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The role of social isolation in physical and emotional outcomes among patients with chronic pain

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Abstract

Objective: Social isolation negatively impacts early-disease processes and long-term health. Individuals with chronic pain are more vulnerable to social isolation, which exacerbates symptoms. It is currently unclear whether: 1. group-based programs for chronic pain improve social isolation, 2. improvements in social isolation account for improvements in outcomes. This study involved secondary data analysis of participants in a 10-week mind-body physical activity program. We examined whether social isolation improved during treatment, and whether such improvements accounted for improvements in emotional and physical functioning.

Methods: Participants (N=82) with chronic pain were randomized to a group-based mind-body physical activity intervention with (*GetActive-Fitbit; n*=41) or without a Fitbit device (*GetActive*; *n*=41). Participants completed self-reported measures of social isolation, emotional functioning (depression and anxiety symptoms), and multimodal physical functioning (self-report, performance-based, and objective). We used linear mixed effects modeling to examine pre-post treatment changes in social isolation and whether these changes accounted for improvements in emotional and physical functioning.

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Results: Both interventions were associated with significant and comparable improvements in social isolation from baseline to end of treatment, and improvements in accounted for significant improvements in self-reported emotional and physical functioning.

Conclusion: Interventions may target social isolation in chronic pain to optimize treatment outcomes.

Keywords

Social isolation; chronic pain; mind-body; physical function; depression; anxiety

1. Introduction

Social isolation is linked to a host of negative mental and physical health outcomes. One meta-analysis of 148 studies found that feeling lonely or isolated and having fewer social contacts and social activities increased the likelihood of all-cause mortality (Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015). Systematic reviews highlight the role of social isolation in the onset and maintenance of a number of chronic health conditions, including depression, anxiety, cardiovascular disease, cancer and dementia (Leigh-Hunt et al., 2017; Menec, Newall, MacKenzie, Shooshtari, & Nowicki, 2020).

Individuals with chronic pain experience substantial emotional and functional limitations, including a heighted risk for social isolation, which in turn relates to worse mental and physical health. Longitudinal analyses indicate that social isolation predicts subsequent pain interference (i.e., the extent to which pain hinders engagement in daily activities), and the association persists after accounting for a number of covariates (e.g., age, gender, race, ethnicity, education, marital status) (Karayannis, Baumann, Sturgeon, Melloh, & Mackey, 2019). Moreover, peer support can improve coping and chronic pain management (Kohut et al., 2016; Matthias, Kukla, McGuire, & Bair, 2016). In light of these findings, researchers emphasize the potential for interventions that increase social connection to improve management of chronic pain and its impact on daily activities (Karayannis et al., 2019; Matthias et al., 2016). However, no studies to date assessed improvement in social isolation after an intervention for chronic pain, nor associated changes in functioning.

We demonstrated that participation in one of 2 identical group-based mind-body physical activity programs, one without (*GetActive*) and one with a Fitbit (*GetActive-Fitbit*), was associated with improvement in emotional and physical function among chronic pain participants (Greenberg et al., 2019; Greenberg et al., 2020). The present study involved secondary data analysis to examine whether social isolation improved following participation in a group-based mind-body physical activity program, and whether this improvement explained improvements in emotional and physical functioning outcomes. Two hypotheses guided this study:

1. Participation in a group mind-body physical activity program will be associated with pre-post treatment improvements (i.e., reductions) in social isolation.
2. Pre-post treatment improvements in social isolation will account for improvements in physical and emotional functioning.

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2. Materials and Methods

2.1. Participants and Procedures

Patients (n=82) with heterogeneous chronic musculoskeletal pain via direct referrals from the Massachusetts General Hospital Pain Clinic and through hospital wide email lists. Detailed inclusion and exclusion criteria, study procedures, intervention development and content, and sample characteristics have been reported previously (Greenberg et al., 2019; Greenberg et al., 2020). Participants were mostly female (n=54, 66%), white (n=66, 80%), non-Hispanic (n=72, 88%), and college-educated (attended 4 years; n=17, 21%; or obtained a Graduate/Professional degree, n=28, 3z4%). Roughly one-fifth of the sample (n=17; 21%) was employed full time. All procedures were conducted in an outpatient clinic from July 2018 to September 2019. Table 1 presents descriptive statistics.

