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Relationship between physical activity and health in individuals with intellectual disability

Caroline Faust | Diane Morin

Department of Psychology, Université du Québec à Montréal, Montréal, QC, Canada

Correspondence
Caroline Faust, Department of Psychology, Université du Québec à Montréal, P.O. Box 8888, Downtown Station, Montréal, QC H3C 3P8, Canada.
Email: faustcaroline@hotmail.com.

Accessible summary

- Individuals with intellectual disability are less physically active and have more health problems than the general population.
- This paper is about information gathered from family members on health and physical activity levels of people with intellectual disability.
- Health of people with intellectual disability do not differ according to the frequency and the intensity of physical activity.
- Research is important for people with intellectual disability because our results helped better understand the need for developing physical activity guidelines specifically for this population and strategies to encourage them to be more physically active.

Abstract

Background: The frequency and intensity of physical activity are directly related to health in the general population. However, to our knowledge, no study has looked at that relationship in people with intellectual disability.
Method: The aim of this study was to determine whether there were differences in the health of 407 people with intellectual disability according to the frequency and intensity of physical activity. The method involved cross-sectional study of secondary data.
Findings: Results showed that the ability to express pain, number of orthopaedic and physiotherapy consultations, body mass index and percentage of psychosis/schizophrenia diagnoses differed with the frequency and intensity of physical activity.
Conclusion: Other studies are needed to learn more about physical activity factors that could improve the health of people with intellectual disability.

KEYWORDS
exercise, health, intellectual disability, physical activity, sports

1 | INTRODUCTION

Many authoritative resources such as the Canadian Society for Exercise Physiology (2019), the American Heart Association (2020) and the US Department of Health and Human Services (2018) have summarised the vast body of research on physical activity and physical health in the general population and issued the following physical activity guidelines: adults should accumulate at least 150 minutes a week of moderate-intensity aerobic activity, or 75 min to 150 min a week of vigorous-intensity aerobic activity, or a combination of both. The American Heart Association (2020) specified that being active 300 min or more per week increases health benefits. It is also recommended to add a minimum of two days a week muscle-strengthening activities to improve multiple health outcomes (2018 Physical Activity Guidelines Advisory Committee, 2018; American Heart Association, 2020; US Department of Health & Human Services, 2018).

Scientific studies on the general population have shown that physical activity is essential for maintaining good health and a healthy body (Rhodes et al., 2017; Warburton & Bredin, 2017; World Health Organization, 2020). Moreover, people who are active have a lower mortality rate than those who are inactive (Arem et al., 2015; World Health Organization, 2020). In that regard, people who practice regular physical activity reduce their risk of developing health problems such as cardiovascular diseases (Vasankari et al., 2017), high blood pressure (White et al., 2015), diabetes (Gay et al., 2016), cancer (Saint-Maurice et al., 2018) and obesity (Jakicic et al., 2019; World Health Organization, 2017). Physical activity also has important benefits for mental health (Teychenne et al., 2020). Research indicates that physical activity improves self-esteem (Donaldson & Ronan, 2006; Findlay & Coplan, 2008; Zarrett et al., 2009), emotional control (Hansen et al., 2003; Holt et al., 2011) and psychological resilience (Bartko & Eccles, 2003). It is as well associated with fewer depressive symptoms (Boone & Leadbeater, 2006), fewer suicide attempts (Taliaferro et al., 2011) and reduced anxiety levels (Carmeli et al., 2009; Schumacher Dimech & Seiler, 2011).

Factors related to physical activity, notably frequency and intensity, can influence one's health condition (Agence de la santé publique du Canada, 2019). Some studies looked at the relationships between these two variables and specific physical health variables in the general population (Eime et al., 2013; Oja et al., 2018; Rosique-Esteban et al., 2019). It was found that walking between 100 and 1300 MET minutes (where MET means metabolic rate, a measure of energy expenditure) per week could improve cardiovascular disease risk factors (Oja et al., 2018) and that health benefits could be achieved with about 200 MET minutes per week (Brannan et al., 2017). According to a study by Rosique-Esteban et al. (2019), moderate-to-vigorous-intensity physical activity was associated with a lower body mass index and better bone mass and muscle strength, while no significant difference in physical health was obtained with light-intensity physical activity.

