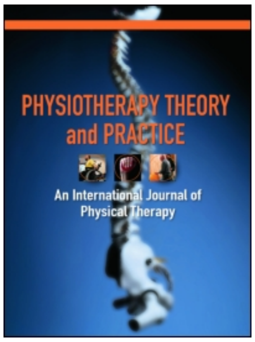

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Factors explaining physical activity level in Parkinson´s disease: A gender focus

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ABSTRACT

Objective: To analyze the multivariate associations between self-rated level of physical activity and demographic characteristics, self-efficacy for physical activity, fall-related self-efficacy, fear of falling, enjoyment from participation in physical activity, social support, fatigue, and *health-related quality of life* in persons with PD with a focus on gender.
Method: Participants were persons with PD (n = 285, mean age 69.1 ± 7 years). *Self-reported scales measuring level of physical activity (Physical Activity Disability Survey–Revised), enjoyment of physical activity (study- specific questions), self-efficacy for physical activity* (Exercise Self-Efficacy Scale), *fall-related self-efficacy* (Falls Efficacy Scale), *social support* (Social Influences on Physical Activity), *fatigue* (Fatigue Severity Scale) *and health-related quality of life* (Parkinson's Disease Questionnaire-39) *were used. The response rate was 58.2%.*
Results: Multiple regression analyses showed that 54.5% of the level of physical activity was explained by low-degree limitations in mobility and activities of daily life (ADL), being younger, higher self-efficacy for physical activity, communication limitations, bodily discomfort, social support and shorter time since diagnosis. Enjoyment of physical activity explained the level of physical activity for women, whereas self-efficacy for physical activity explained the level of physical activity for men.
Conclusion: Implementing strategies to increase functional mobility, self-efficacy for physical activity, social support, and enjoyment of physical activity might facilitate persons with PD beginning and/or maintain different physical activities.

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Gender; Parkinson's disease; physical activity level; physical therapy; self-efficacy; rehabilitation

Introduction

Parkinson's disease (PD) is a chronic and a neurodegenerative age-related disorder that affects around > 1% of all persons above 60 years of age (Morris, 2000; Wirdefeldt et al., 2011). The aetiology of PD is poorly understood, but it involves both genetic and environmental factors (de Lau and Breteler, 2006; Thacker and Ascherio, 2008). One modifiable risk factor of interest for Parkinson's disease is physical inactivity, and several studies provide compelling evidence for an inverse association between physical activity and the onset of PD (Chen et al., 2005; LaHue, Comella, and Tanner, 2016; Logroscino, Sesso, Paffenbarger, and Lee, 2006; Shih, Liew, Krause, and Ritz, 2016; Xu et al., 2010; Yang et al., 2015). Physical activity has also been associated with neuroprotection in animal studies (Ahlskog, 2011; Petzinger et al, 2013) and in human beings (Yang et al., 2015). Men and women might exhibit diverse expressions of PD, such as differences in rigidity and postural instability, and reduced quality of life is more commonly reported by women with PD (Roland, Jakobi, Powell, and Jones, 2011; Shulman, 2007).

Persons with PD are reported to be 29% less active than healthy individuals (van Nimwegen et al., 2011), and physical inactivity might initiate a cycle of deconditioning and disability, independent of latent disease processes, and might worsen various motor and non-motor symptoms that are affected by PD (van Nimwegen et al., 2011). Studies show that physical activity has positive effects on physical functions, strength, balance, walking speed, and health-related quality of life in people with PD (Goodwin et al., 2008; Lauze, Daneault, and Duval, 2016), but to our knowledge only a few studies have investigated whether the effects of varying levels of physical activity differ between men and women with PD (Orcioli-Silva et al., 2014; Teixeira-Arroyo et al., 2014). After a multimodal exercise program, men showed more benefits than women (Orcioli-Silva et al., 2014). These results and the gender differences described above (e.g. in disability and gait) (Roland, Jakobi, Powell, and Jones, 2011; Shulman, 2007) imply a need for a gender perspective when studying physical activity in persons with PD.

