CASE

Effects of COVID-19 "Sheltering in Place" on Activity in People With Multiple Sclerosis

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People with neurologic conditions that impair mobility such as multiple sclerosis (MS) have low levels of physical activity, with walking as their primary form of exercise.[1–3] When the San Francisco Bay Area shelter-in-place order was announced in mid-March 2020 to flatten the curve of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections, the abrupt closure of gyms, fitness studios, and malls greatly limited options for safe exercise. We leveraged an ongoing study using wearable technology to understand the impact of the shelter-in-place policy on physical activity in people with MS (PwMS) at risk for neurologic worsening.

Methods

Average daily step count (STEPS) was measured from a previously detailed UCSF MS Center cohort of PwMS using a wrist-worn accelerometer (Fitbit® Flex2).[3] STEPS before and after the shelter-in-place order were available for 42 participants. Amount, type and frequency of exercise, walking score (a proxy for socioeconomic status [SES] via accessibility of amenities and neighborhood density),[4] and fatigue (Modified Fatigue Index [MFIS-5]) and mental health symptoms (Mental Health Inventory [MHI-5]) were assessed via a questionnaire.[3] The UCSF Institutional Review Board approved the protocol. Descriptive statistics and pre-post comparisons were performed using R studio.

Results

In the 42 adult PwMS, the average age was 53.3 (SD 13.0) and the median Expanded Disability Status Scale (EDSS) was 4.0 (3.5–5.5). At baseline, they reported an average of 3 h/wk of exercise, with "outdoor walking" as the primary form of activity in 28 (66.7%). Median STEPS were 5,106 (2,928–7,572) during February and early March 2020 and dropped to 4,180 (1,720–7,411) between March 16, 2020, and April 7, 2020 (a decline in STEPS of 800 is generally considered clinically meaningful).[5] STEPS decreased in the week (p = 0.024) and month (p = 0.048) after shelter-in-place vs corresponding time periods before (Wilcoxon signed-rank; figure, A and B). By 3 weeks after March 16, 2020, 43.2% had not recovered to within 10% of their preorder activity level. However, the apparent rebound in STEPS from the week directly after shelter-in-place compared with the third week after shelter-in-place was not significant across the entire group (p = 0.888). People who did not recover activity had lower baseline STEPS (3,404 [IQR: 2,136–5,470]) compared with those who rebounded (5,911 [IQR: 2,774–8,263]).

PRACTICAL IMPLICATIONS

Wrist-worn activity monitors can capture in real-time the ecological impact of environmental perturbations on physical activity.

Biosensing technologies could play a crucial role aiding providers to intervene and prevent clinical decline in neurologically vulnerable populations.

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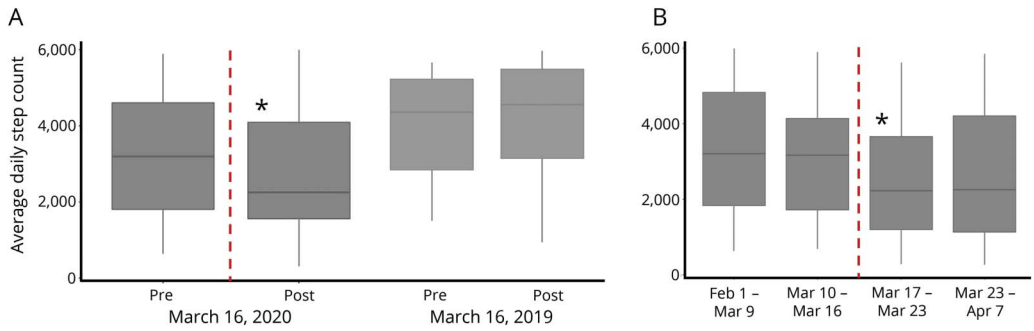
Coinvestigators are listed at links.lww.com/CPJ/A217.

Figure Average Daily Step Count (STEPS) Before and After Various Time Points in 2019 and 2020



(A) Decline in STEPS in the week following the shelter-in-place order (March 16, 2020) relative to the week prior and the corresponding periods for 2019. (B) STEPS between February 1 and April 7, 2020. Dashed red line represents shelter-in-place order (March 16, 2020). *Significant difference with the prior time point. 2020 boxplots are represented in a darker shade to the 2019 boxplots for contrast.

Correlations between STEPS change (absolute drop and stable/increase) with age, sex, walking score, MFIS-5, MHI-5, and EDSS were not observed (linear regression). By comparison, for the same epochs in 2019, STEPS remained stable in the week after relative to the week before March 16 (figure A), for the 27 participants with available data. This suggests that seasonal or other patterns were unlikely to influence the 2020 observations.

Discussion

Our continuously obtained, patient-generated data demonstrate a sharp, clinically meaningful decline in physical activity after the SARS-CoV-2-related shelter-in-place from which almost half of patients had not recovered previous activity levels by 1 month.

Periods of lower physical activity have the potential to affect PwMS in several ways. First, sedentarism could lead to further muscular and cardiovascular deconditioning.[6] Second, low activity levels can also worsen other MS-related symptoms, including depression, fatigue,[7] and spasticity,[8] contributing to a further cycle of worsening in function. These observations are not unique to PwMS, and many patients with other forms of chronic neurologic disability display low levels of physical activity and increased sedentarism.

Although many participants were able to return to near-baseline physical activity, almost half did not. Those who did rebound in ambulatory activity levels might have experienced greater resilience in adapting to home exercise programs or walking under new physical distancing rules or enjoyed greater time for activity because of reductions in time commuting to work. Those who did not rebound also had lower baseline activity and are more vulnerable to disability progression.[3] This highlights the importance of expanding access to telehealth strategies to promote physical activity.

Study limitations include the potential for reactivity, i.e., that knowledge of being monitored increases activity; however, this was not seen in our broader study.[3] Generalizability to the broader MS population may be limited because of the study design that block recruited by disability[3] or because of regional weather or activity patterns. The activity changes observed, although perhaps not specific to MS, have important implications for disability progression in PwMS with baseline limited activity. Because the walking score is an indirect measure of SES, additional measures of SES, among other social determinants of health, could enhance the understanding of their influence on STEPS.

The shelter-in-place order in response to the SARS-CoV2 pandemic offered a natural experiment, showing that wrist-worn activity monitors capture the real-time, real-world impact of ecological perturbations. This study also showed differential ability of patients to respond to such challenges; future evaluations would benefit from focusing more granularly on factors promoting resilience. As biosensor technologies become further integrated into clinical care, this technology could play an important role in clinical responses to such changes, targeting telehealth strategies to increase physical activity and prevent functional decline in neurologically vulnerable populations.

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Appendix Authors

Name	Location	Contribution
Valerie J. Block, PT, DPTSc	Department of Neurology, University of California San Francisco	Designed and conceptualized the study, analyzed the data, and drafted the manuscript for intellectual content
Riley Bove, MD, MMSc	Department of Neurology, University of California San Francisco	Designed and conceptualized the study and revised the manuscript for intellectual content
Jeffrey M. Gelfand, MD, MAS	Department of Neurology, University of California San Francisco	Designed and conceptualized the study, interpreted the data, and revised the manuscript for intellectual content
Bruce A.C. Cree, MD, PhD, MAS	Department of Neurology, University of California San Francisco	Designed and conceptualized the study, interpreted the data, and revised the manuscript for intellectual content

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