

Impact of the COVID-19 Pandemic on the Perceived Physical and Mental Health and Healthy Lifestyle Behaviors of People With Disabilities

A Quantitative Analysis of the International Community Survey

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Objective: This study aims to determine the perceived impact of the coronavirus pandemic on physical and mental health and healthy lifestyle behaviors in community-dwelling persons with disabilities, as compared with those without disabilities.

Design: A prospective cross-sectional study was conducted with a web-based global survey.

Results: Over 3 mos, 3550 responses were collected from 65 countries. The study included 2689 responses without skipped questions as full data for analysis. Most respondents were women (82.82%), and approximately half (52.81%) were between the ages of 25 and 39 yrs, followed by those between the ages of 40 and 60 yrs (38.6%). Among the participants, 52% indicated physical activity levels decreased and 20% reported eating less fruit and vegetables than before. Furthermore, 45% noted that they slept less than before. Perceived physical and mental health and changes to eating habits during the pandemic showed a significant difference in people with and without disabilities. Furthermore, perceived effects on physical health had a significant effect on the reported degree of disability.

Conclusions: This study indicates that the pandemic had a larger impact on perceived physical and mental health and changes in eating habits and tobacco use among people with disabilities than people without disabilities.

Key Words: COVID-19, People With Disabilities, Healthy Lifestyles, Lack of Physical Activity, Mental Health

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What Is Known

- COVID-19 had negative impact on physical activity and habits of general population, but its impact on physical inactivity and sedentariness in people living with disabilities remains unknown.

What Is New

- The present work, through an international survey, found that COVID-19 had an outsized impact on healthy behaviors in people with disabilities, compared with people without disabilities. In particular, people with disabilities were more likely to report worsening physical and mental health and dietary habits when compared with prepandemic levels. Furthermore, perceived effects on physical health had significant impact on the reported degree of disability.

BACKGROUND

The coronavirus (COVID-19) pandemic has disrupted nearly every aspect of daily life, from basic occupational functioning to social and health-related behaviors.^{1,2} Government-imposed lockdowns, which restricted physical and social health

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behaviors, reduced access to in-person and group physical activity (PA), recreation, and therapeutic exercise programs contributing to the 30% decrease in reported PA globally during the pandemic.³⁻⁵ Increased sedentariness and decreased PA have contributed to global weight gain during the pandemic, and obesity has further been identified as a major risk factor for and a confounder during active COVID-19 infections.⁶ Hospitalization rates have been reported as much as 113% higher in virus-infected patients with obesity when compared with those without it, and COVID-19 mortality rates are 48% higher in obese patients than nonobese patients with the disease.⁶⁻⁹

People living with disabilities (PLWDs) have experienced disproportionate impacts, as preexisting inequity gaps related to transportation, health, wellness, physical fitness, recreation, and exercise strategies have widened during this pandemic.¹⁰⁻¹² Despite the United Nations' 2006 Convention on the Rights of Persons with Disabilities, it has been shown, for example, that the right to fitness through PA and recreation is often denied or restricted for PLWDs, especially in low-resource settings, because of institutional, environmental, and behavioral barriers.¹³

In nondisabled communities, the COVID-19 outbreak has been a documented hazard to public health. For example, results of the "Effects of home confinement on multiple lifestyle behaviors during the COVID-19 outbreak" (ECLB-COVID19) electronic survey indicate that around the world, home confinement has altered adult PA and eating behaviors in a health compromising direction.¹⁴ In individual groups of Australian, Italian, and Canadian adults, the pandemic negatively impacted PA, sleep, smoking, and alcohol intake, which were in turn associated with higher depression, anxiety, and stress symptoms.¹⁵⁻¹⁷ In a Canadian cohort, a greater proportion of previously inactive individuals became less active during the pandemic, when compared with previously active individuals. In Belgium, a population-level sample of adults reported having less time, sitting more, and missing the familiar way and competitive element of exercising as the main reasons for a self-reported exercise reduction.¹⁸ In addition, in France, even before home confinement/quarantine measures, the number of seniors attending group PA programs decreased.¹⁹

In the setting of severe restrictions in access to public parks, as well as exercise, fitness, and recreational facilities, COVID-19 has exacerbated the preexisting behaviors of physical inactivity, sedentariness, and related noncommunicable chronic diseases. As such, there is a need to understand the impact of the pandemic on the physical and mental health of PLWDs and advise PLWDs on how to better integrate easily accessible and safe ways to stay healthy in limited spaces with minimal equipment. On the other hand, the lockdown has also created unprecedented opportunities for fitness content to be created, disseminated, and accessed online.²⁰⁻²² The majority of this content, be it formal or informal, is geared toward persons who do not have disabilities.

