

Societal Participation of People with Traumatic Brain Injury Before and During the COVID-19 Pandemic: A NIDILRR Traumatic Brain Injury Model Systems Study

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Participation in Brain Injury During COVID-19

Societal Participation of People with Traumatic Brain Injury Before and During the COVID-19 Pandemic: A NIDILRR Traumatic Brain Injury Model Systems Study

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Abstract

Objective: To examine the impact of the COVID-19 pandemic on societal participation in people with moderate-to-severe traumatic brain injury (TBI).

Design: Cross-sectional retrospective cohort.

Setting: National TBI Model Systems (TBIMS) centers, United States.

Participants: TBIMS enrollees ($N=7,003$), ages 16 and older and 1-30 years post-injury, interviewed either pre-pandemic (PP) or during the pandemic (DP). The sample was primarily male (72.4%) and White (69.5%), with motor vehicle accidents as the most common cause of injury (55.1%).

Interventions: Not applicable.

Main Outcome Measure: The 3 subscales of the Participation Assessment with Recombined Tools-Objective (PART-O): *Out and About* (community involvement), *Productivity*, and *Social Relations*.

Results: *Out and About*, but not *Productivity* or *Social Relations*, scores were appreciably lower among DP participants compared to PP participants (medium effect). Demographic and clinical characteristics showed similar patterns of association with participation domains across PP and DP. When their unique contributions were examined in regression models, age, self-identified race, education level, employment status, marital status, income level, disability severity, and life satisfaction were variably predictive of participation domains, though most effects were small or medium in size. Depression and anxiety symptom severities each showed small zero-order

correlations with participation domains across PP and DP, but had negligible effects in regression analyses.

Conclusions: Consistent with the impact of COVID-19 on participation levels in the general population, people with TBI reported less community involvement during the pandemic, potentially compounding existing post-injury challenges to societal integration. The pandemic does not appear to have altered patterns of association between demographic/clinical characteristics and participation. Assessing and addressing barriers to community involvement should be a priority for TBI treatment providers. Longitudinal studies of TBI that consider pandemic-related effects on participation and other societally linked outcomes will help to elucidate the potential longer-term impact the pandemic has on behavioral health in this population.

Keywords: Anxiety; Brain Injuries, Traumatic; Community Integration; COVID-19 Pandemic; Depression; Personal Satisfaction; Quality of Life; Rehabilitation; Social Relationships

Abbreviations

COVID-19	Coronavirus Disease 2019
DP	During the pandemic
GAD-7	Generalized Anxiety Disorder-7
PART-O	Participation Assessment with Recombined Tools-Objective
PHQ-9	Patient Health Questionnaire-9
PP	Pre-pandemic
PwTBI	People with traumatic brain injury
TBI	Traumatic brain injury

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TBIMS Traumatic Brain Injury Model Systems

WHO World Health Organization

Journal Pre-proof

INTRODUCTION

There is emerging evidence that the Coronavirus Disease 2019 (COVID-19) pandemic has exacerbated negative impacts of traumatic brain injury (TBI) and complicated access to rehabilitative care.¹⁻⁴ Neurological impairment following moderate-to-severe TBI often leads to chronic physical, cognitive, and behavioral limitations that severely limit individuals' ability to participate in society—an outcome of critical importance for those living with TBI and their families.^{5,6} It is well established that people with disabilities such as TBI are already less participatory than those without disabilities.⁷ Determining the effects of the pandemic on societal participation of those living with chronic TBI is imperative in order for rehabilitation professionals to adapt treatment approaches to the evolving public health climate.

The World Health Organization (WHO) defines participation as “involvement in life situations.”⁸ Prior studies have demonstrated that more frequent participation among those with TBI is associated with better quality of life,^{9,10} greater life satisfaction,¹¹ and better mental health outcomes.¹²⁻¹⁴ Although many factors are known to predict less frequent participation (e.g., functional impairment, inability to drive, fatigue, depression, and older age^{13,15-21}), these explain only a portion of the variability in participation outcomes post-TBI. As posited by the WHO, disability arises from a dynamic interaction between health conditions, personal factors, and the environment. The pandemic has had cascading impacts on the landscape of environmental barriers and facilitators that may influence participation for those living with chronic moderate-to-severe TBI.

The impact of the pandemic on participation in the general population has been profound, including record levels of joblessness,²² reduced physical activity,²³ and decreased participation in outdoor leisure activities.²⁴ People with disabilities have been especially vulnerable to

pandemic-related inactivity, social isolation, and loneliness.²⁵ However, information about how the pandemic has influenced the lives of individuals with TBI remains limited. In a study based on U.S. data from May-June of 2020, people with TBI ($N=47$) reported less pandemic-related behavior change than controls (i.e., they made fewer adjustments to their daily routines and health behaviors) but also noted that coping with the pandemic was challenging, including increased mental health concerns.²⁶ The study's small sample size and reliance on retrospective judgments of change preclude definitive conclusions, but its observations highlight the importance of investigating the pandemic's effects on TBI-related outcomes in larger, clinically informative datasets.

Dramatic changes induced by pandemic restrictions could threaten the psychosocial health of individuals with TBI and may indicate a need for targeted intervention. Widespread pandemic-related disruption to daily life also potentially complicates analyses of health outcomes in multi-year longitudinal studies such as the TBI Model Systems (TBIMS), which follows individuals for decades after acute rehabilitation to elucidate long-term outcome trajectories. Knowledge of how participation in the TBIMS may have changed on a study-wide level from before to during the pandemic would be instructive for future analyses.