To our knowledge, few studies have examined the effect of the frequency (Bowker, 2006; Michaud et al., 2006) and intensity (Sanders et al., 2000; Steptoe & Butler, 1996) of physical activity on mental health in the general population. People doing vigorous physical activity usually have a lower risk of emotional distress (Steptoe & Butler, 1996) while those doing moderate physical activity reported a lower depression score than those doing low-intensity physical activity (Sanders et al., 2000). Also, more frequent physical activity has been associated with feelings of well-being (Michaud et al., 2006). Similar studies on the relation between frequency and intensity of physical activity and health in people with intellectual disability were not found (Dowling et al., 2012) nor were specific guidelines for this population (Oviedo et al., 2017).

Individuals who have an intellectual disability are usually less active than the general population (Borland et al., 2020; Dairo et al., 2016; Melville et al., 2017). In fact, few of them meet the physical activity recommendations for good health (Dairo et al., 2016; Hassan et al., 2019; Pitchford et al., 2018). Various factors make it more difficult for them to play sports, such as a lack of awareness of physical activity programmes and opportunities to engage in physical activity (Comella et al., 2019), transportation issues, financial constraints (Johnson et al., 2018), behavioural disorders, lack of support from the community and physical health problems (Hassan et al., 2019). However, some organisations such as Special Olympics give individuals with intellectual disability the opportunity to participate in recreational and competitive, individual and team sports, in a structured setting where they feel valued and can develop their social skills (Special Olympics International, 2020). Although such organisations offer a variety of sports programmes for people with intellectual disability designed to prevent or reduce physical and mental health issues, these individuals have a more limited choice of sport activities than the general population (Bossink et al., 2017; Tint et al., 2016). Moreover, various studies with people with intellectual disability (Finlayson et al., 2011; McGuire et al., 2007; Morin et al., 2012) found that they do more low-to-moderate-intensity physical activities (such as walking) than high intensity physical activities (such as soccer).

Physical activity factors (i.e. frequency and intensity) that affect health could be different for people with intellectual disability since some studies have shown that sport has greater benefits for them than the general population (Grandisson et al., 2010; Hawkins & Look, 2006). Thus, examining the health of individuals with intellectual disability in relation to the frequency and intensity of physical activity using cross-sectional data would be useful. Thereby, we will address the correlations between physical activity factors and health outcomes, but without referring to a cause-and-effect relationship.

1.1 | Objective

The aim of the present study was to explore the linear relationship between the physical and mental health of individuals with intellectual disability, and the frequency and intensity of physical activity.

2 | METHOD

2.1 | Participants

The data for this cross-sectional study came from two sources. First, data were collected at the Special Olympics Quebec (OSQ) Summer Games in 2017, from the parents of 122 athletes aged 18 to 45 years ($M = 25.72$, SD = 6.20). Second, the database ($N = 791$) from a previous study (Morin et al., 2012) was also used. The participants from this database all had intellectual disability; most (87.0%) were recruited by provincially operated agencies specialising in support for people with intellectual disability and autism spectrum disorders. Participants were also recruited through regional health and social services centres (centres providing generic primary care and specialised services) and a federation of organisations for individuals with intellectual disability (People First Movements). In this database, participants' ages ranged from 15 to 82 years, with a mean of 35.68. All the participants in this database aged between 18 and 45 years who did physical activity ($N = 285$) were included in this study. For more information on the method, see the article already published (Morin et al., 2012). The total sample thus consisted of 407 people with intellectual disability, with an average age of 28.43 years (SD = 7.58). See Table 1 for the sample's characteristics.