Of the 1 billion people globally with PLWDs that significantly alter their daily functioning, 80% live in developing countries. Natural disasters and armed conflicts leave 3.5 million refugees and internally displaced people who survive with a physical disability annually²³⁻²⁵ in these regions. Unfortunately, the impact of the COVID-19 pandemic on PA, physical inactivity, and sedentariness remains unknown. Sutter et al.²⁶ reported that access to pediatric rehabilitation therapies was disrupted during

COVID-19, and this may relate to the impact on physical and mental health. A recent review confirmed that the lack of early research about the impacts of COVID-19 experienced by PLWD.²⁷

AIM

The primary aim of the study was to determine the impact of the coronavirus pandemic on perceived PA levels, sedentariness, healthy eating habits, sleep habits, mental health, and tobacco usage, in community-dwelling persons with disabilities, as compared with those without disabilities. These outcomes were chosen because the World Health Organization (WHO) considers food, sleep, and tobacco usage as important health outcomes, together with PA, for enhancing people's well-being and reducing their health risks.²⁸ A secondary aim is to compare the impact of the pandemic on the ability of the disabled people versus the nondisabled people to adopt a healthy lifestyle.

METHODS

Setting and Participants

We developed a cross-sectional web-based survey for community-dwelling adult persons with and without disabilities and disseminated it through referral sampling by the article's authors. A web-based survey was designed because, to varying degrees, social distancing was being enforced all over the world, and this method was useful in conducting research across countries. The survey questionnaire was made available in Korean and the six official and working languages of the WHO, namely, Arabic, Chinese, English, French, Russian, and Spanish. The sampling strategy was done using social media group posts, outpatient clinic distribution, and email blasts targeting a minimum of 1000 adult participants.

Survey Questionnaire

The survey questionnaire included several demographic factors such as sex, age, education level, underlying health conditions, country, and employment status (Addendum 1, Supplemental Digital Content 1, <http://links.lww.com/PHM/B700>). We followed the International Classification of Functioning, Disability and Health framework to assess the concept of disability.^{29,30} Based on the International Classification of Functioning, Disability and Health framework, current level of functioning and disability are described by assessing the following body functions: mental (intellect, attention, memory, learning, emotions regulation, language, etc), seeing, hearing and balance, voice and vocalization, circulatory and autonomic system, digestive, defecation, genitourinary and reproductive functions, and movement (muscle power and tone, joint mobility, etc). Activities and participation were investigated in the following areas: (1) learning, applying knowledge, and communication; (2) mobility (picking up and carrying objects, walking, using transportation); (3) self-care (eating, washing, toileting, etc); (4) domestic life (shopping, cooking, cleaning house, washing dishes, doing laundry, etc); (5) community, social, and civic life (recreation, religion); and (6) relationships (strangers, family, friends, colleagues). The score from 0 (total disability) to 4 (full functioning) was used to identify PLWDs. Disability for analysis was classified according to activity and participation. People with all scores 4 (full functioning) were defined as "not disabled" and

anyone who selected at least one score 0 (no functioning) was defined as “severe disability” and the remainder of the people are classified as “mild-moderate disability.” Recommendations on healthy levels of PA and health-promoting eating habits have been made by the WHO and are publicly available. We assessed PA and eating habits based on these recommendations.³¹ We used previously published survey instruments to develop the two questions related to subjects’ self-perceived overall health and mental health status.³²

Data Analysis

Descriptive quantitative statistics were used for data analysis. A χ^2 test was used to compare the difference among groups (no disability, mild-moderate disability, severe disability). All statistical tests were performed using R for Windows software (R Foundation for Statistical Computing, Vienna, Austria). A *P* value less than 0.05 was set as the level of significance. Post hoc analysis was done for items that showed significant difference to compare each group, and a *P* value less than 0.017 was considered significant.

Ethics

This research was deemed exempt by the Human Research Protection Program Institutional Review Boards at Yale University under protocol IRB #2000028723. Participant consent and data confidentiality have been respected through seeking informed consent among participants and anonymizing results.