Participants completed an initial clinic visit to undergo informed consent and complete baseline assessments. Participants were randomly assigned to one of two 10-week programs (*GetActive* and *GetActive-Fitbit)* that were identical in content and structure, though in one program (*GetActive-Fitbit*) participants additionally received a Fitbit digital monitoring device. Participants attended their first 90-minute group session 1 week after their initial assessment visit, and then returned weekly for the remaining 9 sessions. One week after the last group session, participants completed a post-intervention assessment with measures identical to those administered at baseline. Participants were compensated $30 for each assessment. All study procedures were approved by the *Massachusetts General Hospital Independent* Review Board.

2.2. Intervention components

Details on program development and intervention components have been previously reported (Greenberg et al., 2019; Greenberg et al., 2020). Both the *GetActive* and *GetActive-Fitbit* programs have 10 weekly 90-minute in-person sessions delivered by a clinical psychologist. Core skills were identical between programs, and included hypothesized mechanisms of improvement for physical function such as: 1) weekly SMART goal setting for increases in activity, activities of daily living, and daily practice of mind-body skills 2) individualized quota-based pacing; 3) mind-body skills (diaphragmatic breathing, mindfulness exercises)and 4) education on the disability spiral (e.g. how reducing activity perpetuates pain and disability), pain myths, and automatic pain-related thoughts. The program included content specific to social relationships such as education on types of social support, discussions on the impact of pain on interpersonal relationships, exercises to cultivate empathy, as well as encouragement to uphold an open and supportive group environment, respectfully sharing and listening to others, and maintaining group cohesion.

2.3. Measures

Social Isolation.—We measured social isolation using the PROMIS® Social Isolation instrument (Short Form version 4a) (Hahn et al., 2010) which includes 4 items measuring an individual's perceptions of being excluded, detached, unknown, or avoided by others. Scores are expressed as T scores with M =50 and SD = 10. Internal reliability was excellent (α =.90).

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Emotional Functioning.—We measured emotional functioning with the PROMIS (*v1.08)* depression and anxiety scales (Pilkonis et al., 2011; Pilkonis, Yu, Dodds, Johnston, Maihoefer, & Lawrence, 2014), which each include 8-items that measure the frequency of symptoms over the past week on a 1–5 Likert scale. Scores are expressed as T-scores with M =50 and SD = 10. Internal reliability for the depression (α =.96) and anxiety (α =.95) scales were excellent.

Physical Functioning.—We assessed physical function (PF) via self-reported, objective (i.e. step-count), and performance-based means, in accordance with IMMPACT (Gewandter et al., 2019; Taylor et al., 2016) and the International Classification of Functioning, Disability and Health (ICF) guidelines (Peterson, 2005). Self-reported PF was assessed with the *World Health Organization Disability Assessment Schedule* WHODAS (2.0) (Üstün et al., 2010) a 36-item questionnaire assessing difficulties in 6 main areas of function. Internal reliability was excellent for the WHODAS (α =.97). Performance based PF was measured via the 6-minute walk test (6MWT) recordings of participants' distances walked on a flat surface (Redelmeier, Bayoumi, Goldstein, & Guyatt, 1997). Average daily step counts were calculated via a *wGT3X-BT ActiGraph accelerometer* device (Cain, Conway, Adams, Husak, & Sallis, 2013; Copay, Subach, Glassman, Polly Jr, & Schuler, 2007).

2.4. Statistical Analysis

We conducted hypothesis testing with linear mixed (random and fixed) effects longitudinal models in SAS for Windows, version 9.4 (SAS, 2020). Mixed-effects models are widely used to flexibly analyze longitudinal data and identify relevant predictors of change in clinical trials (Blood & Cheng, 2011; Magidson, Blashill, Safren, & Wagner, 2015).