The current study aimed to determine whether pandemic-related disruptions to daily activities in the general population were detectable as trends in the TBIMS database (i.e., between interviews completed before the pandemic and those completed during the pandemic). To address this question, we planned a cross-sectional analysis of demographically similar cohorts before and during the pandemic. We first aimed to describe demographic and clinical correlates of participation in people with TBI (PwTBI) assessed in the approximately 2.5 years prior to pandemic onset (PP) and those assessed during the pandemic (DP). Time periods were

chosen to be consistent with the samples selected for a study on mental health changes related to the pandemic,²⁷ thereby enabling cross-study interpretations. We predicted that participation in the DP period would be lower relative to the PP period, and that the largest discrepancy would be in the community involvement participation subdomain (e.g., shopping, restaurant dining, travel) due to lockdown restrictions. Given established relationships between reduced participation and demographic and clinical characteristics such as age and functional impairment, we examined whether these relationships were augmented from PP to DP, which may reveal factors that are especially important to participation DP.

METHODS

Participants

Participants were drawn from the TBIMS—a multicenter, longitudinal cohort study of individuals (ages 16+) who receive inpatient rehabilitation for moderate-to-severe TBI, defined according to established clinical criteria.²⁸ We employed the following additional inclusion criteria: follow-up window open between 1/01/2017 and 06/30/2021, with PART-O data collected during that follow up. When a participant had complete data for multiple follow-up sessions during this period, only data for the first follow-up were included. Follow-up data collected between 3/1/2020 and 3/31/2020 were excluded to account for societal transition to pandemic life. Each center received approval for human subjects research from their respective Institutional Review Boards.

Measures

The primary outcome was societal participation measured by the Participation Assessment with Recombined Tools-Objective (PART-O) subscales²⁹ (see³⁰ for full measure and scoring information). The PART-O was developed for use in disability populations bearing

in mind that “participation” may have different meanings across people,^{31,32} It assesses various ways people can be productive members of society (work, school, homemaking; captured by the *Productivity* subscale), are socially integrated (interacting with family, friends, spouses; *Social Relations* subscale), and demonstrate community involvement (going shopping, attending church, dining out; *Out and About* subscale).²⁰ The PART-O has established validity and test-retest reliability.^{29,33–36} Psychometric analysis of the instrument suggests that its items represent a unidimensional construct; however, examination of meaningful subcomponents (i.e., abovementioned subscales) may be relevant for addressing certain clinical or social questions.^{32,37} Each PART-O item is scored out of 5 points, and subscale scores are derived from the average of the subscale items. The PART-O quantifies participation level in a *typical* week or month (e.g., *Productivity* subscale: “In a typical week, how many hours do you spend in active homemaking, including cleaning, cooking and raising children?”; *Social* subscale: “In a typical week, how many times do you socialize with friends (excluding family members), in person or by phone?”; *Out and About* subscale: “In a typical month, how many times do you eat in a restaurant?”). Data collectors at each site were instructed to query individuals on their typical behavior *currently* (i.e., typical week in the pandemic for data collected during this time). This procedure was implemented to avoid participants retrospectively reporting on their participation when queried during the pandemic.

Predictor variables included demographic, injury-related, psychosocial, and functional variables collected by the TBIMS: participant age at follow up, sex as a biological variable, race/ethnicity, education level at follow-up, cause of injury, disability severity, employment status, marital status, household income, urbanicity, problematic substance use, depression

symptom severity, and anxiety symptom severity. For more detailed information on these variables, see Supplementary Table 1.

Data Analysis

Analyses were conducted in SPSS Version 28³⁸ and R Version 4.0.4.³⁹ Comparisons between participants who were retained and excluded, and comparisons between PP and DP groups, were assessed using chi-squared tests for categorical variables and independent samples t-tests for continuous variables. Associations between demographic and clinical characteristics (injury-related, functional, psychosocial variables) and participation outcomes were evaluated using Pearson correlations, point-biserial correlations, and phi coefficients in the full sample, as well as separately by time period (PP and DP).

To evaluate the hypothesis that time period would be uniquely associated with participation, separate linear regression models were constructed with demographic and clinical characteristics, along with a binary indicator of time period (PP vs. DP), as predictors of the PART-O subscale scores. Employment status was removed from the prediction of *Productivity*, and marital status from the prediction of *Social Relations*, as these variables are part of the measurement of those subscales. By design, there were no missing data on any of the outcome variables or on the time period predictor. Missing data on covariates ranged from 0% to 8.2%, though only two covariates (household income and disability severity) were more than 2% missing. Covariate missingness was uncorrelated with values on participation outcomes or with other covariate values ($r_s < \pm .1$). For regression models, complete case analysis (n=5,755; 82.2%) was used. Participants with complete data did not systematically differ from those with incomplete data on any model variables ($r_s < \pm .1$).

Given our ability to detect very small associations at $\alpha < .01$ in this large sample, we focused on effect size versus statistical significance. Effect sizes were evaluated using phi (ϕ ; binary variables) and Cramer's V (categorical variables) for the chi-squared tests, Pearson correlations (r , continuous variables), and Cohen's d for t-tests. In regression analyses, effect sizes were evaluated using semi-partial correlations.