RESULTS

Respondents’ Demographics and Overall Impacts of COVID-19

The survey was administered from September 25 to December 31 in 2020. In total, 3550 responses were collected from 65 countries. For the analysis, 2689 responses without skipped questions were set as full data. Most respondents were women (82.82%), and approximately half (52.81%) were between the ages of 25 and 39 yrs, followed by those between the ages of 40 and 60 yrs (38.6%). The percentage of responses according to the WHO region is presented in Figure 1. The

most represented region was the Americas (78%), and the most represented country was Mexico. Approximately 49% of the respondents had chronic underlying diseases, such as hypertension and diabetes. Other demographic data of the survey respondents including sex, age, education, and employment status are given in Table 1. The overall life impact of COVID-19 pandemic is described in Figure 2. More than 90% of people wore masks in public and were required to maintain social distancing. Approximately half of the participants experienced lockdown or “shelter in place,” and one third lost their jobs and/or lost source of income. Because the rates of these metrics will vary drastically country to country, it is difficult to say whether the reported rates are consistent with individual national averages, but these experiences are known to have risen during the pandemic globally.¹⁻³

Lifestyle Before the COVID-19 Pandemic

General achievements of recommendation in healthy lifestyle before the pandemic are as follows: (a) 20% did more than 4 days of 30 mins of physical exercise per week, (b) 42% had at least five servings of fruits and vegetables more than 4 d/wk, and (c) 42% slept at least 7 hrs more than 4 d/wk. The time spent watching television or other screens in a sitting or lying position was reported 2 to 4 hrs a day, accounting for the response of approximately 45% of the participants. The detailed prepandemic healthy lifestyle behaviors in people with and without disability are shown in Table 2. The percentage of each value did not show significant difference in all three groups: people with no disability, mild-moderate disability, and severe disability (Table 2).

Lifestyle During the COVID-19 Pandemic

During the pandemic, 52% of the participants indicated PA levels decreased and 28% felt remained the same (Table 3). For the eating habits, 53% reported fruit and vegetable intake remained unchanged and 20% reported eating less fruit and vegetables than before. Regarding the sleep patterns, 45% noted that they slept less than before and for 33% of the respondents’ sleep habits remained the same. There were significant differences in perceived physical and mental health, eating habits, body weight, and smoking pattern change among three groups: people with no disability, mild-moderate disability, and severe disability.

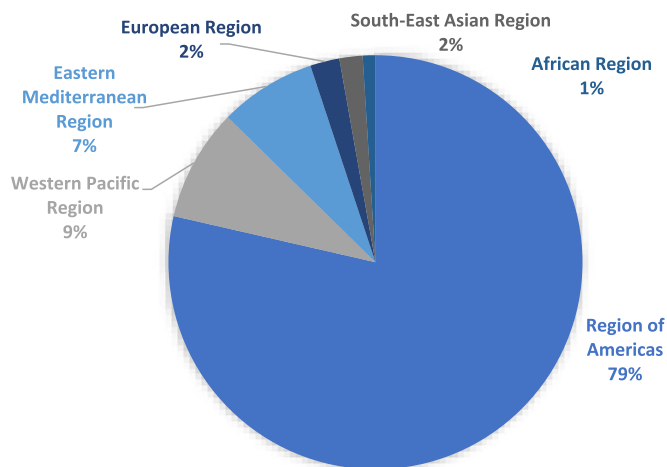


FIGURE 1. The percentage of responses according to the WHO regions.

TABLE 1. Demographic data of survey respondents

	Not Disabled, % (n)	Mild-Moderate, % (n)	Severe, % (n)
Sex			
Female	79.01 (1035)	84.13 (578)	88.73 (614)
Male	20.99 (275)	15.87 (109)	11.27 (78)
Age group			
18–24	2.52 (33)	2.33 (16)	2.31 (16)
25–39	50.99 (668)	53.13 (365)	55.92 (387)
40–60	40.46 (530)	37.12 (255)	36.56 (253)
>60	6.03 (79)	7.42 (51)	5.20 (36)
Education			
No school	0.00 (0)	0.29 (2)	0.29 (2)
Primary/elementary school	0.08 (1)	0.29 (2)	0.29 (2)
Secondary/middle or high school	1.91 (25)	4.37 (30)	4.62 (32)
Bachelor or equivalent	35.11 (460)	34.06 (234)	26.73 (185)
Postgraduate	62.90 (824)	60.99 (419)	68.06 (471)
Employment			
Employed (part-time or full-time)	85.27 (1117)	79.04 (543)	82.66 (572)
Housewife/homemaker	3.44 (45)	5.68 (39)	5.64 (39)
Retired	4.12 (54)	5.68 (39)	4.62 (32)
Student	4.73 (62)	4.80 (33)	3.32 (23)
Unemployed	2.44 (32)	4.80 (33)	3.76 (26)
Smoking			
No	89.01 (1166)	90.10 (619)	87.57 (606)
Yes	10.99 (144)	9.90 (68)	12.43 (86)

