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Original Article

Sociodemographic characteristics associated with physical activity barrier perception among manual wheelchair users

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Background: Individuals with disabilities are sub-optimally active and at increased risk for chronic diseases. Limited knowledge exists about how differences among wheelchair-dependent individuals may affect their perception of physical activity barriers.
Objective: We examined whether the perception of physical activity barriers are associated with wheelchair user sociodemographic characteristics.
Methods: Danish manual wheelchair users (MWCUs) (N = 181; 52.5% females, mean ± SD: age 48 ± 14 yrs) completed the 'Barriers to Physical Activity Questionnaire for People with Mobility Impairments' (BPAQ-MI) online. The BPAQ-MI queries physical activity barriers in four domains (intrapersonal, interpersonal, organizational, and community) and eight subdomains. Participant characteristics evaluated as potentially associated with physical activity barriers included age, sex, years in chair, body mass index (BMI), spinal cord injury (SCI) (if any), education, employment, and resident city size. Simple linear regression (step 1) and multiple regression models (step 2) were created to assess associations between MWCU characteristics and barriers.
Results: Multiple regression models revealed that MWCUs who were obese, who did not complete high school, or were unemployed rated physical activity barriers higher across several subdomains (all $r^2 \leq 0.226$, $p<0.05$). Resident city size was associated with safety subdomain barrier impact ($r^2=0.039$, $p<0.05$). Sex, age, years in chair and SCI were not associated with any barrier domains (all $p \geq 0.064$).
Conclusions: Our results provide new evidence that MWCUs with BMI $\geq$30; who are not employed; or who only have completed high school, may need special consideration and resources to overcome distinct physical activity barriers. Behavioral strategies and interventions focusing on reducing physical activity barriers should be tailored to the individuals above.

Introduction

Insufficient physical activity[1] is a chronic disease risk factor and reduced physical fitness level is strongly associated with increased all-cause mortality[2] in the general population. Individuals with disabilities are less active and at greater risk for chronic diseases compared to the general population.[3] Lower extremity impairments leading to manual wheelchair use are a common disability[4] and force individuals to rely on theirupper-extremities for activities of daily living. Morbidity and physical deconditioning must be prevented or limited to preserve independence, social functioning and quality of life.[5] Hence, it is urgent to understand what factors may potentially restrict manual wheelchair users (MWCUs) to participate in physical activities and subsequently, to develop strategies to mitigate these restrictions.

Previous studies have reported that barriers of intrapersonal character had the strongest association with exercise[6,7] or physical activity participation[8] among individuals with a disability. Intrapersonal barriers are inherent to the individual and include for

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example, lack of energy[9] or compromised health.[7–9] Interpersonal, organizational, and community barriers to physical activity participation have also been reported to play a role. Examples of these include, but are not limited to, lack of social support from family or friends[8] (*interpersonal*); inaccessible fitness centers[7,10] and lack of adaptive exercise equipment[11] (*organizational*); and inaccessible transportation,[12] uneven sidewalks, or a lack of curb cuts in the community[8] (*community*).

We have limited knowledge about how different wheelchair-dependent individuals may perceive the barriers. It is plausible that barrier impact may be related to specific sociodemographic characteristics. For example, in individuals with spinal cord injury (SCI), Ginis et al.[13] found that women; individuals with less recent SCI; and older individuals had the lowest physical activity levels, which suggests barrier impact could be related to sex, duration of disability, and age. Built environmental barriers[14] are among the most prevalent and severe barriers reported by MWCUs. As architecture and built environment differ across cities,[15] it is plausible, but yet unknown, whether city size is related to barrier perception. Employment status and education level may also be related to barrier impact. Hwang et al.[16] reported that individuals with mobility disability (N = 85) who were unemployed or unable to work perceived larger barriers and had lower physical activity levels than those who were employed. Similarly, lower educational background has been associated with an unfavorable health situation through lifestyle behaviors such as lack of exercise,[17] unhealthy diet and lack of problem-solving capacity,[18] all of which could influence barrier perception. The available evidence suggests that barriers to physical activity participation could vary among MWCUs with different sociodemographic characteristics. To improve health of MWCUs, barriers for physical activity must be minimized. In order to do so, a critical step is to identify these barriers and the association to sociodemographic traits. By doing so, future interventions can be specifically targeted towards those individuals that may be at increased risk.