RESULTS

[insert Figure 1 about here]

Sample

Figure 1 depicts the analysis inclusion/exclusion process. Table 1 contains descriptive information for included ($N=7,003$) and excluded individuals. Demographic and clinical characteristics of those eligible, but not included, resembled those of the analytic sample. Small-magnitude differences were noted for age, race/ethnicity, education level, employment status, income, depression symptom severity (only 8.8% of excluded with complete data), and life satisfaction (only 19.2% of excluded with complete data). Differences in disability severity and participation scores were likely due to the requirement that participants have self-reported PHQ-9 and GAD-7 data, thereby excluding participants who were too impaired or otherwise unavailable to complete these measures without assistance. The included sample represented data from the entire DP period; interviews completed during a given DP quarter ranged from 354 to 446.

[insert Table 1 about here]

Correlations Overall and by Time Period (PP and DP)

Demographic and clinical characteristics of the participants were similar between PP and DP groups (Table 2). Follow-up interview timing varied across participants in the PP and DP

periods, with a greater proportion of earlier post-injury follow-ups among PP participants than DP participants. This difference was likely due to the selection strategy, which retained data from only a participant's first follow-up.

[insert Table 2 about here]

PART-O subscale scores showed remarkable consistency throughout the PP period (Figure 2a-c). *Out & About* subscale scores were lower among DP participants than those interviewed PP, suggesting that the former group spent less time in the community during the pandemic; this difference was medium-sized (Figure 2a). PART-O *Productivity* and *Social* subscale scores did not vary by time period.

[insert Figure 2 about here]

Tables 3 and 4 show correlations between the predictors and participation for the full sample and separated by time period, respectively.

In the full sample, effects were typically small and differed across PART-O subscales. Higher educational attainment, employment, and marriage were associated with higher *Out & About* scores, while greater anxiety and depression symptom severities were associated with lower *Out & About* scores (small effects). Higher household income, less disability, and higher life satisfaction ratings were also associated with higher *Out & About* scores (all medium effects).

Younger age, higher educational attainment, marriage, greater time since injury, problematic substance use, and higher life satisfaction were associated with higher *Productivity* scores in the full sample, while higher depression and anxiety symptom severities were associated with lower *Productivity* (all small effects). Black participants reported lower *Productivity* relative to all other groups, and White participants reported higher scores compared

to all other groups (all small effects). Small effects were also seen for injury mechanism: *Productivity* was higher in those with motor vehicle accidents and lower in those with falls, as compared to other injury mechanisms. Higher household income and less disability were associated with higher *Productivity* (medium effects). Large correlations were observed between employment status and *Productivity* because employment status contributes to the calculation of this subscale.

In the full sample, there were small associations between race and ethnicity, educational attainment, household income, depression symptom severity, and anxiety symptom severity with *Social Relations* (direction of effects same as described above for *Productivity*). Being employed and having less disability were associated with lower *Social Relations* (small effects), while life satisfaction and being married were positively associated with *Social Relations* (medium effects). Notably, marital status is included in the calculation of the *Social Relations* subscale, with marriage conferring higher scores.

[insert Table 3 about here]

The magnitudes of correlations between the predictors and PART-O subscales did not differ by time period (Table 4).

[insert Table 4 about here]

[insert Table 5 about here]

Factors Contributing to Participation

Given no evidence of moderation by PP/DP time period in bivariate analyses, only main effects were included in regression analyses (Table 5). Controlling for all other predictors, time period was independently associated with *Out & About* scores, such that DP participants reported spending less time in the community than PP participants (small effect). *Out & About* scores

were inversely associated with disability severity and positively associated with life satisfaction; both effects were small in magnitude. Time period was not uniquely related to *Productivity* or *Social Relations*. In the analysis predicting *Productivity*, younger age (early adult vs. late middle/late adult), having higher household income, and greater life satisfaction emerged as unique predictors. The negative relationship between disability severity and *Productivity* was medium-sized and the largest independent effect in this model. In the model predicting *Social Relations*, only two small, unique effects emerged— income and life satisfaction, which were positively predictive.

DISCUSSION

Consistent with our hypothesis, community involvement—as measured by the PART-O *Out and About* subscale—was significantly lower in the DP period compared to PP. Notably, this subscale assesses frequency of attendance at community establishments that were specifically targeted by pandemic restrictions, including restaurants, stores, theaters, gyms, sporting events, and religious services. Other contributing factors to decreased community involvement may be related to the significant social and political unrest that was also present during the pandemic period in the United States. No remarkable differences between the PP and DP periods were found in the *Productivity* and *Social Relations* subscales, which was somewhat surprising given how profoundly disruptive the pandemic has been to society at large.

As noted earlier, societal participation is already reduced among PwTBI, and associated with certain demographic and clinical characteristics (these were also borne out by our correlational analyses, viz. education, income, marital status, disability severity, emotional symptoms, and life satisfaction). The current findings indicate that, at the aggregate level, the effects of these characteristics on participation have *persisted with similar magnitude* during the

pandemic; therefore, any contributory effect of the pandemic experience may have been rendered trivial. That is, participation limitations among PwTBI present before the pandemic may have made productivity and social limitations induced by the pandemic appear small in comparison. This should *not* be interpreted as resilience against the pandemic experience or taken to mean that PwTBI were well integrated in their communities during the pandemic. Rather, pandemic-specific effects in PwTBI may have been overshadowed by existing and enduring problems related to sociodemographic and clinical factors. Specifically, disability severity and greater age (excluding 65+) independently and negatively contributed to *Productivity*, while greater household income and life satisfaction had positive independent effects on *Productivity*. Greater household income and life satisfaction were also uniquely predictive of increased *Social Relations*.