Mild-moderate, mild-moderate disability; severe, severe disability.

Physical and mental health and changes in eating habits showed significant differences between the no disability group versus mild-moderate disability group and the no disability group versus severe disability group. In addition, there was a significant difference in self-reported physical health between people with mild-moderate disability and those with severe disability. Table 3 shows the details of perceived health-related lifestyle patterns during the pandemic in three groups.

Smoking

Among the all respondents, 11% were smoking before the COVID-19 pandemic, and 90% reported that their smoking habits were unchanged. The increase or decrease in tobacco usage during the pandemic accounted for the same proportion of

5%. Regarding the amount of tobacco product usage, there was a significant difference between the unimpaired group and the severely disabled people group (Table 3). A greater proportion of the severely disabled group reported an increase in tobacco product use during pandemic ($P = 0.003$).

Sedentariness

In general, uninterrupted sedentary time such as watching time in sitting or reclined posture also had significantly changed when comparing before and during the pandemic. Before the pandemic, 44.92% reported that they spent 2 to 4 hrs/d sitting or reclining and watching TV, and 32.73% said that they spent 0 to 1 hrs of sedentariness. During the pandemic, 49.68% of the respondents reported 0 to 1 hr and 29.75% said that they

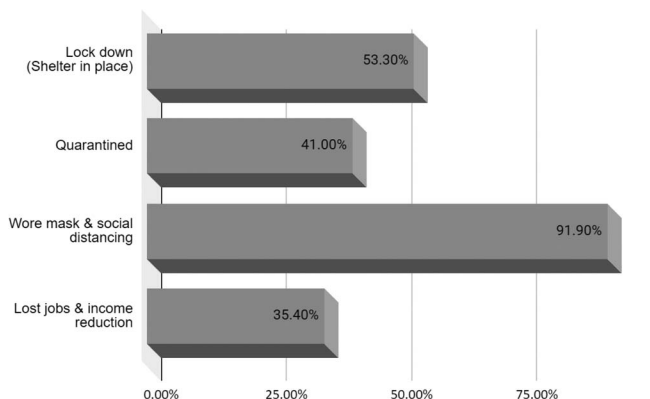


FIGURE 2. General impact of COVID-19 pandemic.

TABLE 2. Prepandemic healthy lifestyle behaviors in people with and without disabilities

	Frequency	Not Disabled, % (n)	Mild-Moderate, % (n)	Severe, % (n)	P
Physical exercise ≥30 mins	>4 d/wk	20.46 (268)	20.96 (144)	20.09 (139)	0.6719
	0–1 d/wk	19.39 (254)	17.47 (120)	17.05 (118)	
	2–4 d/wk	41.15 (539)	40.03 (275)	41.47 (287)	
	None	19.01 (249)	21.54 (148)	21.39 (148)	
Fruit and vegetable intake ≥5 servings	>4 d/wk	41.53 (544)	42.07 (289)	44.08 (305)	0.4447
	0–1 d/wk	10.38 (136)	10.48 (72)	11.42 (79)	
	2–4 d/wk	43.89 (575)	44.54 (306)	40.03 (277)	
	None	4.20 (55)	2.91 (20)	4.48 (31)	
Sleep ≥7 hrs	>4 d/wk	43.66 (572)	42.94 (295)	39.88 (276)	0.2385
	0–1 d/wk	14.50 (190)	11.79 (81)	14.74 (102)	
	2–4 d/wk	35.50 (465)	37.99 (261)	36.99 (256)	
	None	6.34 (83)	7.28 (50)	8.38 (58)	
Sedentariness	>4 hrs/d	16.95 (222)	17.47 (120)	16.62 (115)	0.9962
	0–1 hrs/d	32.60 (427)	32.17 (221)	33.53 (232)	
	2–4 hrs/d	44.89 (588)	45.12 (310)	44.80 (310)	
	None	5.57 (73)	5.24 (36)	5.06 (35)	

Mild-moderate, mild-moderate disability; severe, severe disability.

spent 2 to 4 hrs/d sitting or reclining. In addition, there was no significant difference among the three groups.