We recently reported a high prevalence and severity of physical activity barriers identified among a large group of Danish MWCUs.[8] However, the degree to which sociodemographic background influences barrier perception remains to be elucidated. Therefore, the purpose of the present study was to identify the relationships between MWCU subgroups and physical activity barriers within different domains of physical activity among Danish MWCUs.

Methods

Design

The present study was a sub-study of a larger cross-sectional study[8] using a web-based survey to obtain information about physical activity barriers among Danish MWCUs. The study followed the STROBE guidelines for reporting of cross-sectional studies. The study was approved by the local Institutional Review Board and registered at the University's (Aalborg University, Denmark) inventory under journal number: 2019-899/10-0112.

Participants were recruited through multiple channels over a six month period. The survey was distributed in a web-based format (SurveyXact, Rambøll, Denmark) through a wide range of organizations related to physical disability, including SCI and general disability organization websites and social media forums. While the posting and distribution of the survey was active, recruitment was passive since the participants themselves had to access the survey.[19] This approach can increase the number of recruited participants compared to active recruitment, but increases the risk of only including individuals interested in this topic.[19] Interested individuals who did not have web access were encouraged to request a paper survey (N = 1).

Inclusion criteria included: age ≥18 years, using a manual wheelchair for primary mobility, and lack of any self-identified intellectual or cognitive disability that compromised the capability to read or understand the questionnaire.

Participants

Three hundred and seven responses were obtained, 126 were excluded (duplicates (N = 10); not completing the demographic section (N = 82); completing demographic data only (N = 34)), such that 181 were included in the analysis. Of the 181, 125 completed all BPAQ-MI items.

The 15–20 min survey included two sections: a) demographic information and b) perceived barriers for physical activity, assessed using the ‘Barriers to Physical Activity Questionnaire for People with Mobility Impairments (BPAQ-MI).[20]

Demographic characteristics queries included age, sex, city of residence, highest education level completed, current employment, any SCI (if known, level of injury and completeness), height, body weight, and years using a wheelchair. Body mass index (BMI) was calculated based on the participants self-reported body weight (kg) and height (m), classified into obesity and non-obesity.[21] Resident city size was defined based on the number of citizens. Sex, highest completed education, employment status and SCI information were assessed using items with multiple choices.

The BPAQ-MI[20] was translated and cross-culturally adapted to a Danish version, as described elsewhere[8] (see supplemental online material 1, which includes the Danish translated version). The BPAQ-MI consisted of 61 items distributed over four domains, with each domain divided into two subdomains. The eight subdomains, which are based on an ecological model of health promotion describing how the individual interacts with the environment,[22] describe ‘health’ and ‘attitudes/beliefs towards physical activity’ (intrapersonal); ‘friends’ and ‘family’ (interpersonal), ‘fitness center built environment’ (Fitness center_BE) and ‘staff/program/policy’ (organizational), and ‘community built environment’ (Community_BE) and ‘safety’ (community) (see supplemental online material 2, which describes the BPAQ-MI items[8]). Except for the final open ended question about any other comments to the questionnaire, answers were restricted to pre-defined selections. The BPAQ-MI's general structure was to ask the respondent to indicate whether he/she experienced a barrier that hindering them from engaging in physical activity.[20] If the respondent had not experienced the particular barrier within the last three months, a score of 0 was given (0 = not a barrier). Conversely, if the respondent answered with a “yes”, they then scored the severity of that barrier on a scale from 1 (very small) to 5 (very big)[20]. For item 28 specifically, if the participants responded ‘no’ to the question asking ‘whether they wanted to go to a fitness center or gym during the last three months, but couldn't', all items (21) belonging to the ‘Fitness center_BE’ and ‘staff/program/policy’ subdomain were skipped over.[20]

Individual barrier impact scores (from 0 = not a barrier to 5 = very big barrier) (see Ref. 8 for full description) were summed within each subdomains and across all domains, and termed as ‘barrier subdomain impact score’ and ‘total barrier impact score’, respectively. Total barrier impact score was calculated to provide general information about the association between subgroups and barriers across all domains. The BPAQ-MI is validated for use in individuals with mobility disability including wheelchair users, with moderate to very good internal consistency (Cronbach's alpha: 0.792–0.935), and good test-retest reliability.[20] Similarly, within our sample, the BPAQ-MI demonstrated acceptable reliability coefficients[23] across most subdomains with Cronbach's alpha ranging from 0.717 (health) to 0.931 (Fitness center_BE). The only exception was the 'belief' subdomain, which demonstrated a Cronbach's alpha of 0.566.