Community reintegration continues to be problematic for PwTBI long after injury;⁴⁰ thus, these individuals may be particularly vulnerable to daily life disruptions induced by the pandemic. Moreover, the pandemic has challenged social norms and altered human communities and institutions for the foreseeable future. While the general population will gradually adjust to these societal changes, PwTBI—who may not be as cognitively or behaviorally flexible—are at risk of being left behind. Clinicians should be aware of potential pandemic-related health disparities in this population to identify opportunities for early intervention/prevention of psychosocial complications. Encouragingly, there exist opportunities for both health and community resource facilitation that were not in wide use prior to the pandemic, including telehealth and home-community based rehabilitation and outreach services as alternatives to face-to-face and institution/hospital-based programs.^{4,41,42} Additionally, mobile health technology is a burgeoning area that holds significant promise for delivery of rehabilitation

interventions.⁴³ We anticipate that these innovative health care approaches will be increasingly important in addressing long-term psychosocial effects of the pandemic on PwTBI and others with chronic disability.

Study Limitations and Future Directions

The current study had limitations that reveal opportunities for future research. Although the PART-O is a validated measure of overall societal participation after TBI, it is not an exhaustive index of home and community activity. It is possible that activity patterns among PwTBI changed qualitatively during the pandemic (e.g., from in-person to virtual activity), which would not have been captured by the measure. Moreover, the PART-O considers only participation *level*, such as frequency of an activity. Despite relative consistency in participation levels between PP to DP, there could have been important changes in the quality or personal *meaningfulness* of participation among PwTBI.⁴⁴ Additionally, in the absence of a control group, we could not draw comparisons between participation in the TBI and general populations, for example, to determine whether lack of change in PART-O scores were due to high baseline participation limitations in TBI. Although individuals excluded from analyses were demographically and clinically similar to those included based on effect sizes, the collective impact of small observed differences on external validity is unknown. Additionally, our study excluded individuals who could not self-report data and thus tended to be more disabled; consequently, our analysis cannot be generalized to individuals with very severe injury-related functional limitations.

Recognizing that geographic region can influence participation, we included urbanicity of individuals' residential communities, but data on nuanced place features such as access to transportation and characteristics of the built environment may be illuminating. Further,

participation during the pandemic may have been influenced by local, time-varying governmental policies regarding public health behavior; continuous policy data at the state or municipal level, with linking to more precise participant geodata, are needed to investigate these potential effects. We also did not have subjective measures of pandemic literacy and health risk appraisal, factors that likely guide personal decisions to engage in or avoid community activity. A strength of the TBIMS is that it systematically characterizes TBI recovery by employing clearly specified inclusion criteria (e.g., admission to acute rehabilitation), but these preconditions introduce selection bias. Because certain demographic groups have poorer access to care, results may underestimate health disparities.

The current study was a cross-sectional analysis of demographically similar cohorts, and a future step would be to investigate whether and how individual participation trajectories differ using within-subject analytic techniques. We expect that the longitudinal TBIMS database will be ideally suited to answer these questions in the coming years. As COVID-19 becomes endemic, we will be able to evaluate longer-term, within-participant changes in psychosocial outcomes from before to during and after the pandemic. The elucidation of factors potentially moderating participation, such as individual resilience and family/care-partner support, may also prove useful in identifying appropriate interventions.

Conclusion

The current data support a negative impact of the pandemic on community involvement. The extent to which this reflects a compounding of existing difficulties in societal integration after TBI should be addressed by clinicians on an individual basis to identify immediate patient needs. Relatively stable productive and social participation levels before and during the pandemic provide favorable conditions for ongoing longitudinal research studies as well as

established clinical practices. However, it remains to be determined whether current clinical practices will be able to adequately address all residual pandemic-related participation problems across individuals. Known demographic, injury-related, psychosocial, and functional contributors to participation before the pandemic appear to have been similarly influential during the pandemic. Nonetheless, ongoing longitudinal studies such as the TBIMS will need to account for pandemic-related effects on participation and other behaviors associated with societal integration when modeling TBI outcome trajectories. Critically, this approach will be necessary to capture longer-term impacts of the pandemic on behavioral health in those living with chronic TBI, as well as recovery trajectories of individuals undergoing acute rehabilitation during the pandemic.