We ran a series of models to test the hypotheses that there were pre-post treatment improvements (i.e., reductions) in social isolation (Step 1), and that improvements in social isolation accounted for improvements in emotional and physical functioning over time (Step 2). In Step 1, we first sought to establish whether social isolation changed significantly over time. This would be indicated via a significant relationship between change in social isolation and the binary categorical variable Time (baseline, post-intervention). Group (binary: GetActive, GetActive-Fitbit) and the interaction of Time X Group were also included in the model to account for any differences between group conditions. In all models, interactions that were nonsignificant were removed and the model rerun.

In Step 2, we included emotional and physical functioning measures as dependent (continuous) variables in separate respective analyses. For each dependent variable, we ran a model including the fixed effects of Time, social isolation, and their interactions with Group (*GetActive, GetActive-Fitbit*). Including time in this model determines whether emotional and physical outcomes changed from baseline to posttreatment, independently of social isolation. Inclusion of social isolation as a fixed effect reveals whether changes in social isolation helped to account for changes in outcomes. For all models, residuals were checked graphically to see if they conformed to the assumption of normality.

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3. Results

At baseline, means of all self-report measures and of performance-based physical function were similar to those reported in other studies of adults with chronic pain (Choi, Pepin, Marti, Stevens, & Bruce, 2020; Jeong, Kim, & Park, 2019; Krein, 2016; McDonough et al., 2013). The average daily step count of participants was lower than some published in other physical activity RCTs for chronic pain (Jeong et al., 2019; McDonough et al., 2013), and higher than others (Krein, 2016).

3.1. Step 1: Pre-Post Treatment Improvements in Social Isolation

Within-group pre-post treatment improvements in social isolation were significant ($M =$ 50.33 vs 47.56, diff =2.77, $F(1,80)=5.62$, p=.02). Participants in the *GetActive-Fitbit* program had comparable social isolation scores with *GetActive* participants on average ($M =$ 50.83 vs 47.06, diff = 3.77, $F(1,80)=3.68$, p = .06). The group by time interaction was not significant, suggesting that the two groups had similar improvements in social isolation. Residuals from this model conformed reasonably well to the normality assumption, as was the case for all models below.

3.2. Step 2: The impact of improvement in social isolation onto improvement in emotional and physical function.

When controlling for the effects of Group and Time, improvements in social isolation accounted for improvements in depression (unstandardized partial regression coefficient=B=0.48, p<.0001), anxiety (B=0.52, p<.0001), self-reported physical function (B=1.03, p<.0001), and performance-based physical functioning (B=−1.26, p=.026)(Table 2). Every 1 point improvement in social isolation during treatment was associated with .48 and .52 improvement on depression and anxiety scores respectively. For self-reported physical functioning, a 1 point improvement in social isolation during treatment was associated with a 1.03 improvement in self-reported physical functioning. For performance-based physical functioning, a 1 point improvement in social isolation during treatment was associated with a 1.26 meter improvement in performance-based physical functioning (6-minute walk test). Improvements in social isolation did not significantly (p>.05) account for improvements on average daily step count for participants in either group program.

4. Discussion

Our study is the first to provide evidence of improvement in social isolation following a mind-body intervention for patients with chronic pain. Social isolation is linked to a wide array of health outcomes (Karayannis et al., 2019; Leigh-Hunt et al., 2017; Menec et al., 2020), it is possible that improving social isolation through mind-body physical activity programs may also lead to improved health outcomes (Karayannis et al., 2019). Consistent with our first hypothesis, we observed significant pre-post treatment improvements in social isolation that were similar in magnitude for participants in both the *GetActive* and *GetActive-Fitbit* conditions. Further, the magnitude of these improvements was similar to those found following interventions for other clinical populations (Choi et al., 2020). The potential for the programs to improve social isolation is notable given its high prevalence in chronic pain (Karayannis et al., 2019). Though we did not explicitly target social isolation, our group-based mind-body intervention did include content and skills relevant for improving social isolation, including education on social relationships, and engaging social support when setting activity goals. Our second hypothesis, that improvements in social isolation would account for improvements in emotional and physical function, was partially supported. Improvements in social isolation from baseline to posttest explained improvements in anxiety symptoms, and partially explained depression, and self-reported physical function. This supports previous findings from studies indicating a link between social isolation, physical function, and emotional function (Karayannis et al., 2019; Leung et al., 2016; Solé et al., 2020).