DISCUSSION

During the pandemic, the perceived wellness was significantly different among the three groups, people with no disability, people with mild-moderate disability, and those with severe disability, from before the COVID-19 pandemic. The demographic factors and prepandemic health-related lifestyle factors, however, showed no difference among the groups between before and during the pandemic. These results in our global sample of PLWDs indicated that the critical aspects of a healthy

lifestyle (physical health, mental health, healthy eating habits) had worsened disproportionately for them, when compared with persons without disabilities. To our knowledge, the present survey is the first study to include the degree of disability according to activity and participation level and to be implemented across countries with different policies and responses during the ongoing COVID-19 crisis.

Not only the presence of disability but also the degree of disability had a significant influence on the self-reported physical health during the COVID-19 pandemic. While sedentariness was unexpectedly reported at lower levels during the pandemic than before, generally, 52% of participants reported that they

TABLE 3. Perceived physical and mental health, eating habit, body weight, and smoking pattern changes in people with and without disabilities during the pandemic

		Not Disabled, % (n)	Mild-Moderate, % (n)	Severe, % (n)	P
Physical health (physical fitness)	Better than	18.78 (246) ^{a,b}	17.18 (118) ^{a,c}	15.90 (110) ^{b,c}	<0.001
	Same as	41.68 (546) ^{a,b}	34.79 (239) ^{a,c}	28.18 (195) ^{b,c}	
	Worse than	39.54 (518) ^{a,b}	48.03 (330) ^{a,c}	55.92 (387) ^{b,c}	
Mental health (emotional wellness)	Better than	7.02 (92) ^{a,b}	6.70 (46) ^a	6.36 (44) ^b	<0.001
	Same as	31.60 (414) ^{a,b}	23.73 (163) ^a	19.08 (132) ^b	
	Worse than	61.37 (804) ^{a,b}	69.58 (478) ^a	74.57 (516) ^b	
Eating habits	Better than	30.61 (401) ^{a,b}	33.92 (233) ^a	29.19 (202) ^b	<0.001
	Same as	42.21 (553) ^{a,b}	34.93 (240) ^a	32.51 (225) ^b	
	Worse than	27.18 (356) ^{a,b}	31.15 (214) ^a	38.29 (265) ^b	
Weight gain	No	53.13 (696) ^a	45.71 (314) ^a	47.25 (327)	0.005
	Yes	42.90 (562) ^a	48.33 (332) ^a	48.55 (336)	
	I don't know	3.97 (52) ^a	5.97 (41) ^a	4.19 (29)	
Smoking patterns	Less than	5.27 (69) ^b	5.39 (37)	6.07 (42) ^b	0.021
	More than	3.44 (45) ^b	4.80 (33)	6.65 (46) ^b	
	Same as	91.30 (1196) ^b	89.81 (617)	87.28 (604) ^b	

^a P < 0.017 was deemed to have significant differences between not disabled vs. mild-moderate groups with post-hoc analysis.

^b P < 0.017 was deemed to have significant differences between not disabled vs. severe groups with post-hoc analysis.

^c P < 0.017 was deemed to have significant differences between mild-moderate vs. severe groups with post-hoc analysis.

Mild-moderate, mild-moderate disability; severe, severe disability.

are doing less PA, and 45.9% reported that their physical health worsened during the pandemic. This is consistent with other studies reporting reduced PA during the COVID-19.³³ It is well known that PA is essential in the prevention of various chronic diseases. In addition, PA is critical for quality of life and subjective well-being.³⁴ There is a lack of qualified data of PA levels for PLWD even before the pandemic.³⁵ Among them, reports from some high-income societies show that the estimates of PLWDs meeting the PA guidelines ranging from 20.6% to 60.1%, in contrast to estimates ranging from 53.7% to 91.1% for adults without disabilities.^{36,37} A recent article highlighted that the importance of addressing the needs of the disability community with eased restrictions as the effects of COVID-19 lockdown created negative impacts on PA levels and mental health of children and young adults with disabilities.³⁸ Presented results also support this point as PA and physical health were more affected in the disabled and more severe groups. Accordingly, policymakers and stakeholders need to consider the more vulnerable groups to physically and mentally healthy in this prolonged crisis period.