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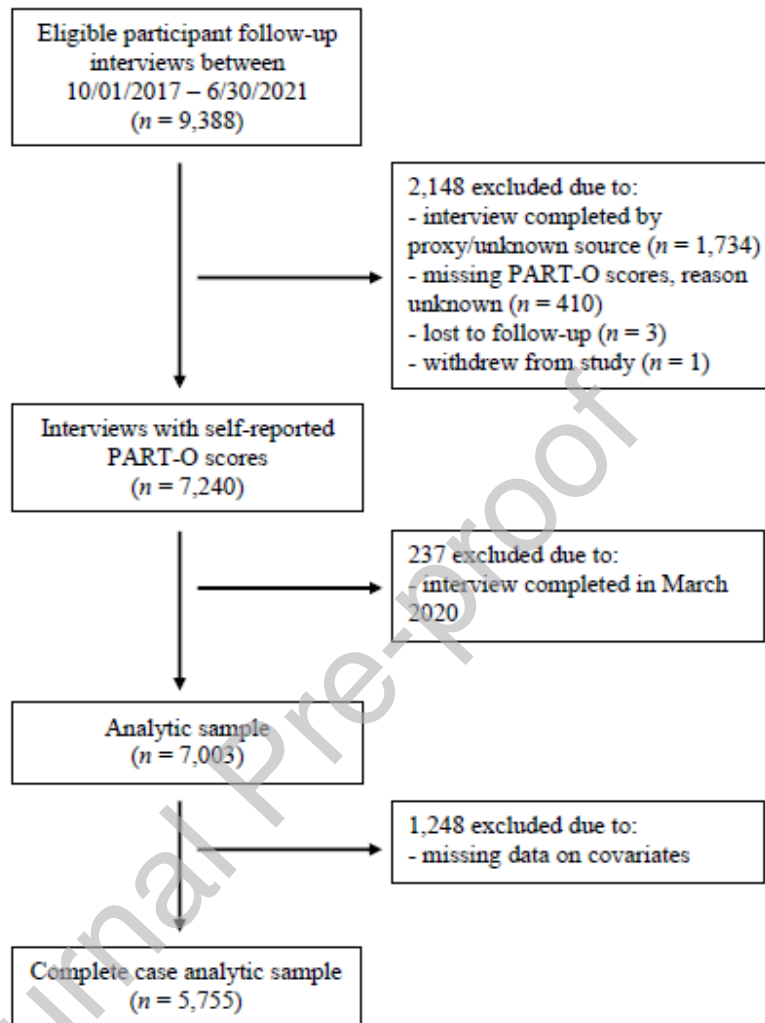
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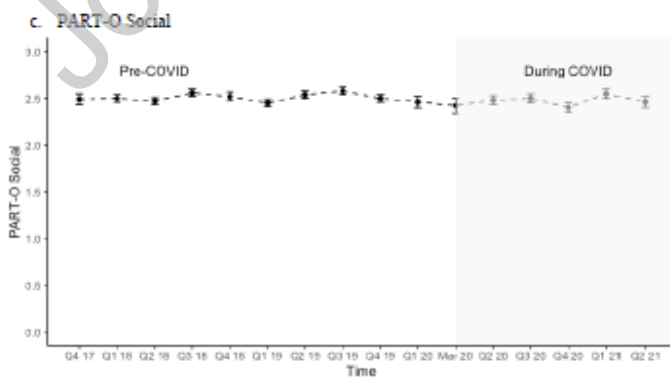
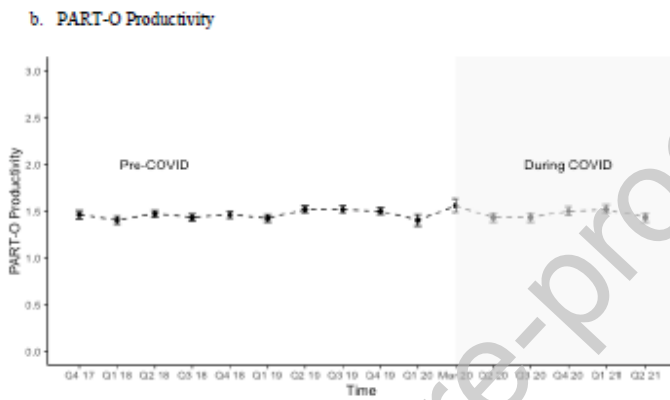
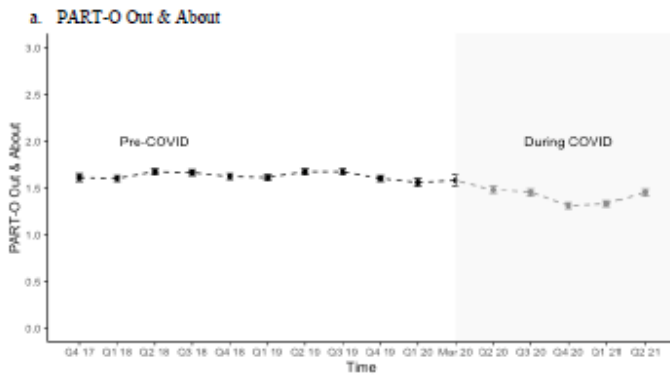
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1. **Flow Diagram for Analytic Sample.** *Note.* PART-O = Participation Assessment with Recombined Tools-Objective.



2. **PART-O Subscale Scores Across Time (October 2017 – June 2021).** *Note.* PART-O = Participation Assessment with Recombined Tools-Objective. Shaded area represents data collected during COVID-19 pandemic.

Table 1

Comparisons of Included & Excluded Participants

	Included <i>n</i> = 7003	Excluded <i>n</i> = 2385	Effect Size
Demographic Characteristics			
Sex, male (%)	5071 (72.4)	1800 (75.7)	.03
Age (%)			.10
Early adult (16 – 34 years)	1902 (27.2)	604 (25.4)	
Early middle (35 – 44 years)	1502 (21.5)	439 (18.5)	
Late middle (45 – 64 years)	2376 (34.0)	705 (29.7)	
Late adulthood (> 64 years)	1214 (17.4)	629 (26.5)	
Race and Ethnicity (%)			.11
American Indian	30 (0.4)	17 (0.7)	
Asian	186 (2.7)	84 (3.5)	
Black	1152 (16.5)	468 (19.7)	
Hispanic	690 (9.9)	375 (15.8)	
“Other” racial group	77 (1.1)	38 (1.6)	
White	4863 (69.5)	1396 (58.7)	
Education (%)			.15
Less than high school (%)	825 (11.8)	518 (22.9)	
High school or GED (%)	2147 (30.7)	765 (33.8)	
Greater than high school (%)	4019 (57.5)	980 (43.3)	
Employment status (%)			.19
Employed	3046 (43.6)	510 (23.1)	
Student	150 (2.1)	31 (1.4)	
Other (i.e., homemaker, retired)	2906 (41.6)	1369 (62.1)	
Unemployed	890 (12.7)	296 (13.4)	
Marital status (%)			.07
Single, never married	2616 (37.4)	950 (41.7)	
Married	2564 (36.7)	713 (31.3)	
Divorced	1265 (18.1)	387 (17.0)	
Separated	249 (3.6)	70 (3.1)	
Widowed	293 (4.2)	157 (6.9)	
Household income (%)			.15
<\$25k	2111 (32.8)	865 (49.2)	
\$25k - <\$50k	1535 (23.9)	390 (22.2)	