To compare state of health (measured with 113 health variables) according to the frequency and intensity of physical activity, four groups were created as follows: (1) moderate frequency and moderate intensity (MFMI; $N = 112$), (2) moderate frequency and high intensity (MFHI; $N = 103$), (3) high frequency and moderate intensity (HFMI; $N = 75$) and (4) high frequency and high intensity (HFHI; $N = 117$). To determine the frequency, we used the number of times per week the participant had engaged in physical activity for 20 to 30 min per session in the previous three months. The participants were placed in a moderate frequency group if they did physical activity once or twice per week, and in a high frequency group if they did physical activity three or more times per week. To determine the intensity level associated with each physical activity, the Compendium of Physical Activities (Ainsworth et al., 2000, 2011) was used. Although not specifically designed for people with intellectual disability, this Compendium is recommended for studies comparing the intensity levels of different physical activities. All physical activities with MET values of less than 6 were considered moderate-intensity activities while those with MET values of 6 or more were deemed to be high-intensity activities. In this study, moderate-intensity physical activities reported were boccia, bowling, cycling, dance, gardening, golf, gym class, rhythmic gymnastics, riding, sexual relations, sliding, softball, stretching, walking, Wii games and yoga. High-intensity physical activities included athleticism, basketball, boxing, fitness programme, hockey, martial arts, powerlifting, running, skating, skiing, snowshoeing, soccer, swimming and tennis.

2.2 | Procedure

The study was approved by a Research Ethics Committee on 26 May 2017. Recruitment took place at the site of the OSQ Games in Quebec from 29 June to 2 July 2017. Six research assistants approached parents of athletes aged 18 to 45 years. They explained the specific objectives of the study to the parents and what their participation would entail, namely completing a demographic and health information form and the Short Form-36 Health Survey, version 2. If they agreed to participate, parents were given an envelope containing the questionnaires. They could return the completed questionnaires to one of the research assistants before the end of the Games or mail the stamped preaddressed envelope.

2.3 | Measures

2.3.1 | Demographic and health information form

The demographic and health information form was used to collect the participants' demographic data such as sex, age, weight and living environment as well as health information (physical and mental health diagnoses, sexual health, health-related behaviours, psychological well-being). Health-related behaviours' section includes some questions about physical activity: (1) number of times per week the participant had engaged in physical activity for 20 to 30 min per session over the last three months (less than once a week, one to two times per week, three times or more per week) and (2) types of physical activities practised (e.g. walking, bowling, softball, dance). All physical activities (exercise, individual and team sports) were included in this study and used to categorise each participant in their respective physical activity intensity group. We used this form from a previous study (Morin et al., 2012) since some of the participants in the present study came from their database. This way, it would be easier to make comparisons since there is consistency in the data from the two groups. The research team of this study (Morin et al., 2012) developed this form based on the Éco-Santé database (Éco-Santé Québec, 2006). It was piloted for clarity and revised before using it with 791 participants. The demographic and health information form contains 46 items, some of which include sub-items, for a total of 113 health variables measured. For example, one item refers to the physical health diagnoses of the people with intellectual disability. The participants must check from a list all physical health problems that have been diagnosed by a health professional. Each physical health diagnosis (e.g. allergies, diabetes, epilepsy) is considered as a different health variable and analysed as a yes–no question (e.g. do you have allergies?). Participants were also asked multiple-choice questions such as when was the last consultation with a general practitioner (less than 12 months ago, 1 to 5 years ago, more than 5 years ago, never).

2.3.2 | Short Form-36 Health Survey, version 2

This standardised questionnaire was used to assess the participants' physical and mental health as perceived by the respondents. The 36 items in the second version of the Short Form-36 Health Survey (SF-36v2; Leplège et al., 2001) measure eight dimensions of functioning, namely physical functioning, role physical (which refers to an array of physical health-related role limitations), bodily pain, general health, vitality, social functioning, role emotional (which refers to mental health-related role limitations) and mental health, divided into a physical component and a mental component. Low scores