To understand physical activity and why people engage in or not engage in physical activity and exercise

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we need to understand physical activity as a behavior. Social cognitive theory (Bandura, 1997, 2006) is a useful framework for understanding physical activity behavior, and self-efficacy is one essential part of this theory and is important when engaging in physical activity. Self-efficacy is a cognitive, personal belief about one´s ability to perform a particularly activity or behavior in a given situation (Bandura, 1997), and self-efficacy for physical activity has been shown to be an important facilitator for physical activity in the general population (Sherwood and Jeffery, 2000), but it has only been sparsely studied in persons with PD (Ellis et al., 2011). Fear of falling is common in people with PD, with prevalence estimates ranging from 37% to 59% (Lindholm, Hagell, Hansson, and Nilsson, 2014). Fear of falling is a widely used umbrella term for concerns about: falling (Jonasson et al., 2015); decreased balance confidence (Powell and Myers, 1995); and low fall-related self-efficacy (Tinetti, Richman, and Powell, 1990). Fall-related self-efficacy is defined as "the confidence in one´s ability to perform activities of daily living without falling" (Tinetti, Richman, and Powell, 1990). Fear of falling has been identified as a barrier to physical exercise (Ellis et al., 2013) while social support from family and/or from health care has proven to be a facilitating factor for physical activity in people with PD (Prezer-Aboff, Galik, and Resnick, 2009).

Another important factor for engaging in physical activity is motivation. Enjoyment is an intrinsic part of motivation and is defined as a positive affective state that reflects feelings such as pleasure, liking, and fun (Roberts and Treasure, 2012). Enjoyment is sparsely studied in persons with PD.

Further, fatigue, which is often a troubling symptom in PD with a prevalence between 33% and 58% (Friedman et al., 2007), has yielded contradictory results as a factor with an impact on physical activity levels in individuals with PD (Elbers et al., 2009; Lindholm, Hagell, Hansson, and Nilsson, 2014).

Knowledge of the factors that affect the level of physical activity of individuals with PD might guide clinicians in promoting physical activity and its benefits. Few studies have examined the factors affecting physical activity level with a special emphasis on gender, and thus the aim of the present study was to analyze the multivariate associations between self-rated level of physical activity and demographic characteristics, self-efficacy for physical activity, fall-related self-efficacy, fear of falling, enjoyment from participation in physical activity, social support, fatigue, and health-related quality of life (i.e. mobility, activities of daily living [ADL], emotional well-being, stigma, social support, cognition, communication, and bodily discomfort) in persons with PD with a focus on gender.

Method

Study cohort

Community-dwelling persons between 18 and 80 years old with a diagnosis of PD were recruited via the neurological clinic at a university hospital in Sweden. All registered subjects living in the county of Uppsala were invited to participate (490 subjects). The final sample consisted of 285 subjects with PD (response rate 58.2%). In total, there were 184 men (64.6%) and 101 women (35.4%), yielding a male-to-female ratio of 1.82:1. The mean age was 69.1 ± 7.0 years (Table 1). The male-to-female ratio for the 205 subjects who did not respond to the invitation was 1.28:1 and did not significantly differ between respondents and the non-respondents (p = .06). Non-respondents were younger than respondents (66.8 ± 9.3 vs 69.1 ± 7.0 years, p = .013) and non-respondent males were younger than respondent males (66.0 ± 9.4 vs 68.0 ± 6.8 years, p = .013).

Procedure

A questionnaire, an information letter, a written consent form, and a stamped reply envelope were sent out by surface mail. Due to its length, the self-assessment questionnaire was divided into two parts with the second part sent out two weeks after a reply with answers to the first part of the questionnaire was received. Two reminders were sent to subjects who did not answer either of the parts within three weeks. Written informed consent to participate was provided by all participants in the study, and the study was approved by the Regional Ethical Review Board, Uppsala, Sweden, D-no 2010/278.