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\$50k - <\$100k	1580 (24.6)	326 (18.5)	
\$100k - <\$150k	676 (10.5)	99 (5.6)	
\$150k - <\$200k	252 (3.9)	33 (1.9)	
>\$200k	274 (4.3)	46 (2.6)	
Urbanicity (%)			.06
Rural	1970 (28.6)	523 (23.5)	
Urban	2698 (39.1)	1001 (44.9)	
Suburban	2224 (32.3)	703 (31.6)	
Injury-related Characteristics			
Follow-up period (%)			.12
Year 1	1641 (23.4)	747 (31.3)	
Year 2	514 (7.3)	261 (10.9)	
Year 5	1381 (19.7)	473 (19.8)	
Year 10	1476 (21.1)	404 (16.9)	
Year 15	1169 (16.7)	296 (12.4)	
Year 20	616 (8.8)	146 (6.1)	
Year 25	137 (2.0)	42 (1.8)	
Year 30	69 (1.0)	16 (0.7)	
Cause of injury (%)			.09
Motor vehicle	3852 (55.1)	1062 (44.8)	
Fall	1679 (24.0)	733 (30.9)	
Violence	654 (9.3)	286 (12.1)	
Other cause	811 (11.6)	288 (12.2)	
Disability rating, m (sd)	5.37 (4.4)	2.1 (2.1)	-1.19
Problematic substance use, yes (%)	1755 (28.0)	624 (26.0)	-.02
Mental Health			
Satisfaction with life, m (sd)	22.2 (8.2)	20.6 (8.4) ⁺	.20
Depression symptom severity, m (sd)	4.9 (5.5)	5.5 (5.7) ⁺	-.10
Anxiety symptom severity, m (sd)	3.9 (5.1)	4.2 (5.0)	-.07
Participation (PART-O) Scores			
Out & About	1.6 (0.7)	1.1 (0.8)	.64
Productivity	1.5 (1.0)	0.7 (0.9)	.76
Social	2.5 (1.0)	1.8 (1.1)	.64

Note. Included participants have complete data for PART-O, PHQ-9, GAD-7, and date of interview (COVID period determination). Effect sizes are phi or Cramer's V for categorical variables and Cohen's d for continuous variables.

⁺Data are missing for > 80% of participants.

Table 2

Sample Descriptive Statistics

	Pre- COVID <i>n</i> = 4995	During COVID <i>n</i> = 2008	Effect Size
Demographic Characteristics			
Sex, male (%)	3620 (72.5)	1451 (72.3)	-.00
Age at follow-up (%)			.07
Early adult (16 – 34 years)	1448 (29.0)	454 (22.6)	
Early middle (35 – 44 years)	1003 (20.1)	499 (24.9)	
Late middle (45 – 64 years)	1688 (33.8)	688 (34.3)	
Late adulthood (> 64 years)	850 (17.0)	364 (18.2)	
Race and Ethnicity (%)			.02
American Indian	21 (0.4)	9 (0.4)	
Asian	128 (2.6)	58 (2.9)	
Black	801 (16.0)	351 (17.5)	
Hispanic	504 (10.1)	186 (9.3)	
“Other” racial group	56 (1.1)	21 (1.0)	
White	3483 (69.8)	1380 (68.8)	
Education (%)			.01
Less than high school (%)	594 (11.9)	231 (11.5)	
High school or GED (%)	1518 (30.4)	629 (31.4)	
Greater than high school (%)	2874 (57.6)	1145 (57.1)	
Employment status (%)			.03
Employed	2180 (43.7)	866 (43.2)	
Student	115 (2.3)	35 (1.7)	
Other (i.e., homemaker, retired)	2087 (41.9)	819 (40.8)	
Unemployed	605 (12.1)	285 (14.2)	
Marital status (%)			.02
Single, never married	1890 (37.9)	726 (36.3)	
Married	1814 (36.4)	750 (37.4)	
Divorced	901 (18.1)	364 (18.2)	
Separated	169 (3.4)	80 (4.0)	
Widowed	210 (4.2)	83 (4.1)	
Household income (%)			.04
<\$25k	1545 (33.5)	566 (31.2)	
\$25k - <\$50k	1120 (24.3)	415 (22.9)	
\$50k - <\$100k	1111 (24.1)	469 (25.9)	
\$100k - <\$150k	478 (10.4)	198 (10.9)	
\$150k - <\$200k	166 (3.6)	86 (4.7)	
>\$200k	195 (4.2)	79 (4.4)	
Urbanicity (%)			.00
Rural	1403 (28.6)	567 (28.6)	
Urban	1926 (39.2)	772 (39.1)	