TABLE 1 Descriptive statistics

Variable	Moderate frequency and moderate intensity ($n = 112$) N (%)	Moderate frequency and high intensity ($n = 103$) N (%)	High frequency and moderate intensity ($n = 75$) N (%)	High frequency and high intensity ($n = 117$) N (%)	p
Age (years)					
Youth (18–24)	33 (29.5)	47 (45.6)	14 (18.7)	55 (47.0)	.000[b]
Adults (25–45)	79 (70.5)	56 (54.4)	61 (81.3)	62 (53.0)	
Sex					
Female	61 (54.5)	27 (26.2)	39 (52.0)	51 (43.6)	.000[b]
Male	51 (45.5)	76 (73.8)	36 (48.0)	66 (56.4)	
ID severity					
Mild	35 (32.4)	41 (40.6)	41 (56.9)	49 (41.9)	.017[b]
Moderate	59 (54.6)	57 (56.4)	27 (37.5)	58 (49.6)	
Severe	11 (10.2)	3 (3.0)	4 (5.6)	6 (5.1)	
Profound	3 (2.8)	0 (0.0)	0 (0.0)	4 (3.4)	
Autism spectrum disorder					
Yes	12 (10.7)	11 (10.7)	11 (14.7)	20 (17.1)	.489
No	100 (89.3)	92 (89.3)	64 (85.3)	97 (82.9)	
Behavioural disorders					.016[b]
Yes	56 (50.9)	56 (54.4)	31 (41.9)	42 (35.9)	
No	54 (49.1)	47 (45.6)	43 (58.1)	75 (64.1)	
Mobility/getting around					
Walks independently	88 (78.6)	92 (89.3)	68 (90.7)	108 (92.3)	.029[b]
Needs assistance in certain situations	19 (17.0)	9 (8.7)	6 (8.0)	5 (4.3)	
Needs constant assistance[a]	5 (4.5)	2 (1.9)	1 (1.3)	4 (3.4)	
Work status					
Employed	56 (50.0)	49 (47.6)	38 (50.7)	67 (57.3)	.440
Unemployed	56 (50.0)	54 (52.4)	37 (49.3)	49 (41.9)	

Note: Sample size varies from 398 to 407 due to missing data.

Abbreviation: ID, intellectual disability.

[a]Person always needs help to get around or needs an ambulation aid such as a walker or wheelchair, which can be self-propelled or pushed.

[b]Significant results, indicating that the percentage differs significantly between groups.

are associated with more severe health problems, with a mean of 50 and standard deviation of 10. The SF-36v2 has good psychometric properties (McHorney et al., 1993; Ware & Sherbourne, 1992). Cronbach's alpha coefficients vary between 0.80 and 0.94, and the test–retest reliability index is 0.70 (Leplège et al., 2001; McHorney et al., 1993).

2.4 | Data analysis

Excel 2016 and IBM SPSS Statistics version 25 were used for the statistical analyses. Descriptive statistics were computed to characterise the four groups (see Table 1). A preliminary analysis of the data was carried out to correct the skewness of six of the eight SF-36v2 scales (role physical, vitality, social functioning, role emotional, physical functioning, and general health) and the two summary measure scores (physical and mental components). For the body mass index variable presented in Table 2, skewness and kurtosis were, respectively, 0.749 and 0.782, indicating that the normality assumption was not violated. No outlier was found.

Binomial and multinomial logistic regression analyses were conducted to compare binary (e.g. hearing aid, physical and mental health diagnoses) and categorical (e.g. physiotherapy consultations, eating habits) health variables according to the frequency (moderate, high) and intensity (moderate, high) of physical activity, the two independent variables. Linear regression analyses were also computed to compare continuous health variables (e.g. body mass index, SF-36v2 scales such as role physical and physical functioning) according to the frequency and intensity of physical activity, the two independent variables. The simple effect of frequency according to intensity and intensity according to frequency was analysed for each variable for which the interaction effect (frequency × intensity) was significant. Since sex, age and intellectual disability severity could explain some differences between groups (see Table 1), we controlled for these three variables in all our regressions. Bonferroni corrections (pairwise comparisons) were used as post hoc tests.