Statistical analysis

All continuous variables were tested for normality with the Shapiro Wilk test. Descriptive statistics were reported as mean ± standard deviation (SD), and categorical variables were reported as count and frequency (%).

There were no differences in demographic variables between the participants included in the analysis (N = 181) and those who only completed the demographic section (N = 34), as well as between those that fully (N = 125) or partially (N = 56) completed the BPAQ-MI (analysis described in[8]). Therefore, the entire (N = 181) sample was used for the analysis.

To explore the relationships between MWCU subgroups and physical activity barriers, a set of linear regressions were performed. To identify variables (predictors) to be included in multiple linear regression analysis, simple linear regression (step 1) was first performed between each subdomain barrier impact score and total barrier impact score (dependent variable) on the one hand and each candidate predictor variable on the other hand. The predictors were then included in the multiple regression (MR) model (step 2) if more than one was significantly associated with the dependent variable. Candidate variables included the following individual (age, sex, years in chair, BMI, SCI level and completeness) and socio-economic factors (education, employment, resident city size). Out of these factors, sex, BMI, education, employment, SCI level and completeness were categorical variables (dummy coded) and the rest were treated as continuous variables. All MR were tested for multicollinearity. No independent variable had a variance inflation factor of >5[8]. Statistical significance was considered at $p < 0.05$, and all data analysis was conducted using SPSS (Version 26.0, IBM Corporation, Armonk, NY, USA).

Table 1
Participant demographic (n = 181).

Age (years), mean ± SD	47.5 ± 13.5
Years in chair (years), mean ± SD	18.4 ± 14.8
City size (population), mean ± SD	94149,13± 169683,27
Sex, n (%)	
Female	95 (52.5%)
Male	86 (47.5%)
BMI (kg·m^{-2}), n (%)	
Underweight (<18.5)	13 (8.2%)
Normal weight (18.5–24.9)	71 (44.7%)
Overweight (25–29.9)	40 (25.2%)
Obese (≥30)	35 (22%)
SCI, n (%)	
Yes	114 (63%)
No	67 (37%)
SCI level (n = 114), n (%)	
Tetraplegia	22 (19.3%)
Paraplegia	81 (71.1%)
Unknown	11 (9.6%)
SCI type (n = 114), n (%)	
Complete	59 (51.8%)
Incomplete	50 (43.9%)
Unknown	5 (4.4%)
Highest level of completed education, n (%)	
Some high school	30 (16.6%)
High school	55 (30.4%)
Bachelor	60 (33.1%)
Graduate/Master	25 (13.8%)
PhD	1 (0.6%)
Other	10 (5.5%)
Work status, n (%)	
Unemployed	90 (49.7%)
Part-time employed	35 (19.3%)
Full-time employed	24 (13.3%)
Other	32 (17.7%)

NOTE: SD = standard deviation. SCI = spinal cord injury; BMI = body mass index; Participants that reported 'other education' primarily included 'baker', carpenter', and 'sailor'. The majority of participants that reported 'other employment' were either retired, on a 'disability-retirement', or in flex-job.

Results

Of the included participants (N = 181), 52.5% were female with mean age of 48 ± 14 years, and 18 ± 15 years of wheelchair use. Complete participant demographics are shown in Table 1.

Association between subdomain and total barrier impact score and demographics

The final models from the MR analysis are shown in Table 2.

Health barrier impact score

Using simple linear regression, sex ($p < 0.003$), BMI ($p < 0.001$) and employment ($p = 0.001$) met the criteria for entry into the multiple linear regression (MR) model (all other $p \geq 0.06$). In the adjusted model (MR) only BMI (obese perceived larger barriers than non-obese) and employment remained associated with barrier score (part-time and full-time employed perceived smaller barriers than unemployed). The MR model explained 22.6% of the variance in health barrier score (Table 2).