Suburban	1582 (32.2)	642 (32.4)	
Injury-related Characteristics			
Follow-up period (%)			.21
Year 1	1152 (23.1)	489 (24.4)	
Year 2	484 (9.7)	30 (1.5)	
Year 5	1120 (22.4)	261 (13.0)	
Year 10	1010 (20.2)	466 (23.2)	
Year 15	736 (14.7)	433 (21.6)	
Year 20	370 (7.4)	246 (12.3)	
Year 25	87 (1.7)	50 (2.5)	
Year 30	36 (0.7)	33 (1.6)	
Cause of injury (%)			.04
Motor vehicle	2698 (54.1)	1154 (57.5)	
Fall	1249 (25.0)	430 (21.4)	
Violence	457 (9.2)	197 (9.8)	
Other cause	585 (11.7)	226 (11.3)	
Disability rating, m (sd)	2.0 (2.1)	2.2 (2.1)	-.07
Problematic substance use, yes (%)	1514 (30.6)	549 (27.6)	-.03
Mental Health			
Satisfaction with life, m (sd)	22.1 (8.2)	22.5 (8.0)	-.04
Depression symptom severity, m (sd)	5.0 (5.5)	4.8 (5.4)	.03
Anxiety symptom severity, m (sd)	3.9 (5.1)	3.9 (5.0)	.00
Participation (PART-O) Scores			
Out & About	1.6 (0.7)	1.4 (0.7)	.31
Productivity	1.5 (1.0)	1.5 (1.0)	.00
Social	2.5 (1.0)	2.5 (1.1)	.03

Note. Effect sizes are phi or Cramer's V for categorical variables and Cohen's d for continuous variables.

Table 3

Demographic, Injury-Related, and Psychosocial Correlations with Participation (PART-O) Outcomes, Full Sample ($n = 7,003$)

	Out & About	Productivity	Social
Sex (Female vs. Male)	.05	-.02	-.03
Age (vs. all other)			
Early adult (16 – 34 years)	.05	.16	.02
Early middle (35 – 44 years)	.05	.17	.08
Late middle (45 – 64 years)	-.04	-.07	-.05
Late adulthood (>64 years)	-.07	-.29	-.05
Race and Ethnicity (vs. all other)			
American Indian/Alaska Native	-.01	.00	-.00
Asian	-.02	.01	-.02
Black	-.09	-.13	-.13
Hispanic	-.02	.01	-.08
“Other” racial group	-.01	.01	-.01
White	.09	.10	.17
Education (vs. all other)			
Less than high school	-.15	-.15	-.16
High school or GED	-.13	-.11	-.12
Greater than high school	.22	.20	.22
Employment status (vs. all other)			
Employed	.27	.79	.29
Student	.03	.06	-.01
Other (i.e., homemaker, retired)	-.23	-.63	-.23
Unemployed	-.08	-.27	-.09
Marital status (vs. all other)			
Single, never married	-.05	.00	-.24
Married	.15	.12	.51
Divorced	-.07	-.06	-.21
Separated	-.04	-.05	-.11
Widowed	-.08	-.13	-.16
Household income	.30	.37	.43
Urbanicity (vs. all other)			
Rural	.01	.01	.04
Urban	-.07	-.07	-.09
Suburban	.07	.06	.05
Follow-up period	.03	.10	.01
Cause of injury (vs. all other)			
Motor vehicle	.06	.17	.08
Fall	-.05	-.15	-.03
Violence	-.07	-.08	-.09
Other cause	.03	.02	.01
Disability rating	-.34	-.49	-.27

Problematic substance use	.00	.13	.03
Satisfaction with life	.32	.29	.35
Depression symptom severity	-.24	-.19	-.18
Anxiety symptom severity	-.17	-.12	-.12

Note. Indicates small ($.1 \leq r < .3$) effect; Indicates medium ($.3 \leq r < .5$) effect; Indicates large ($r \geq .5$) effect.

Table 4

Demographic, Injury-Related, and Psychosocial Correlates with Mental Health Outcomes by COVID Period

	Pre-COVID (<i>n</i> = 4995)			During COVID (<i>n</i> = 2008)		
	Out & About	Productivity	Social	Out & About	Productivity	Social
Sex (Female vs. Male)	.05	-.01	-.03	.07	-.04	-.04
Age (vs. all other)						
Early adult (16 – 34 years)	.04	.17	.02	.03	.14	.02
Early middle (35 – 44 years)	.05	.16	.08	.08	.18	.10
Late middle (45 – 64 years)	-.04	-.08	-.05	-.02	-.04	-.05
Late adulthood (>64 years)	-.05	-.28	-.05	-.09	-.30	-.08
Race and Ethnicity (vs. all other)						
American Indian/Alaska Native	-.03	-.01	-.02	.02	.03	.03
Asian	-.01	.00	-.01	-.05	.01	-.04
Black	-.08	-.14	-.13	-.09	-.12	-.14
Hispanic	-.04	.00	-.09	.01	.02	-.07
“Other” racial group	-.01	.01	-.02	-.01	.01	.01
White	.10	.11	.17	.08	.08	.16
Education (vs. all other)						
Less than high school	-.15	-.16	-.16	-.13	-.14	-.15
High school or GED	-.13	-.10	-.10	-.14	-.13	-.17
Greater than high school	.22	.20	.20	.21	.21	.25
Employment status (vs. all other)						
Employed	.28	.78	.30	.26	.80	.28