Measurements

For all measurements, the Swedish versions of the scales were used. Psychometrically sound measures were used, which are described below. The level of physical activity during the previous week was measured by the Physical Activity Disability Survey–Revised (PADS-R) (Kayes et al., 2009). This survey includes six subscales (exercise, leisure time physical activity, general activity, therapy, employment and wheelchair use), and the level of physical activity during the previous week is reported for each subscale. The total PADS-R score is the sum of the subscale ratings, and a higher score indicates a higher level of physical activity. Test-retest reliability has been shown to be good in a multiple sclerosis and stroke population (intraclass correlation coefficient (ICC) (0.87), 95% limits of agreement (±1.13) (Kayes et al., 2009).

Self-efficacy for physical activity was measured using the Exercise Self-Efficacy Scale (ESES) (Ahlstrom, Hellstrom, Emtner, and Anens, 2015; Kroll, Kehn, Ho, and Groah, 2007). Confidence when 10 items measured engaging in regular physical activities and exercise answered with one of the following options (1 = not at all, 2 = rarely true, 3 = moderately true, 4 = always true). A maximum total score of 40 is possible, and a higher score indicates higher self-efficacy for exercise. Satisfactory content validity as well as high internal consistency (Cronbach's alpha 0.927 and EQ Length Spearman Brown 0.88) have been shown (Kroll, Kehn, Ho, and Groah, 2007).

Fall-related self-efficacy was measured using the Falls Efficacy Scale-Swedish version (FES(S)) (Hellstrom and Lindmark, 1999; Hellstrom, Lindmark, and Fugl-Meyer, 2002). The original scale measures the degree of confidence in performing 10 common activities without falling (Tinetti, Richman, and Powell, 1990), and the Swedish version includes three additional items. All items were graded on a visual scale from not confident at all (0) to completely confident (10). All items in the Swedish version can be added up to yield a total score of 130 points with a higher score indicating higher self-efficacy. The score has shown high test-re-test reliability (ICC 0.97) (Hellstrom and Lindmark, 1999). Fear of falling was measured with the question, "Are you afraid of falling?" Possible answers were "Yes" or "No".

Social support for physical activity was measured using the Social Influences on Physical Activity questionnaire (SIPA) (Chogahara, 1999; Driver, 2007). This questionnaire includes two subscales (positive and negative social influences from family, experts, and friends). Only positive influences from family were reported in this study due to the very low rating (floor effect) of the other subscales. The occurrence of social influences over the last 12 months is measured on a 5-point scale (from 0 = never to 4 = very often) (Chogahara, 1999). The 15 questions on positive family support are summed and divided by 15 to give the total score, and a higher score indicates greater social support. Evidence of content validity and reliability (Cronbach's alpha 0.67–0.91) has been shown (Chogahara, 1999; Driver, 2007).

Fatigue was measured with the Fatigue Severity Scale (FSS) (Krupp, LaRocca, Muir-Nash, and Steinberg, 1989; Mattsson et al., 2008) that includes nine items to identify features of fatigue. Each item is ranked from 1 (strongly disagree) to 7 (strongly agree). The total score is calculated as the mean of scores for the nine statements, and a higher score indicates a more severe level of fatigue (Krupp, LaRocca, Muir-Nash, and Steinberg, 1989). The Swedish and the English versions have been found to be reliable (Cronbach's alpha 0.88–0.94) and valid (Krupp, LaRocca, Muir-Nash, and Steinberg, 1989; Mattsson et al., 2008).

Health related quality of life was measured using the Parkinson's Disease Questionnaire-39 (PDQ-39) (Hagell and Nygren, 2007; Peto, Jenkinson, Fitzpatrick, and Greenhall, 1995), which is made up of 39 questions covering eight domains of health and well-being. The eight domains are mobility, ADL, emotional well-being, stigma, social support, cognition, communication, and bodily discomfort. Each domain can be summed, and the domains can be summed up to calculate a total PDQ-39 score. Total scores are scaled from 0 to 100, and higher scores reflect a lower health-related quality of life. Hagell and Nygren (2007) provide general support for the acceptability and reliability (Cronbach's alpha 0.72–0.95, ICC 0.76–0.93) of the PDQ-39.