Belief/attitudes towards physical activity barrier impact score

BMI ($p = 0.012$) and education ($p = 0.006$) qualified for entry into the MR model (all other p-values ≥ 0.1). In the adjusted model (MR), BMI and education remained related to barrier score, in which obese participants perceived larger barriers than non-obese ($p = 0.014$), and those with high school education perceived smaller barriers than those with only some high school education ($p = 0.007$). Together, BMI and education explained 8.6% of the variance in belief/attitude barrier score.

Friends barrier impact score

Education ($p = 0.001$) and employment ($p = 0.019$) met the criteria for entry into the MR model (all other p-values ≥ 0.08). In the adjusted model (MR) participants with other employment (the majority were either retired, on a 'disability-retirement', or in flex-job) perceived larger barriers ($p = 0.041$) than unemployed, and participants with high school education ($p < 0.001$), bachelor ($p = 0.001$), and post graduates ($p = 0.024$) perceived smaller barriers than participants with only some high school education. Collectively, education and employment explained 17.6% of the variance in friends barrier score.

Family barrier impact score

There was a possible association between education and family barriers. Even though the regression model with only education as an independent variable did not explain more than 3.6% of the variability in family subdomain barriers ($p = 0.3$), participants with a bachelor degree seemed to perceive smaller barriers than those with some high school education ($p = 0.041$). No other associations were found (all p-values ≥ 0.12).

Fitness center built environment barrier impact score

BMI ($p = 0.007$) and employment ($p = 0.033$) qualified for entry into the MR model (all other p-values ≥ 0.06). In the MR model, BMI (obese perceived larger barriers than non-obese, $p = 0.004$) and employment (part-time employed perceived smaller barriers than unemployed, $p = 0.015$) collectively explained 10.6% of variance in Fitness center_BE barrier score.

Table 2
Multiple linear regression analysis. Associations between demographic variables and subdomain and total barrier impact score.

Dependent variable	Independent variable	β	95% CI	sr
Health subdomain barrier score	Sex (men)	−1,81	−3.88 to 0.26	−1.12
	BMI (obese)	**5.8**	3.28 to 8.32	0.31
$F_{5,171} = 10.0$; $p < 0.001$, $R^2 = 0.226$	Employment			
N = 177	Part-time employed	**−4.73**	−7.39 to −2.07	−0.24
	Full-time employed	**−5.72**	−8.9 to −2.55	−0.24
	Other	−0.26	−2.96 to 2.45	−0.13
Beliefs/Attitudes subdomain barrier score	BMI (obese)	**2.88**	0.56 to 5.16	0.19
	Education			
	High school	**−3.74**	−6.42 to −1.05	−0.21
$F_{5.156} = 2.939$; $p < 0.05$, $R^2 = 0.086$	Bachelor	−2.2	−4,83 to 0.43	−0.13
N = 162	Postgraduate	−2.12	−5.31 to 1.08	−0.1
	Other	−3.45	−7.59 to 0.55	−0.13
Friends subdomain barrier score	Education			
	High school	**−5.15**	−7.3 to −3	−0.36
	Bachelor	**−3.72**	−5.83 to −1.62	−0.26
$F_{7.144} = 4.399$; $p < 0.001$, $R^2 = 0.176$	Postgraduate	**−2.96**	−5.52 to −0.4	−0.17
N = 152	Other	−2.39	−5.57 to 0.8	−0.11
	Employment			
	Part-time employed	0.17	−1.71 to 2.04	0.01
	Full-time employed	0.36	−1.8 to 2.52	0.03
	Other	**1.99**	0.08 to 3.9	0.16
Family subdomain barrier score	Education			
	High school	−1.76	−3.85 to 0.33	−0.14
$F_{4.133} = 1.244$; $p = 0.295$, $R^2 = 0.036$	Bachelor	**−2.12**	−4.14 to −0.09	−0.18
N = 138	Postgraduate	−1.81	−4.23 to 0.61	−0.13
	Other	−0.65	−3.74 to 2.43	−0.04
Fitness Center_BE subdomain barrier score	BMI (obese)	**8.12**	2.68 to 13.57	0.25
	Employment			
$F_{4,125} = 3.7$; $p < 0.01$, $R^2 = 0.106$	Part-time employed	**−6.98**	−12.58 to −1.37	−0.21
N = 130	Full-time employed	1.11	−5.28 to 7.49	0.03
	Other	−0.38	−6.16 to 5.4	−0.01
Staff/Program/Policy subdomain barrier score	BMI (obese)	**4.29**	0.78 to 7.8	0.21
	Employment			
$F_{4.120} = 3.218$; $p < 0.05$, $R^2 = 0.097$	Part-time employed	**−4.68**	−8.23 to −1.13	−0.23
N = 125	Full-time employed	−0.11	−4.37 to 4.15	−0
	Other	0.86	−2.8 to 4.52	0.04
Community_BE subdomain barrier score	Employment			
	Part-time employed	**−9.73**	−15.92 to −3.54	−0.27
$F_{3,121} = 4.581$; $p < 0.01$, $R^2 = 0.102$	Full-time employed	**−9.05**	−16.48 to −1.63	−0.21
N = 125	Other	**−6.64**	−13.04 to −0.25	−0.18
Safety subdomain barrier score	City size	**5.964E-6**	7.108E-7 to 0.00001	0.2
$F_{1.123} = 5.05$; $p < 0.05$, $R^2 = 0.039$				
N = 125				
Total barrier score	BMI (obese)	**15.81**	2.68 to 28.95	0.17
	Employment			
$F_{4,172} = 4.71$; $p < 0.01$, $R^2 = 0.099$	Part-time employed	**−24.36**	−38.05 to −10.68	−0.25
N = 177	Full-time employed	**−16.42**	−32.24 to −0.6	−0.15
	Other	−2.92	−17.04 to 11.2	−0.03