Emerging research on COVID-19 has documented that the virus has led to a higher level of psychological distress, including depression, anxiety, and loneliness.^{39,40} Prolonged social isolation itself might have a considerable effect on mental health, chronic physical symptoms, frailty, even increased mortality risk, or suicidal ideation.⁴¹ Changes in sleep pattern and increased family conflicts due to restrictions in outside activities were revealed to be associated with depression due to COVID-19.⁴⁰ In this survey, as well as physical health, many people reported worsened perceived mental health. Approximately 66.9% reported worsened mental health during the COVID-19 pandemic, a higher percentage than those who reported worsened physical health. In addition, a higher rate of deterioration was noted in the group with disabilities. Even before the pandemic, people with disabilities had to make more effort to cope with loneliness and stress.⁴² However, the COVID-19 pandemic introduced trauma, stress, and risk of isolation with decreased access to facilities in the disability community.⁴³ As a result, mental health in a disabled group might have been affected to a higher degree by the effects of COVID-19 restrictions on PA than those without a disability group.

There is a report that food consumption and meal patterns (the type of food, eating out of control, snacks between meals, number of main meals) were unhealthier during home confinement.¹⁴ The presented results of our survey, however, showed relatively preserved healthy food consumption compared with physical and mental health in terms of the amount of fruit and vegetable consumption. Overall, more than 40% of people had five or more fruit and vegetable servings for more than 4 d/wk. Approximately 40% reported that they had sufficient fruit and vegetable 2 to 4 d/wk before the pandemic. Moreover, 80% reported that their eating the same or more fruit and vegetables during the pandemic. Nevertheless, as with physical and mental health, people with mild-moderate or severe disabilities reported significantly higher deterioration rates than those without disabilities. The concept of “healthy eating” may not correlate with increased fruit and vegetable intake in different contexts. A WHO report recommends 400-g edible fruit and vegetables per day to reduce the risk of noncommunicable diseases, which translates to roughly five portions per day.⁴⁴ In this regard, the questions

on whether people ate more than five servings of fruits and vegetables were used to assess eating habits. In the future, the use of consistent wording may improve the interpretation.

Limitations

There are limitations related to the cross-sectional nature of our sampling strategy because of it does not allow for temporal analysis of trends or conclusions on causal relationships. Moreover, as the study relies on self-report and perceived data, we have to consider the possibility of a perception bias. This is supposed to be present in all analyzed subgroups, whose demographic factors and prepandemic health-related lifestyle showed no difference between three groups. These aspects become important because health-related decisions and behaviors (and the perceptions of them) are dynamic, especially during the pandemic where local regulations, information about COVID-19, and vaccine uptake are changing rapidly as well as with great variation across countries. The study was done at the first year of the pandemic after or during the time of first wave. The COVID-19 pandemic situation is constantly changing; in the second and third waves, variants, policies, and people’s reactions are changing accordingly. The sampling strategy relied heavily on technology and Internet connectivity, so our responders were highly educated and technology-savvy, which is not representative of the global population, especially those ill-equipped with online technological applications. Results, therefore, may not be generalizable beyond the cohort of self-selected survey respondents. It should be noted that even in this group, regardless of disability, more than 60% felt that their mental health had deteriorated, and 35% lost their job or lost their income, while higher education did not guarantee stability in life. The Americas, and Mexico in particular, were overrepresented, which would limit generalizability and the relevance of all findings to other regions. Finally, women outpaced men in terms of responses. While it is unclear why, this led to an imbalanced data set. This finding is not unusual as women tend to be more likely to self-select to participate in online surveys.⁴⁵ Further research is needed to understand the effects on a broader range of regional, socioeconomic, sexual, age, and disability statuses. The characteristics and policies of the society to which each population group belongs can also have a significant impact, so related research is needed.

CONCLUSIONS

Ultimately, self-reported health-related behaviors, including physical health, mental health, and healthy eating habits, were worse in those with disabilities and those perceptions worsened with increasing disability severity. As numerous studies from various sectors have suggested, the pandemic has illuminated—and in some cases widened—existing gaps in access to health for marginalized populations, such as PLWDs that exist within and outside the context of the pandemic. As the pandemic progresses, vaccinations are globally taking place, and societies start to reopen, health and wellness advocates and organizations should take stock of how equitable and inclusive movement-, eating-, and sleep-related health strategies are and intentionally fill in gaps where needed.