3 | RESULTS

To achieve our objective, we compared the 113 health variables (e.g. physical and mental health diagnoses, drug consumption, eating habits, psychological abuse) from the demographic and health information form and the ten health variables from the SF-36v2 (physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, mental health, physical component summary, mental component summary) according to the frequency and intensity of physical activity. Table 2 shows the five health variables where interaction (frequency × intensity), frequency or intensity effects were found. Other health variables analysed from the demographic and health information form are listed in the notes under Table 2. People who did physical activity more often were more able to express their pain than the other two groups ($\chi^2(1) = 7.750$, $p = .005$). For the moderate frequency, people who engaged in moderate-intensity physical activity had a higher percentage of psychosis or schizophrenia diagnoses than those who engaged in high-intensity physical activity ($\chi^2(1) = 7.740$, $p = .005$). For the high-intensity physical activities, people who engaged less frequently in physical activity had a higher percentage of psychosis or schizophrenia than people who engaged more frequently in physical activity ($\chi^2(1) = 5.150$, $p = .023$). Concerning orthopaedic consultations, they were more frequent in people who did high-intensity physical activity compared with moderate-intensity physical activity at a high frequency ($\chi^2(1) = 7.003$, $p = .008$). For the moderate-intensity physical activities, people who engaged less frequently in physical activity reported more orthopaedic consultations ($\chi^2(1) = 7.246$, $p = .007$) and fewer physiotherapy consultations than those who engaged more frequently ($\chi^2(1) = 7.210$, $p = .007$). The last difference related to the body mass index that was lower in the high-intensity and high-frequency group compared to the moderate frequency group ($F(1, 210) = 8.127$, $p = .005$) and to the moderate-intensity group ($F(1, 179) = 4.283$, $p = .040$). No interaction effect between the frequency and intensity of physical activity was found between the four groups for the other variables analysed such as physical health diagnoses ($\chi^2(1) = 1.905$, *ns*) and mental health diagnoses ($\chi^2(1) = 0.170$, *ns*). Multinomial logistic regression analyses were also conducted to determine whether health varied according to the type of physical activity; no differences were found in these subanalyses.

4 | DISCUSSION

To our knowledge, this was the first study to examine the relationship between the frequency and intensity of physical activity, and the health, specifically for individuals with intellectual disability. Based on studies done with the general population (Agence de la santé publique du Canada, 2019; Oja et al., 2018; Rosique-Esteban et al., 2019), we expected to find a difference in health according to the frequency and intensity of physical activity, namely better health in participants doing physical activities more often and with greater intensity; however, this was not the case. It is conceivable that it would be more demanding for individuals with intellectual disability than without intellectual disability to do any sport or physical activity (Lante et al., 2010) given their poorer state of health (Krahn et al., 2006; Morin et al., 2012) and other disabilities they might have (van Timmeren et al., 2016). Thus, it is probable that the effort made by the participants in the moderate-intensity groups was like the effort made by those in the high-intensity groups. Another explanation is the measure of physical activity. Our study does not include all physical activity throughout the day as we asked how many times per week the participants had engaged in at least 20- to 30-min sessions. From this perspective, if a participant walks 15 min to go to work and 15 min to get back from work each day, that is not considered in

TABLE 2 Logistic and linear regression results: effect of physical activity factors on health variables

Variable	Effect	β	SE	χ^2	p
Ability to express pain/discomfort	Frequency	7.63	2.60	8.61	.003[b]
	Intensity	4.43	2.56	3.07	.084
	Frequency × intensity				N/A[a]
Psychosis/Schizophrenia	Frequency	5.39	2.53	4.52	.034[b]
	Intensity	6.62	2.56	6.69	.010[b]
	Frequency × intensity	−3.86	1.60	5.82	.016[b]
Orthopaedic consultations	Frequency	−5.23	2.19	5.71	.017[b]
	Intensity	−3.46	1.51	5.24	.022[b]
	Frequency × intensity	3.02	1.18	6.56	.010[b]
Physiotherapy consultations	Frequency	−4.04	2.36	2.94	.086
	Intensity	−3.93	2.00	3.85	.049[b]
	Frequency × intensity	2.71	1.37	3.93	.047[b]
	Effect	**β**	**SE**	**t**	**p**
Body mass index	Frequency	5.37	2.45	2.19	.029[b]
	Intensity	5.67	2.31	2.46	.014[b]
	Frequency × intensity	−4.16	1.49	−2.79	.006[b]