Our findings emphasize the need for interventions for chronic pain to address social isolation not only as an outcome, but also as a potential mechanism for improving emotional and physical function. Such interventions, may for example, place more emphasis on social dynamics of the group, or implement strategies such as pairing up for activities and having an “activity buddy” to facilitate favorable self-reported emotional and physical function (Cholewa & Irwin, 2008; Tucker & Irwin, 2006). Further, interventions employing mind-body skills can consider tailoring discussions of skills (e.g. mindfulness) to target pain-related thoughts contributing to withdrawal from social relationships. The finding that changes in social isolation did not correlate with performance-based or objectively-measured physical function highlights the discrepancy between the modalities of physical function assessment, supporting the notion that they capture important but separate aspects of physical function (Greenberg, 2020; Taylor et al., 2016). Improvement in social isolation may thus relate to the subjective sense of increased physical function, independent of physical capacity in a structured test or weekly step-count.

The present study had a number of strengths. Our study builds on previous literature examining the role of social isolation in connection to the emotional and physical functioning of chronic pain patients over time. Our secondary analysis of a mind-body physical activity RCT provides insight into the potential for group treatment to improve social isolation, and thereby influence outcomes. We also assessed physical functioning comprehensively using established criteria (Gewandter et al., 2019; Peterson, 2005; Taylor et al., 2016). Finally, our mixed-modeling approach allowed us to: (1) simultaneously consider random effects for subjects and the effects over time, (2) compare both direct and indirect effects of social isolation on emotional and physical function, and (3) control for potential group effects.

A few limitations should be considered. The sample size is relatively small, which restricted statistical power. Additionally, we examined interventions that taught identical skills without a no-treatment control condition, which limited the degree to which changes could be attributed to specific skills (e.g. strengthening social support) or non-specific factors (e.g. support from the therapist or group). Spontaneous improvement over time in outcomes or regression to the mean cannot be ruled out. Future studies with larger sample sizes and active control conditions (Mahaffey et al., 2018) may provide a more granular account of the mechanisms of change.

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5. Conclusion

This study is the first to provide evidence of improvements in social isolation following a mind-body intervention for chronic pain, as well as for the emotional and physical correlates of such improvement. Interventions for chronic pain may benefit from integration of components targeting social isolation (e.g. group-cohesion exercises, engaging in shared activities and “buddying-up”) to help reduce the isolation to which this population is more vulnerable and potentially help facilitate emotional and physical function outcomes.

References

Blood EA, & Cheng DM (2011). The use of mixed models for the analysis of mediated data with time-dependent predictors. Journal of environmental and public health, 1–12.

Cain KL, Conway TL, Adams MA, Husak LE, & Sallis JF (2013). Comparison of older and newer generations of ActiGraph accelerometers with the normal filter and the low frequency extension. International Journal of Behavioral Nutrition and Physical Activity, 10(1), 51–57.