Enjoyment of physical activity participation was measured using the following three statements (developed by our research group) regarding one´s experience during or shortly following physical activity of at least 10 minutes' duration (e.g., walking): "I experience that it is fun to be physically active", "I experience a feeling of wellbeing when I am physically active", and "I feel happy with myself when I am physically active". The answers were graded on a visual scale from 0 to 5, and were summed to give a total score ranging from 0 to 15, with 15 being the highest level of enjoyment. This instrument has not yet been psychometrically evaluated.

Questions on background variables such as living conditions and education were also included in the questionnaire (Table 1). Co-morbidity was assessed with an open question regarding other health problems beyond PD. From the open question, the authors used the Functional Comorbidity Index (Groll, To, Bomardier and Wright, 2005) afterwards. Body Mass Index (BMI) was calculated as kg/m^2.

Statistical analysis

The sample size was estimated as 50 + 8k, where k is the number of predictors (Field, 2009), and this resulted in a minimum sample size of 210 for $\alpha = 0.05$ and $\beta = 0.20$ (Tabachnick and Fidell, 2001). Data were analyzed using SPSS v. 23 (IBM). Missing values for occasional data in scales with ordinal questions were imputed with the median of the appropriate subscale when the level of missing data was <33% of the subscale. When the amount of missing data was ≥ 33% the total of the scale was not calculated. For the different measures, this was the case for four PADS-R, seven PDQ-39, three FSS, five ESES, three FES(S), and twenty-five SIPA items. Height and weight were missing in a few cases and these values were imputed using the mean for men or women (Tabachnick and Fidell, 2001). Forced-entry multiple regression analysis was used to investigate factors that might influence physical activity (the dependent variable) for all participants and for men and women separately. The most important independent variables in each group (standardized beta with $p < .25$) were analyzed in an additional regression analysis to evaluate the prediction of physical activity. No multi-collinearity in the regression analysis was found by screening a correlation matrix of all included variables ($r < 0.8$) and by evaluating the variance inflation factors and tolerance statistics. There was no autocorrelation found with the Durbin-Watson test of independence of residuals. The assumptions of linearity, homoscedasticity, and normally distributed residuals were met when checking the histograms and normal probability plots of the residuals. Outliers were checked by evaluating the percentage of standardized residuals with an absolute value of greater than 2 (< 5%), greater than 2.58 (< 1%) or greater than 3.29 (0%), thus showing acceptable levels in most cases (Field, 2009). The level of significance was set to $p \leq 0.05$.

Results

All participants

Background characteristics and outcome measures are presented in Table 1. In the multivariate analyses including all independent variables and all participants, younger age, higher self-efficacy for physical activity, good social support from family, good mobility, low-degree limitations of ADL, greater communication limitations and bodily discomfort limitations explained 52.5% of the self-rated physical activity level (Table 2). When recalculating to include the most important variables ($p < .25$) younger age, shorter time since diagnosis, higher self-efficacy for physical activity, good social support from family, and the PDQ-39 subscale ratings of good mobility, low-degree limitations of ADL, greater communication limitations and bodily discomfort limitations explained 54.5% of self-rated physical activity level. Good mobility, low-degree limitations of ADL, and younger age were the strongest contributors to the association (Table 2).

Table 1. Background characteristics and outcome measures shown as mean ± SD, median (IQR) or number (percent).