Note: Sample size varies from 390 to 398 due to missing data. Other health variables analysed from the demographic and health information form are as follows: hearing aid, physical health diagnoses (e.g. allergies, asthma, diabetes, epilepsy), mental health diagnoses (e.g. mood disorder, anxiety disorder, personality disorder, sleep disorder), current medication, behavioural disorders (e.g. self-mutilation, physical aggression towards others, stereotyped and repetitive behaviour), last consultation with a general practitioner, last complete medical examination, last specialist consultation (e.g. gynaecology, cardiology, podiatry, dentistry), last PAP test, last mammography, last screening for testicular cancer, las screening for prostate cancer, sexual relations, use of contraceptive measure (e.g. condoms, vasectomy, oral contraceptives, tubal ligation), hospitalisations, number of cigarettes smoked, number of alcoholic drinks, drug consumption, eating habits, job, physical abuse, sexual abuse, psychological abuse and suicide attempts.

[a]Since none of the participants in the high-frequency/high-intensity group reported being unable to express their pain/discomfort, the interaction effect could not be tested for this variable.

[b]Indicates significant results.

our study. These two hypotheses could explain why so few health variables (5 of 113) differed according to the frequency and intensity of physical activity.

Our findings showed that orthopaedic consultations were more numerous in people playing a high-intensity sport more frequently than a moderate-intensity sport. This finding agrees with those of Räisänen et al. (2016), who noted that the intensity of the sport plays a crucial role in the number of injuries, with the risk in high-intensity sports being 4.1 times higher. Our results also indicate that people who play less frequently a moderate-intensity physical activity have more orthopaedic consultations than those who do the same activity more frequently. This finding may indicate that people with more pre-existing orthopaedic concerns are precluded from engaging in more frequent physical activity. The systematic review of Ekegren et al. (2018) showed that people with serious orthopaedic injury had lower physical activity levels not only during stages of recovery but also up until seven months postinjury. Also, Stattin et al. (2017) maintained that the risk of injury declines when a sport is played more often. If there is less risk of injury, it seems logical that there would be fewer orthopaedic consultations. Conversely, it is conceivable that the number of physiotherapy consultations would be higher in people who do moderate-intensity physical activities frequently than in those who do them less often. In other words, in an activity such as walking or bowling, athletes have less risk of getting injured and having to consult a physiotherapist if they do it once compared to three times per week. Hamel and Goulet (2006) reached a similar conclusion with the general population, noting that more than half of the injuries reported in their study in the general population occurred in people who did physical activities regularly, that is at least three times per week. Another possible explanation is that the frequency of physical activity increases after a physiotherapy consultation since, according to the study by Freene et al. (2019) in the general population, the therapist helps to reduce pain and takes the time to discuss physical activity guidelines with the athlete at the end of the consultation. In addition, the sessions with the physiotherapist can be included in the count of physical activity; hence, participants who had engaged more frequently in physical activity have more physiotherapist consultations.

Concerning body mass index, our analyses showed that a higher frequency and a higher intensity were correlated to a lower body mass index. More precisely, the body mass index was lower in the HFHI (M = 25.70, SD = 5.99) than the HFMI group (M = 29.57, SD = 9.21). Our results are similar to those obtained in the study on the general population by Liu et al. (2018), who maintained that moderate-intensity activity is sufficient to maintain a normal weight. However, people who want to lose weight (i.e. lower their body mass index) must increase the intensity of their physical activity. Studies on elderly people (Barengo et al., 2017; Koolhaas et al., 2017) showed that body mass index was lower for those engaging in moderate or high physical activity intensity compared with those engaging in low physical activity intensity. Similar findings were found in people with chronic conditions (Dhalwani et al., 2016) or cardiovascular disease (Pandey et al., 2017; Troeschel et al., 2020), as practising physical activity was associated with lower body mass index. In our study, we also found a lower body mass index in the HFHI (M = 25.70, SD = 5.99) than the MFHI group (M = 28.23, SD = 7.54). Grasdalsmoen et al. (2019) reached the same conclusion with their study on the general population, indicating that the probability of having a body mass index over 30 goes up as the frequency of physical activity goes down.