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REFERENCES

- Martinez-Ferran M, de la Guía-Galipienso F, Pareja-Galeano H, et al: Metabolic impacts of confinement during the COVID-19 pandemic due to modified diet and physical activity habits. *Nutrients* 2020;12:1549
- Peçanha T, Goessler KF, Roschel H, et al: Social isolation during the COVID-19 pandemic can increase physical inactivity and the global burden of cardiovascular disease. *Am J Physiol Heart Circ Physiol* 2020;318:H1441–6
- Haug N, Geyrhofer L, Londei A, et al: Ranking the effectiveness of worldwide COVID-19 government interventions. *Nat Hum Behav* 2020;4:1303–12
- Wedig IJ, Duelle TA, Elmer SJ, et al: Infographic: Stay physically active during COVID-19 with exercise as medicine. *Br J Sports Med* 2021;55:346–7
- Taylor JK, Ndiaye H, Daniels M, et al: Lockdown, slow down: impact of the COVID-19 pandemic on physical activity—an observational study. *Heart* 2021;8:e001600
- Knight RL, McNarry MA, Sheeran L, et al: Moving forward: understanding correlates of physical activity and sedentary behaviour during COVID-19—an integrative review and socioecological approach. *Int J Environ Res Public Health* 2021;18:10910
- Zachary Z, Brianna F, Brianna L, et al: Self-quarantine and weight gain related risk factors during the COVID-19 pandemic. *Obes Res Clin Pract* 2020;14:210–6
- Mason TB, Barrington-Trimis J, Leventhal AM, et al: Eating to cope with the COVID-19 pandemic and body weight change in young adults. *J Adolesc Health* 2021;68:277–83
- Popkin BM, Shufa D, Green WD, et al: Individuals with obesity and COVID-19: a global perspective on the epidemiology and biological relationships. *Obes Rev* 2020;21:e13128
- Armitage R, Nellums RB: The COVID-19 response must be disability inclusive. *Lancet Public Health* 2020;5:e257
- UN News: Preventing discrimination against people with disabilities in COVID-19 response. 2020. Available at: <https://news.un.org/en/story/2020/03/1059762>. Accessed July 1, 2020
- Lai B, Chiu CY, Pounds E, et al: COVID-19 modifications for remote teleassessment and telerehabilitation of a complementary alternative medicine intervention for people with multiple sclerosis: protocol for a randomized controlled trial. *JMIR Res Protoc* 2020;9:e18415
- Martin JJ: Benefits and barriers to physical activity for individuals with disabilities: a social-relational model of disability perspective. *Disabil Rehabil* 2013;35:2030–7
- Ammar A, Brach M, Trabelsi K, et al: Effects of COVID-19 home confinement on eating behaviour and physical activity: results of the ECLB-COVID19 international online survey. *Nutrients* 2020;12:1583
- Stanton R, To QG, Khalesi S, et al: Depression, anxiety and stress during COVID-19: associations with changes in physical activity, sleep, tobacco and alcohol use in Australian adults. *Int J Environ Res Public Health* 2020;17:4065
- Maugeri G, Castrogiovanni P, Battaglia G, et al: The impact of physical activity on psychological health during Covid-19 pandemic in Italy. *Heliyon* 2020;6:e04315
- Lesser IA, Nienhuis CP: The impact of COVID-19 on physical activity behavior and well-being of Canadians. *Int J Environ Res Public Health* 2020;17:3899
- Constandt B, Thibaut E, De Bosscher V, et al: Exercising in times of lockdown: an analysis of the impact of COVID-19 on levels and patterns of exercise among adults in Belgium. *Int J Environ Res Public Health* 2020;17:4144
- Goethals L, Barth N, Guyot J, et al: Impact of home quarantine on physical activity among older adults living at home during the COVID-19 pandemic: qualitative interview study. *JMIR Aging* 2020;3:e19007
- Greiwe J, Nienhuis SM: Wearable technology and how this can be implemented into clinical practice. *Curr Allergy Asthma Rep* 2020;20:36
- Newton RU, Hart NH, Clay T: Keeping patients with cancer exercising in the age of COVID-19. *JCO Oncol Pract* 2020;16:656–64
- Scherrenberg M, Frederix I, De Sutter J, et al: Use of cardiac telerehabilitation during COVID-19 pandemic in Belgium. *Acta Cardiol* 2021;76:773–6