NOTE. Significant ($p < 0.05$) β-coefficients are indicated in bold font. Participants that reported 'other education' were primarily 'baker', carpenter', and 'sailor'. The majority of participants that reported 'other employment' were on a 'disability-retirement', retired, or in flex-job. Reference categories for the categorical variables are some high school (education), unemployed (employment), non-obese (BMI ≤29.9). For sex, men were coded as 1, and women as 0. BMI = body mass index; SCI = spinal cord injury; Fitness Center_BE = fitness center built environment; Community_BE = community built environment; DV = dependent variable; IV = independent variable; sr = semi-partial correlation; CI = Confidence interval.

Staff barrier impact score

BMI ($p = 0.039$) and employment ($p = 0.021$) qualified for inclusion in the MR model (all other p-values ≥ 0.16). In the MR model, obese participants perceived larger barriers than non-obese ($p = 0.017$), and part-time employed participants perceived smaller barriers than those who were unemployed ($p = 0.01$). Collectively, BMI and employment explained 9.7% of the variance in staff barrier score.

Community built environment barrier impact score

Employment status was the only variable significantly associated with Community_BE barriers (simple linear regression) (all other p-values ≥ 0.06). Specifically, participants with full-time ($p = 0.017$), part-time ($p = 0.002$) or other employment

($p = 0.042$) perceived smaller barriers than unemployed participants. Employment explained 10.2% of the variance in Community_BE barrier score.

Safety barrier impact score

City size was associated with safety barriers. Specifically, participants residing in larger populated cities perceived larger barriers ($p = 0.026$, variance explained = 3.9%). No other variables were associated with safety barriers (all other p-values ≥ 0.13).

Total barrier impact score

Employment ($p = 0.001$) and BMI ($p = 0.045$) met the criteria for entry into the MR model (all other p-values ≥ 0.12). In the MR, the obese participants ($p = 0.019$) and participants with part-time ($p = 0.01$) and full-time ($p = 0.042$) employment perceived respectively larger and smaller barriers than non-obese and unemployed participants. Collectively, BMI and employment explained 9.9% of the variance in total barrier score (Table 2).