Choi NG, Pepin R, Marti CN, Stevens CJ, & Bruce ML (2020). Improving social connectedness for homebound older adults: randomized controlled trial of tele-delivered behavioral activation versus tele-delivered friendly visits. The American Journal of Geriatric Psychiatry, 28(7): 698–708 [PubMed: 32238297]

Cholewa S, & Irwin JD (2008). Project IMPACT: brief report on a pilot programme promoting physical activity among university students. Journal of health psychology, 13(8), 1207–1212. [PubMed: 18987094]

Copay AG, Subach BR, Glassman SD, Polly DW Jr, & Schuler TC (2007). Understanding the minimum clinically important difference: a review of concepts and methods. The Spine Journal, 7(5), 541–546. [PubMed: 17448732]

Gewandter JS, Eisenach JC, Gross RA, Jensen MP, Keefe FJ, Lee DA, & Turk DC (2019). Checklist for the preparation and review of pain clinical trial publications: a pain-specific supplement to CONSORT. Pain reports, 4(3), 1–8.

Greenberg J, Lin A, Zale EL, Kulich RJ, James P, Millstein RA, … Vranceanu AM (2019). Development and early feasibility testing of a mind-body physical activity program for patients with heterogeneous chronic pain; the getactive study. Journal of Pain Research, 12, 3279–3297. doi:10.2147/JPR.S222448 [PubMed: 31849515]

Greenberg J, Mace RA, Popok PJ, Kulich R, & Vranceanu AM . (2020). Psychosocial correlates of objective, performance-based, and patient-reported physical function among patients with heterogeneous chronic pain. Journal of Pain Research, 13, 2255–2265. 10.2147/JPR.S266455 [PubMed: 32982388]

Greenberg J, Popok PJ, Lin A, Kulich R, James P, Macklin EA, … Vranceanu A-M (2020). Mind-body physical activity program for chronic pain with or without a Digital-Monitoring-Device: Proof-of-concept feasibility RCT. JMIR Formative Research, 4(6):e18703. doi:10.2196/18703 [PubMed: 32348281]

Hahn EA, DeVellis RF, Bode RK, Garcia SF, Castel LD, Eisen SV, … Cella D (2010). Measuring social health in the patient-reported outcomes measurement information system (PROMIS): item bank development and testing. Quality of Life Research, 19(7), 1035–1044. [PubMed: 20419503]

Holt-Lunstad J, Smith TB, Baker M, Harris T, & Stephenson D (2015). Loneliness and Social Isolation as Risk Factors for Mortality: A Meta-Analytic Review. Perspectives on Psychological Science, 10(2):227–237. doi:10.1177/1745691614568352 [PubMed: 25910392]

SAS Institute (2020). SAS (Version 9.4). Cary, NC.

Jeong J-N, Kim S-H, & Park K-N (2019). Relationship between objectively measured lifestyle factors and health factors in patients with knee osteoarthritis: The STROBE Study. Medicine, 98(26), 1–7.

Karayannis NV, Baumann I, Sturgeon JA, Melloh M, & Mackey SC (2019). The impact of social isolation on pain interference: a longitudinal study. Annals of Behavioral Medicine, 53(1), 65–74. [PubMed: 29668841]

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Kohut SA, Stinson JN, Ruskin D, Forgeron P, Harris L, van Wyk M, … Campbell F (2016). iPeer2Peer program: a pilot feasibility study in adolescents with chronic pain. Pain, 157(5), 1146–1155. [PubMed: 26808145]

Krein SL (2016). Opioid use and walking among patients with chronic low back pain. Journal of Rehabilitation Research & Development, 53(1), 107–116. [PubMed: 26934620]

Leigh-Hunt N, Bagguley D, Bash K, Turner V, Turnbull S, Valtorta N, & Caan W (2017). An overview of systematic reviews on the public health consequences of social isolation and loneliness. Public Health, 152, 157–171. [PubMed: 28915435]

Leung YY, Teo SL, Chua MB, Raman P, Liu C, & Chan A (2016). Living arrangements, social networks and onset or progression of pain among older adults in S ingapore. Geriatrics & Gerontology International, 16(6), 693–700. [PubMed: 26081796]

Magidson JF, Blashill AJ, Safren SA, & Wagner GJ (2015). Depressive symptoms, lifestyle structure, and ART adherence among HIV-infected individuals: A longitudinal mediation analysis. AIDS and Behavior, 19(1), 34–40. [PubMed: 24874725]