- O'Young B, Gosney J, Ahn C, et al: The concept and epidemiology of disability. *Phys Med Rehabil Clin N Am* 2019;30:697–707
- Bethge M, von Groote P, Giustini A, et al: The world report on disability: a challenge for rehabilitation medicine. *Am J Phys Med Rehabil* 2014;93(suppl 1):S4–11
- World Health Organization: *World Report on Disability*. Geneva, Switzerland, World Health Organization, 2011
- Sutter EN, Smith Francis L, Francis SM, et al: Disrupted access to therapies and impact on well-being during the COVID-19 pandemic for children with motor impairment and their caregivers. *Am J Phys Med Rehabil* 2021;100:821–30
- Lebrasseur A, Fortin-Bédard N, Lettre J, et al: Impact of COVID-19 on people with physical disabilities: a rapid review. *Disabil Health J* 2021;14:101014
- Global recommendations on physical activity for health. Available at: <https://www.who.int/publications/item/9789240015128>. Accessed June 11, 2022
- World Health Organization: *International Classification of Functioning, Disability and Health (ICF)*. Geneva, Switzerland, World Health Organization, 2001
- Kostanjsek N: Use of the International Classification of Functioning, Disability and Health (ICF) as a conceptual framework and common language for disability statistics and health information systems. *BMC Public Health* 2011;11:S3
- Healthy diet. Available at: <https://www.who.int/news-room/fact-sheets/detail/healthy-diet>. Accessed June 11, 2022
- Wong LP, Alias H, Md Fuzi AA, et al: Escalating progression of mental health disorders during the COVID-19 pandemic: evidence from a nationwide survey. *PLoS One* 2021;16:e0248916
- Bourdas DI, Zacharakis ED: Impact of COVID-19 lockdown on physical activity in a sample of Greek adults. *Sports (Basel)* 2020;8:139
- Hu Z, Lin X, Chiwanda Kaminga A, et al: Impact of the COVID-19 epidemic on lifestyle behaviors and their association with subjective well-being among the general population in mainland China: cross-sectional study. *J Med Internet Res* 2020;22:e21176
- Martin Ginis KA, van der Ploeg HP, Foster C, et al: Participation of people living with disabilities in physical activity: a global perspective. *Lancet* 2021;398:443–55
- Carroll DD, Courtney-Long E, Stevens AC, et al: Vital signs: disability and physical activity—United States, 2009–2012. *MMWR Morb Mortal Wkly Rep* 2014;63:407–13
- de Hollander EL, Proper KI: Physical activity levels of adults with various physical disabilities. *Prev Med Rep* 2018;10:370–6
- Theis N, Campbell N, De Leeuw J, et al: The effects of COVID-19 restrictions on physical activity and mental health of children and young adults with physical and/or intellectual disabilities. *Disabil Health J* 2021;14:101064
- Pai N, Vella SL: COVID-19 and loneliness: a rapid systematic review. *Aust N Z J Psychiatry* 2021;55:1144–56
- Kim DM, Bang YR, Kim JH, et al: The prevalence of depression, anxiety and associated factors among the general public during COVID-19 pandemic: a cross-sectional study in Korea. *J Korean Med Sci* 2021;36:e214
- Morina N, Kip A, Hoppen TH, et al: Potential impact of physical distancing on physical and mental health: a rapid narrative umbrella review of meta-analyses on the link between social connection and health. *BMJ Open* 2021;11:e042335
- Olsen J: Socially disabled: the fight disabled people face against loneliness and stress. *Disabil Soc* 2018;33:1160–4
- Lund EM, Forber-Pratt AJ, Wilson C, et al: The COVID-19 pandemic, stress, and trauma in the disability community: a call to action. *Rehabil Psychol* 2020;65:313–22
- Promoting fruit and vegetable consumption. European Food and Nutrition Action Plan 2015–2020. Available at: <https://www.euro.who.int/en/health-topics/disease-prevention/nutrition/activities/technical-support-to-member-states/promoting-fruit-and-vegetable-consumption>. Accessed July 1, 2020
- Smith WG: *Does Gender Influence Online Survey Participation?: A Record-Linkage Analysis of University Faculty Online Survey Response Behavior*. San Jose, CA, San Jose State University, 2008