Discussion

The purpose of this study was to determine if sociodemographic traits of Danish MWCUs were related to perception of physical activity barriers across multiple domains. Our results provide new evidence that MWCU subgroups who were obese, who did not complete high school, or were unemployed, rated physical activity barriers higher than their higher-educated, non-obese and employed counterparts. In contrast, the demographic characteristics of sex, age, years in chair and SCI lesion level and completeness were not associated with any barrier domains. The relationship between barrier perception and employment status confirms previous findings in mobility disabled individuals.[16] However to the best of our knowledge, the associations found between BMI, education level, and physical activity barriers provide novel contributions that advance our understanding of the interplay between physical activity and disability.

Having a BMI $\geq$30 (i.e. obese) was associated with the perception of greater intrapersonal (health, beliefs/attitudes) and structural/organizational (fitness center_BE, staff/program/policy) physical activity barriers. The relationships between obesity and physical activity barrier perception may be interdependent and multi-directional.[24] For example, excess body-weight can lead to poorer health[25], thereby directly increasing perception of health barriers. Poorer health can lead to deconditioning, thereby increasing the relative challenge of navigating the built environment[26] and possibly perception of environmental barriers. BMI has been reported to be related to manual wheelchair immobility and physical strain.[27] Psychological characteristics, such as self-efficacy[28,29] and motivation for being physical active may also contribute to higher perceived barriers among individuals with a BMI of $\geq$30. Among able-bodied individuals, BMI is negatively associated with physical activity and exercise self-efficacy.[28] Among mobility disabled individuals with SCI, self-efficacy is predictive of frequency and intensity of exercise participation.[30] Self-efficacy theory[29] suggests that personal confidence about the ability to bring about a behavior influences the persistence, direction and intensity of behavior. Thus, self-efficacy and barrier perception may come together in a feedforward loop that perpetuate existing physical activity levels. As exercise self-efficacy of wheelchair users is improved after 6 weeks of exercise training,[31] supportive short duration exercise experiences may represent an underutilized opportunity to achieve long term increases in physical activity levels. Finally, it is also possible that societal judgements and negative attitudes about obesity from staff or other fitness center members could exaggerate barrier perception for this subgroup.[32] This is also reflected in the association of BMI to Staff/Program/Policy subdomain barrier score in this current study.

These results suggest that effort should be given towards reducing intrapersonal and organizational barriers among obese MWCUs. Tailored exercise guidance and psychological coaching emphasizing self-efficacy could be means to reduce intrapersonal barriers. To overcome organizational barriers, adaptive exercise programs with an increased focus on training of fitness staff in how to adapt exercise for (obese) disabled[10] and how to create a supportive environment for obese individuals should be considered. Future studies assessing barrier perception in disabled populations should consider including assessment of health conditions, perceived health, self-efficacy and previous exercise/physical activity history in order to gain further insights about these relationships.

We also observed that MWCUs with only some high school education perceived larger intra (belief/attitudes) and inter (friends, family) personal barriers than those with more education. Poor information and lack of social support have previously been identified as barriers for physical activity in individuals with disability.[33] An explanation for lower belief/attitudes barriers among the higher educated could be that higher educational achievement improves an individual's exposure to and ability to understand information, which in turn alters their beliefs/attitudes about the value of physical activity.[18] Regarding the higher friends and family barriers reported by the lower educated, education may be a proxy for other co-variates such as social relations and situations encountered, or as a proxy for mental health.[34] Indeed, educational level has been proposed as a determinant of self-reported mental and physical health.[35] Moreover, by acquiring e.g. intellectual, socioemotional and interactive knowledge and skills, education can support mental health through the development of a greater sense of control, social interactional abilities and social support,[36] which likely affects the engagement and interaction with social relations, and therefore perception of interpersonal barriers.