Another difference found in our study related to the diagnosis of psychosis/schizophrenia, which was more common in the moderate frequency and the moderate-intensity groups. A possible explanation is that people with significant thought disorders may find it difficult to engage frequently in higher intensity physical activity. Our results echo the conclusions of Sormunen et al. (2017), who maintained that there is an association between developing schizophrenia and a low physical activity index (i.e. lower intensity, lower frequency) in the general population. According to these authors, it is "likely that a complex combination of deviant motor development, motivational and reward deficits, subtle affective problems, and difficulties in social interaction all contribute to lower interest in physical activities and in particular those forms requiring social skills" (Sormunen et al., 2017, p. 4). This conclusion is consistent with the findings from other studies (Newberry et al., 2018; Stubbs et al., 2018). Firth et al. (2018) showed that maintaining exercise after a first episode psychosis had positive effects on symptoms, cognition and social functioning. Further research should explore how to develop autonomous motivation to exercise in people with psychosis to facilitate their inclusion in the society, knowing all the physical activity benefits.

It is also interesting to see that no differences between the groups were reported for physical health and mental health diagnoses. In other words, participants engaging in physical activity more frequently and more intensely do not have less health problems. This finding is unexpected since the literature has shown a positive impact of physical activity on health variables as cardiovascular disease risk factors (DuBois et al., 2019; Oja et al., 2018) and mental health problems (Teychenne et al., 2020). More precisely, DuBois et al. (2019) found that Special Olympics Athletes who practised high-intensity sports had fewer cardiovascular disease risk factors than athletes practising low or moderate-intensity sports. Programmes, such as Beat it, had also shown that behavioural activation was associated with significant reductions in depressive symptoms (Jahoda et al., 2017). Considering that cardiovascular disease and mental health problems are amongst the most impactful and deadliest in individuals with intellectual disability, it is questioning that we did not find linear relationships between physical activity factors and health variables. However, it is conceivable that health problems influence physical activity level, rather than the frequency and intensity of physical activity improving health status in people with intellectual disability. In addition, Agiovlasitis et al. (2018) reported that the relationship between physical activity and health is influenced by a multitude of interactive factors. The ministère de la Santé et des Services sociaux du Québec (2012) also proposed a Conceptual framework of health and its determinants explaining the influence of individual characteristics (e.g. lifestyle and health behaviours), living environments (e.g. family environment, workplace), systems (e.g. Social Assistance and Social Solidarity programmes, social and health services system) and contexts (e.g. political, economic, social and cultural context) on physical, mental, psychosocial and overall health. For physical activity, personal factors such as intellectual disability severity (King et al., 2003) and physical and mental health problems; social factors such as social support (Martin Ginis et al., 2016); and environmental factors such as cost (Cartwright et al., 2017), accessibility and transport (Murphy et al., 2008; Shields et al., 2012) can either be facilitators or barriers to physical activity. In our analyses, we did control for intellectual disability severity. However, we could not control the other factors mentioned above. For example, accessibility of more intense physical activities may vary from one participant to another, hence, potentially introducing a bias in our study. To reduce barriers and to improve engagement in physical activity, it is important to increase the number of sport programmes, diversify the offer according to the interests of people with intellectual disability and make inclusive programmes accessible to everyone.

This study also documented that some people with intellectual disability experience more health conditions and have more functional limitations that likely contribute to poorer health that leads to less physical activity. In this regard, it is becoming a priority to offer more sport programmes adapted to their needs (e.g. adaptation of instructions and simplification of rules) and corresponding to their interests to encourage them to move to improve their health. Burns and Johnston (2020) have established concrete recommendations on adaptations for sport programmes in relation to the needs of people with intellectual disability. In addition, to encourage them to be more active, their motivation must be considered since it is a central element in physical activity engagement (Farrell et al., 2004). Therefore, it is important to inform and educate people with an intellectual disability about the benefits of participating in sport programmes. In this sense, by increasing their motivation and their understanding of the physical activity benefits, we can assume that people with intellectual disability will be more inclined to engage in physical activity.

