Race/Ethnicity										
NH White	624	86.1	202	91.0	422	83.9				.0369
Hispanic	65	9.0	14	6.3	51	10.1				
NH Black	19	2.6	5	2.3	14	2.8				
NH Other	17	2.3	1	0.5	16	3.2				
Level of Education (current)										< .0001
Less than High School	35	4.8	5	2.3	30	6.0				
High School/GED	161	22.2	28	12.6	133	26.4				
Greater than High School	529	73.0	189	85.1	340	67.6				
Employment/Student Status (current)										.0195
Employed/Student	437	60.3	148	66.7	289	57.5				
Not Employed/Not Student	288	39.7	74	33.3	214	42.5				
Mode of Transportation (current)										< .0001
Drives Self	493	68.0	173	78.0	320	63.6				
Gets Rides	232	32.0	49	22.1	183	36.4				
SRS (current)										< .0001
Independent	542	74.8	187	84.2	355	70.6				

Nominal Variables	Overall			Volunteer			No Volunteer			Comparison [‡]	
	N	Percent		N	Percent		N	Percent		p-value	
Overnight or Part-time Supervision	130	17.9		31	14.0		99	19.7			
Full-time Indirect or Direct Supervision	53	7.3		4	1.8		49	9.7			
GOS-E (current)										<.0001	
Favorable	612	84.4		208	93.7		404	80.3			
Unfavorable	113	15.6		14	6.3		99	19.7			
GCS Category (<i>n</i> = 719)										.4420	
Mild (13–15)	173	50.7		48	51.6		125	50.4			
Moderate (9–12)	58	17.0		19	20.4		39	15.7			
Severe (8 or less)	110	32.3		26	28.0		84	33.9			
[Intubated]	[125]	-		[42]	-		[83]	-			
[Chemically Paralyzed or Sedated]	[253]	-		[85]	-		[168]	-			
Follow-up Period										.0021	
1-year	32	4.4		3	1.4		29	5.8			
2-year	181	25.0		45	20.3		136	27.0			
5-year	512	70.6		174	78.4		338	67.2			

SD: standard deviation; IQR: interquartile range; PTA: post traumatic amnesia; NH: non-Hispanic; SRS: Supervision Rating Scale; GOS-E: Glasgow Outcome Scale Extended; GCS: Glasgow Coma Scale.

* Percentages calculated without Intubated or Chemically Paralyzed or Sedated.

[‡] Calculations based on two-sample *t*-tests, Wilcoxon rank sum, or chi square tests comparing volunteering and not volunteering.

Table 2.

Unadjusted relationship between volunteer status and PART-O and SWLS outcomes.

Overall Unadjusted Model				
	SWLS	PART-O Out & About	PART-O Productivity	PART-O Social Relations
N	667	725	725	725
Model R ²	0.03	0.09	0.01	0.03
Model (1, DDF)	(1, 665)	(1, 723)	(1, 723)	(1, 723)
Model F	20.54	69.75	6.52	22.22
Model p-value	<0.0001	<0.0001	0.0109	<0.0001
Root Mean Square Error	7.40	0.61	1.00	0.93

Mean (SE)				
	SWLS	PART-O Out & About	PART-O Productivity	PART-O Social Relations
Volunteer	26.94 (0.50)	2.16 (0.04)	1.84 (0.07)	2.84 (0.06)
Not Volunteer	24.17 (0.35)	1.75 (0.03)	1.64 (0.05)	2.49 (0.04)

Unadjusted Comparison* (Volunteer - Not Volunteer)				
	SWLS	PART-O Out & About	PART-O Productivity	PART-O Social Relations
Difference	2.78	0.41	0.21	0.35
SE	0.61	0.05	0.08	0.07
95% CI	(1.57, 3.98)	(0.31, 0.50)	(0.05, 0.36)	(0.21, 0.50)
Effect Size f^2	0.38	0.67	0.21	0.38

SWLS: Satisfaction with Life Scale; PART-O: Participation Assessment with Recombined Tools – Objective; DDF: denominator degrees of freedom; SE: standard error; CI: confidence interval; ES: effect size.

* Comparisons based on a two-sample *t*-test assuming equal variance.

[†] Effect size computed as the mean difference divided by the root mean square error.

Table 3.

Adjusted relationship between volunteer status and PART-O and SWLS outcomes.

Overall Adjusted Model					
	SWLS	PART-O Out & About	PART-O Productivity	PART-O Social Relations	
<i>N</i>	667	725	725	725	725
Model R ²	0.20	0.27	0.48	0.20	0.20
Model (NDF, DDF)	(16, 650)	(14, 710)	(16, 708)	(14, 710)	(14, 710)
Model F	11.42	20.00	42.65	13.89	13.89
Model <i>p</i> -value	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Root Mean Square Error	6.71	0.54	0.72	0.84	0.84

Adjusted Comparison* (Volunteer - Not Volunteer)					
	SWLS	PART-O Out & About	PART-O Productivity	PART-O Social Relations	
Difference	1.94	0.27	0.07	0.19	0.19
SE	0.58	0.05	0.06	0.07	0.07
<i>p</i> -value	0.008	<0.0001	0.2799	0.0058	0.0058
95% CI	(0.81, 3.06)	(0.18, 0.36)	(−0.05, 0.18)	(0.06, 0.33)	(0.06, 0.33)
Effect Size [†]	0.29	0.50	0.10	0.23	0.23

Model Effects						
	SWLS		PART-O Out & About		PART-O Social Relations	
	F Ratio	<i>p</i> -value	F Ratio	<i>p</i> -value	F Ratio	<i>p</i> -value
Volunteer Status	11.31	.0008	36.09	< .0001	1.17	0.2800
Sex	0.44	.5055	3.40	.0655	6.58	0.0105
Age	1.05	.3064	7.27	.0072	39.36	< 0.0001
Age × Age	6.44	.0114	-	-	17.14	< 0.0001
Education	1.03	.3562	14.50	< .0001	5.81	0.0031
Follow-up Period	0.22	.8039	1.44	.2372	0.78	0.4589
Employment/Student	5.69	.0174	0.40	.5270	-	-
Transportation	2.40	.1219	4.22	.0403	50.58	< 0.0001
GOS-E	12.31	.0005	0.00	.9631	1.38	0.2400

	Model Effects									
	SWLS		PART-O Out & About		PART-O Productivity		PART-O Social Relations			
	F Ratio	p-value	F Ratio	p-value	F Ratio	p-value	F Ratio	F Ratio	p-value	
SRS	1.83	.1610	1.64	.1954	8.34	0.0003	1.22		.2962	
FIM TM Cognitive	39.55	< .0001	0.38	.5366	15.66	< 0.0001	19.36		< .0001	
FIM TM Cognitive × FIM TM Cognitive	-	-	-	-	7.75	0.0055	-		-	
FIM TM Motor	10.41	.0013	14.59	.0001	7.83	0.0053	0.76		.3836	
FIM TM Motor × FIM TM Motor	5.26	.0221	-	-	3.04	0.0817	-		-	

SWLS: Satisfaction with Life Scale; PART-O: Participation Assessment with Recombined Tools – Objective; NDF: numerator degrees of freedom; SE: standard error; CI: confidence interval; GOS-E: Glasgow Outcome Scale – Extended; SRS: Supervision Rating Scale.

* Comparisons based on a two-sample *t*-test assuming equal variance.

[†] Effect Size is computed as the mean difference divided by the root mean square error.