Mahaffey BL, Mackin DM, Vranceanu A-M, Lofaro L, Bromet EJ, Luft BJ, & Gonzalez A (2018). The Stony Brook Health Enhancement Program: The development of an active control condition for mind–body interventions (epub ahead of print). Journal of health psychology, 1359105318787024. doi: 10.1177/1359105318787024

Matthias MS, Kukla M, McGuire AB, & Bair MJ (2016). How do patients with chronic pain benefit from a peer-supported pain self-management intervention? A qualitative investigation. Pain Medicine, 17(12), 2247–2255. [PubMed: 28025359]

McDonough SM, Tully MA, Boyd A, O'Connor SR, Kerr DP, O'Neill SM, … Baxter GD (2013). Pedometer-driven walking for chronic low back pain a feasibility randomized controlled trial. The Clinical Journal of Pain, 29(11), 972. [PubMed: 23446066]

Menec VH, Newall NE, MacKenzie CS, Shooshtari S, & Nowicki S (2020). Examining social isolation and loneliness in combination in relation to social support and psychological distress using Canadian Longitudinal Study of Aging (CLSA) data (epub ahead of print). PLoS ONE. doi:10.1371/journal.pone.0230673

Peterson DB (2005). International classification of functioning, disability and health: An introduction for rehabilitation psychologists. Rehabilitation Psychology, 50(2), 105.

Pilkonis PA, Choi SW, Reise SP, Stover AM, Riley WT, & Cella D (2011). Item Banks for Measuring Emotional Distress from the Patient-Reported Outcomes Measurement Information System (PROMIS): Depression, Anxiety, and Anger. Assessment, 18(3), 263–283. [PubMed: 21697139]

Pilkonis PA, Yu L, Dodds NE, Johnston KL, Maihoefer CC, & Lawrence SM (2014). Validation of the Depression Item Bank from the Patient-Reported Outcomes Measurement Information System (PROMIS) in a Three-Month Observational Study. Journal of Psychiatric Research, 56, 112–119. [PubMed: 24931848]

Redelmeier DA, Bayoumi AM, Goldstein RS, & Guyatt GH (1997). Interpreting small differences in functional status: the Six Minute Walk test in chronic lung disease patients. American journal of respiratory and critical care medicine, 155(4), 1278–1282. [PubMed: 9105067]

Solé E, Racine M, Tomé-Pires C, Galán S, Jensen MP, & Miró J (2020). Social Factors, Disability, and Depressive Symptoms in Adults With Chronic Pain. The Clinical Journal of Pain, 36(5), 371–378. [PubMed: 32040011]

Taylor AM, Phillips K, Patel KV, Turk DC, Dworkin RH, Beaton D, … Williams DA (2016). Assessment of physical function and participation in chronic pain clinical trials: IMMPACT/OMERACT recommendations. Pain, 157(9), 1836–1850. [PubMed: 27058676]

Tucker P, & Irwin JD (2006). Feasibility of a campus-based "buddy system" to promote physical activity: Canadian students' perspectives. Journal of Physical Activity and Health, 3(3), 323–334. [PubMed: 28834502]

Üstün TB, Chatterji S, Kostanjsek N, Rehm J, Kennedy C, Epping-Jordan J, … Pull C (2010). Developing the World Health Organization disability assessment schedule 2.0. Bulletin of the World Health Organization, 88, 815–823. [PubMed: 21076562]

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Highlights

- Social isolation exacerbates chronic pain (CP) symptoms
- Unclear whether CP treatments reduce social isolation and thereby improve outcomes
- We examined changes in social isolation and associated improvements in outcomes
- Social isolation improved during treatment; accounted for improvements in outcomes
- Interventions should target social isolation to optimize treatment outcomes.

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Table 1.