In summary, our findings highlighted differences in the ability to express pain, orthopaedic and physiotherapy consultations, body mass index and psychosis/schizophrenia diagnoses according to the frequency and intensity of physical activity in people with intellectual disability. However, other significant differences could have been detected between our groups if we would have included all physical activities with bouts of 10 min or more (Canadian Society for Exercise Physiology, 2019), rather than 20- to 30-min sessions. It is also possible that we underestimated the effort required to do physical activity in people with intellectual disability, which is a downside of using the Compendium of Physical Activities designed for the general population to categorise the intensity of each physical activity reported by the participants. The importance of increasing the frequency of physical activity for people with intellectual disabilities is undeniable, considering their predisposition to health problems and their significant inactivity. To increase the frequency of physical activity within this population, it would be important to implement adapted sport programmes that meet their needs and interests, ensure familiarity (with familiar people in known environments), integrate well into their daily routines and offer support (Hassan et al., 2019). This final element is crucial, since social support is a key factor in the sport participation, personal fulfilment and self-determination of people with intellectual disabilities. In contexts such as the current COVID-19 pandemic, isolation, depressive and anxious symptoms as well as solitude are heightened. The effect of physical activity on mental health is therefore even more important (Callow et al., 2020). Thus, it becomes essential to find quick and easy solutions for reducing the rates of inactivity and improve the health of people with intellectual disabilities.

4.1 | Limitations of the study

This study is novel, insofar as it identifies the links between the frequency and intensity of physical activity and the health of people with intellectual disability. Also, the sample size was relatively big, which allows a generalisation of the results, all while considering certain limitations to the study. Firstly, questionnaires, not direct measures, were used to report the data, which could have had an impact on the accuracy of the information collected. It is conceivable that proxy informants do not know the answer to some questions (e.g. how are your child's eating habits, what is his/her weight and height). However, to avoid guessed or hypothetical answers, almost all questions had “I don't know” as a response choice. Information would still have been more accurate if we would had measured and weighed participants directly. The wording of the questions can also have introduced a bias in our study since questions from the SF-36v2 were formulated in the first person. In this regard, parents were told to be careful while completing this questionnaire and to answer according to their perceptions of their child's health. Nonetheless, their perceptions may not reflect as well as direct measures the health status of their child. Parents may not know that their child is in pain, but a dentist examination could reveal infection and inflammation of the gums or cavities, usually causing discomfort. Secondly, participants were asked only about the frequency and intensity of physical activity, not about the duration of each session. Thus, the study did not distinguish between people who ran once a week for 20 min versus those who ran for two hours, which could have had an impact on the health-related results. Finally, even though the Compendium of Physical Activities used in this study is recommended for studies comparing physical activity intensity levels, it has not been validated for people with intellectual disability. Physical activity levels may differ between the general population and the population with intellectual disability, with the result that some participants may have been classified in a moderate-intensity group instead of a high-intensity group. To determine intensity, it could have been interesting to use self-reported increases in breathing or heart rate during physical activity instead of the Compendium's MET values for the sport played or activity done.

4.2 | Future research

This study was intended to be more of a wide overview of physical and mental health variables according to the frequency and intensity of physical activity, as, to our knowledge, no study had explored this linear relationship in individuals with intellectual disability. Our study helped determine, beyond significance, the variables that were most strongly correlated with the frequency and intensity of physical activity. Future research is needed on additional variables that can influence the relationship between physical activity factors and health variables in people with intellectual disability to help physical activity promotion. It would now be interesting to conduct a study on personal (e.g. transport, financial constraints), social (e.g. social support) and environmental (e.g. living environment) factors that can influence the relationship between the frequency and intensity of physical activity and health variables in people with intellectual disability to help understand which factors are the most important facilitators and barriers to physical activity in this population. Similarly, it would be pertinent to identify, on an individual level, certain risk factors (ex. physical and mental health problems) and protective factors (ex. physical activities, healthy eating habits) to understand how they interact to promote or restrict the social integration of people with intellectual disabilities within sport programmes over a medium- and long-term time frame. It would also be advisable to conduct a study on a grander scale to establish precise recommendations on the type, frequency, intensity, duration and total quantity of physical activity necessary for people with disabilities to draw health benefits from it. These recommendations are essential for the development of sport programmes adapted to this population and to encourage them to engage in physical activity.

CONFLICT OF INTEREST
No conflicts of interest have been declared.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are not available due to privacy or ethical restrictions.

ORCID

Caroline Faust https://orcid.org/0000-0003-4274-625X

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