Consistent with previous research[37] in a different sample of Danish disabled individuals approximately half (49.7%) of the participants in our sample were unemployed. Also, consistent with previous research in disabled[16] and general population[17] we found that those without employment perceived larger barriers than those with employment. Specifically, unemployed MWCUs perceived larger barriers within the health, friends, staff, Fitness center_BE and Community_BE subdomains than those who were either part- or full-time employed. We suggest that employment status could be a proxy for other variables driving the higher barrier perception. First, among the disabled, being unemployed is associated with poorer self-reported health,[37] which could decrease propensity to be physically active. Second, given the importance of social support for engagement in physical activities,[33] the absence of social interactions that normally occur when employed could increase perception of social barriers. In support of this, Vissers et al.[38] found that social support was one of the most important facilitators for being physical active after acquiring a SCI induced mobility disability. Finally, employment could simply be a proxy for economic wellbeing. Previous studies have reported that membership and transportation costs affect usage of fitness and recreational facilities.[11] However, if employment merely reflects economical resources, then it is difficult to explain why the part-time but not full-time employed perceived smaller organizational barriers than those who were unemployed. Compared to those with full-time employment, it may be that MWCUs with part-time employment possess increased flexibility regarding time and structure of when and where to exercise, attributes that are important for being physical active.[17]

Although no causal relationship can be inferred from our analyses, it appears that being outside the working force and having lower education is associated with larger physical activity barriers. Despite this reservation, we propose that decision-takers on a national and community policy-level provide targeted physical activity information to these subgroups, and (continue to Ref. 39) develop strategies on how to reduce unemployment rates among individuals with disability, so that these individuals can be included in the community. Similarly, future physical activity/barrier removal-studies may consider to specifically include those disabled that are currently outside employment and/or have not completed high school, as our results indicate that physical activity barrier perception is exaggerated in these subgroups. Our results are particularly relevant considering the trend for a general increase in disability in Europe predicting that recent cohorts may be at risk of experiencing higher levels of disability than previous generations.[40] Actions to handle physical activity barriers among the disabled, are therefore vital in order to reduce morbidity and improve wellbeing for these individuals in the future.

In addition to our core themes of obesity, education, and unemployment we observed two other findings of interest. First was the association between resident city size and safety concerns. Although safety barriers generally are infrequently reported among Danish MWCUs,[8] participants residing in larger cities do have larger safety concerns, consistent with studies showing a high prevalence of safety barriers among individuals with disability living in large urban cities.[9] Second was the lack of a sex based difference in barrier perception when sex was included in models adjusted for BMI and employment. Previous studies in both the general[41] and SCI populations[42] have found that men are more physically active than women, yet our results do not suggest that women perceive more barriers than men. It is possible that differences among the samples (SCI and able-bodied vs collective group of MWCUs) or discrepancies between perceptions vs. actual behavior could explain these differences.

Limitations

When interpreting the above results, the following limitations should be considered. First, given the cross-sectional design, causality cannot be inferred. Second, selection bias is a concern. Even though we assessed for differences between participants that completed, partially completed, and not completed the BPAQ-MI, the passive recruitment exacerbates the risk of including only those wheelchair users who are interested in the topic of physical activity.[19] In Denmark, the number of MWCUs is unknown, making it impossible to determine the response rate and evaluate whether the sample represents the population. Third, we cannot exclude that sociodemographic factors, other than those included in this study, such as household income or ethnic background may have confounded the observed associations between barrier scores and demographic characteristics. Fourth, given the present survey format, we relied on participants self-report of demographic characteristics, including body weight and height (and thus BMI). Fifth, of the 181 participants that completed the survey, only a portion (N = 125) completed all items. Consequently, there are various levels of missing data. Finally, R^2 for the regression models ranged from 0.036 to 0.226, suggesting that additional factors other than the included demographic characteristics explain substantial parts of the variance in subdomain barriers.

Conclusion

This study showed that manual wheelchair users (MWCUs) with a BMI $\geq$30; MWCUs without any current employment; or MWCUs who only have completed high school may need special consideration and resources to overcome distinct physical activity barriers. Considering the ecological framework of BPAQ-MI, interventions targeting multiple levels may be ideal to reduce barrier perception. For instance, intrapersonal and organizational barriers were major concerns among obese participants. Implementing behavioral strategies and interventions adjusted to the individual, such as through use of physicians (health-related), psychologists/coaches (belief/attitude-related) increased education of fitness personnel (staff) and adaptive exercise programs (fitness center built environment) could be solutions. Further, MWCUs who have only some high school education or are unemployed perceives larger physical activity barriers. Accordingly, policy-makers on both a national and community level needs to develop solutions on how to include these individuals in the community.

Conflicts of interest

The authors report no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dhjo.2021.101119.

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