Descriptive Statistics for Study Variables

	Baseline ***M (SD)***	**Post-test** ***M (SD)***	**Pre-Post Change** ***M* (95% CI)**	***t (df)=x*** [a]	***p***
Social Isolation	50.33 (10.57)	47.24 (9.78)	−2.34 (−0.02, 4.70)	*t*(71)=1.97	.05
Depression	56.58 (10.60)	52.55 (8.98)	−3.24 (1.41, 5.07)	*t*(71)=3.53	.001
Anxiety	56.42 (9.90)	53.54 (9.37)	−2.22 (8.99)	*t(71)=2.10*	.04
Physical functioning (WHODAS)	31.77 (19.20)	22.43 (15.98)	−7.54 (3.70, 11.38)	*t*(71)=3.53	<.001
6-minute walk test distance (m)	339.06 (88.06)	396.13 (73.79)	45.61 (−58.71, −32.52)	*t*(60)=−6.97	<.001
Average daily step count	5432.47 (2942.66)	5697.55 (2812.42)	78.53 (−472.38, 629.45)	*t*(52)=0.29	.776

Note.

* p<.05.

** p<.01.

*** p<.001.

[a] Paired samples t-test were conducted for the entire sample, without distinguishing participants by intervention program.

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Table 2.

Results for Linear mixed effects models for self-reported emotional and physical functioning

	Depression (PROMIS)				Anxiety (PROMIS)				Self-reported PF (WHODAS)				Performance-based PF (6MWT)			
Model	**B**				**B**				**B**				**B**			
Variable	**Est.**	***SE***	***t***	***p***	**Est.**	***SE***	***t***	***p***	**Est.**	***SE***	***t***	***p***	**Est.**	***SE***	***t***	***p***
Model: Group, Time																
Intercept	49.95	1.36	36.83	**<.001**	51.12	1.39	36.77	**<.001**	18.31	2.44	7.50	**<.001**	392.34	12.88	30.46	**<.001**
Group(0,1;reference=NoFitb)	6.00	1.86	3.22	**0.001**	5.42	1.82	2.99	**0.004**	9.72	3.30	2.95	**0.004**	−8.76	17.71	−0.49	0.622
Time(0,1; reference=Post)	3.63	0.90	4.02	**<.001**	2.58	1.04	2.49	**0.015**	8.60	1.89	4.56	**<.001**	−48.90	6.48	−7.55	**<.001**
Model: Group, Soc. Isolation																
Intercept	27.42	3.01	9.11	**<.001**	27.67	3.03	9.13	**<.001**	−28.82	5.56	−5.19	**<.001**	435.61	34.30	12.70	**<.001**
Group(0,1;reference=NoFitb	4.31	1.55	2.78	**0.007**	3.51	1.49	2.36	**0.021**	5.56	2.77	2.01	**0.049**	−3.44	18.50	−0.19	0.853
Social Isolation	0.52	0.06	8.71	**<.001**	0.53	0.06	8.74	**<.001**	1.10	0.11	9.98	**<.001**	−1.53	0.66	−2.32	**0.024**
Model: Group, Time, Soc. Isolation																
Intercept	28.17	2.86	9.86	**<.001**	27.71	3.01	9.19	**<.0001**	−28.78	5.05	−5.70	**<.0001**	450.50	28.48	15.82	**<.001**
Group(0,1;reference=NoFitb)	4.15	1.51	2.75	**0.007**	3.52	1.49	2.37	**0.020**	5.56	2.59	2.14	**0.035**	−3.50	17.30	−0.20	0.840
Time(0,1; reference=Post)	2.37	0.8	2.96	**0.004**	1.19	0.90	1.33	0.188	5.75	1.49	3.85	**0.0002**	−46.50	6.56	−7.08	**<.001**
Social Isolation	0.48	0.06	8.22	**<.001**	0.52	0.06	8.37	**<.0001**	1.03	0.10	10.03	**<.0001**	−1.26	0.55	−2.27	**0.026**

B = unstandardized partial regression coefficient. For binary categorical variables, this is the difference in adjusted means for the focal category relative to the reference category.