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Student	.03	.06	-.01	.03	.06	.01
Other (i.e., homemaker, retired)	-.24	-.63	-.23	-.22	-.63	-.24
Unemployed	-.08	-.26	-.10	-.07	-.27	-.08
Marital status (vs. all other)						
Single, never married	-.04	.02	-.24	-.07	-.04	-.24
Married	.15	.10	.52	.17	.16	.51
Divorced	-.07	-.06	-.21	-.06	-.06	-.21
Separated	-.03	-.04	-.10	-.07	-.07	-.14
Widowed	-.09	-.13	-.17	-.07	-.11	-.13
Household income	.30	.37	.42	.33	.37	.45
Urbanicity (vs. all other)						
Rural	-.00	.00	.04	.03	.03	.03
Urban	-.07	-.07	-.08	-.08	-.07	-.10
Suburban	.07	.07	.04	.05	.04	.07
Follow-up period	.04	.11	.02	.07	.11	-.02
Cause of injury (vs. all other)						
Motor vehicle	.07	.17	.07	.06	.17	.10
Fall	-.05	-.15	-.03	-.05	-.15	-.04
Violence	-.07	-.08	-.08	-.06	-.08	-.13
Other cause	.02	.02	.00	.04	.02	.02
Disability rating	-.34	-.48	-.27	-.33	-.50	-.28
Problematic substance use	-.02	.13	.03	.04	.13	.03
Satisfaction with life	.34	.30	.34	.28	.28	.35
Depression symptom severity	-.27	-.19	-.18	-.20	-.16	-.16
Anxiety symptom severity	-.18	-.12	-.12	-.16	-.10	-.12

Note. Indicates small (.1 ≤ r < .3) effect; Indicates medium (.3 ≤ r < .5) effect; Indicates large (r ≥ .5) effect.

Table 5

PART-O Participation Regression Analyses ($n = 5,755$)

	Out & About			Productivity			Social		
	<i>B</i>	<i>SE</i>	<i>r_{sp}</i>	<i>B</i>	<i>SE</i>	<i>r_{sp}</i>	<i>B</i>	<i>SE</i>	<i>r_{sp}</i>
Sex (ref. male)	-0.09	0.02	-.05	-0.10	0.02	-.04	-0.06	0.03	-.03
Age (ref. early adult)									
Early	-0.00	0.03	.00	-0.09	0.03	-.03	0.11	0.04	.04
middle (35 – 44 years)									
Late middle (45 – 64 years)	-0.05	0.03	-.02	-0.40	0.03	-.13	-0.03	0.03	-.01
Late adulthood (>64 years)	-0.12	0.04	-.04	-0.93	0.04	-.24	-0.11	0.04	-.03
Race and Ethnicity (ref. White)									
American Indian/Alaska Native	-0.02	0.13	-.00	0.17	0.15	.01	0.04	0.17	.00
Asian	-0.16	0.06	-.03	-0.02	0.06	-.00	-0.21	0.08	-.03
Black	0.02	0.03	.01	-0.07	0.03	-.02	-0.05	0.03	-.02
Hispanic	0.00	0.03	.00	0.07	0.04	.02	-0.23	0.04	-.06
“Other” racial group	-0.09	0.08	-.01	-0.11	0.09	-.01	-0.19	0.11	-.02
Education (ref. less than high school or GED)									
High school or GED	0.08	0.03	.03	0.09	0.04	.03	0.05	0.04	.01
Greater than high school	0.23	0.03	.09	0.19	0.04	.05	0.15	0.04	.04
Employment status (ref. unemployed)									
Employed	0.04	0.03	.01	--	--	--	0.04	0.04	.01
Student	0.05	0.07	.01	--	--	--	-0.08	0.09	-.01
Other (i.e., homemaker, retired)	-0.06	0.03	-.02	--	--	--	-0.12	0.04	-.03
Marital status (ref. married)									
Single, never married	-0.07	0.02	-.03	-0.17	0.03	-.06	--	--	--
Divorced	-0.05	0.03	-.02	-0.02	0.03	-.01	--	--	--
Separated	0.01	0.05	.00	-0.01	0.06	-.00	--	--	--
Widowed	-0.10	0.05	-.03	-0.13	0.06	-.02	--	--	--

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Household income	0.06	0.01	.09	0.15	0.01	.16	0.23	0.01	.25
Urbanicity (ref. rural)									
Urban	-0.05	0.02	-.03	0.01	0.03	.00	-0.08	0.03	-.03
Suburban	0.02	0.02	.01	0.02	0.03	.01	-0.03	0.03	-.01
Follow-up period	0.01	0.01	.03	0.05	0.01	.07	-0.01	0.01	-.01
Cause of injury (ref. motor vehicle)									
Fall	-0.06	0.02	-.03	-0.13	0.02	-.05	-0.07	0.03	-.03
Violence	-0.05	0.03	-.02	-0.14	0.04	-.04	-0.07	0.04	-.02
Other cause	0.02	0.03	.01	-0.09	0.03	-.03	-0.06	0.04	-.02
Disability rating	-0.06	0.01	-.13	-0.16	0.01	-.30	-0.04	0.01	-.07
Problematic substance use	-0.04	0.02	-.03	0.10	0.02	.05	0.02	0.03	.01
Satisfaction with life	0.02	0.00	.15	0.02	0.00	.11	0.03	0.00	.20
Depression symptom severity	-0.01	0.00	-.06	0.00	0.00	.01	-0.00	0.00	-.01
Anxiety symptom severity	0.01	0.00	.05	0.01	0.00	.02	0.02	0.00	.06
COVID period	-0.24	0.02	-.15	-0.00	0.02	-.00	-0.07	0.03	-.03
	$R^2_{adjusted} = .24$			$R^2_{adjusted} = .43$			$R^2_{adjusted} = .29$		

Note. r_{sp} = semi-partial correlation. Employment status is excluded from *Productivity* analysis. Marital status is excluded from *Social Relations* analysis. Indicates small ($.1 \leq r < .3$) effect; Indicates medium ($.3 \leq r < .5$) effect.