	Women (n = 101)	Men (n = 184)	Total (n = 285)
Age (years)	69 ± 7	70 ± 7	69 ± 7
Living conditions			
Living alone	30 (30%)	27 (15%)	57 (20%)
Living with children	4 (4%)	9 (5%)	13 (5%)
Education status			
Compulsory school	31 (31%)	61 (34%)	92 (34%)
Upper-secondary school	36 (36%)	60 (34%)	96 (35%)
University education	32 (32%)	54 (31%)	86 (31%)
Employment status			
Unemployed	0 (0%)	3 (1%)	3 (1%)
Employed	6 (6%)	14 (8%)	20 (7%)
Retired due to age	79 (79%)	138 (76%)	217 (77%)
Sickness benefit	12 (12%)	21 (12%)	33 (12%)
Other	3 (3%)	5 (3%)	8 (3%)
Time since diagnosis (years)	9 ± 6	9 ± 7	9 ± 6
Smoking (yes)	4 (4%)	10 (6%)	14 (5%)
Physical activity [a]	−0.54 ± 0.99	−0.34 ± 1.08	−0.41 ± 1.05
Co-morbidity, incl. BMI	0.44 ± 0.73	0.53 ± 0.74	0.50 ± 0.74
BMI (kg/m^2)	24 ± 4	25 ± 4	25 ± 4
Enjoyment of physical activity	12.5 ± 3.4	12.2 ± 3.3	12.3 ± 3.4
Self-efficacy for physical activity	19 (15–24)	22 (17–29)	21 (17–29)
Fall-related self-efficacy	75 ± 41	91 ± 36	85 ± 38
Fear of falling			
Yes	52 (58%)	73 (43%)	125 (48%)
No	38 (42%)	98 (57%)	126 (52%)
Social support, family	0.87 (0.40–1.80)	1.27 (0.67–2.27)	1.13 (0.06–2.07)
Walking			
Yes	97 (97%)	181 (98%)	278 (98%)
No	3 (3%)	3 (2%)	6 (2%)
PDQ-39 total score	35.1 ± 16.3	31.8 ± 17.0	33.0 ± 16.1
Two domains of the PDQ-39			
Mobility	49.1 ± 29.1	38.4 ± 29.6	42.2 ± 29.8
ADL	39.4 ± 27.9	39.6 ± 25.9	39.5 ± 26.6

ADL = Activities of Daily Living, BMI = Body Mass Index, PDQ-39 = Parkinson´s Disease Questionnaire 39
[a] Physical activity was measured by the Physical Activity Disability Survey – Revised

Table 2. Physical activity regression models for all persons.

Independent variables	All independent variables (n = 204) ß	p	Variables with $p < .25$ in the initial multivariate analyses (n = 221) ß	p
Age (years)	−0.192	0.000*	−0.205	0.000*
Gender	0.014	0.772		
Living with partner (yes/no)	0.036	0.489		
University education (yes/no)	0.083	0.114	0.087	0.075
Time since diagnosis (years)	−0.094	0.085	−0.100	0.048*
Co-morbidity incl. BMI	−0.012	0.821		
Enjoyment of physical activity	0.092	0.097	0.089	0.074
Self-efficacy for physical activity	0.139	0.043*	0.157	0.011*
Fall-related self-efficacy	0.116	0.203	0.067	0.339
Fear of falling (yes/no)	0.033	0.612		
Social support, family	0.114	0.039*	0.103	0.036*
Fatigue	0.109	0.086	0.092	0.116
Domains of the PDQ-39:				
Mobility	−0.296	0.002*	−0.330	0.000*
ADL	−0.253	0.004*	−0.250	0.001*
Emotional well-being	−0.066	0.411		
Stigma	0.058	0.350		
Social support	0.025	0.718		
Cognitions	−0.128	0.094	−0.105	0.132
Communication	0.160	0.026*	0.148	0.020*
Bodily discomfort	0.131	0.043*	0.120	0.028*
	Adj $R^2 = 0.525$, $F(20,183) = 12.22$, $p = .000$.		Adj $R^2 = 0.545$, $F(13, 207) = 21.23$, $p = .000$.	

ADL = Activities of Daily Living, BMI = Body Mass Index, PDQ-39 = Parkinson´s Disease Questionnaire 39, β = Standardized beta coefficient, R^2 = adjusted R square, * = $p \le 0.05$.

For women, younger age, university education, enjoyment of physical activity participation, and low-degree limitations of ADL, explained 52.5% of the self-rated physical activity level (Table 3). For men, younger age, higher self-efficacy for physical activity, good mobility, low-degree limitations of ADL, and bodily limitations explained 55% of the association with self-rated physical activity level. The strongest contributors for women were low-degree limitations of ADL, enjoyment of physical activity participation, and younger age. The strongest contributors for men were good mobility, low-degree limitations of ADL, and younger age (Table 3).

Discussion

The aim of the present study was to analyze the multivariate associations between self-rated level of physical activity and demographic characteristics, self-efficacy for physical activity, fall-related self-efficacy, fear of falling, enjoyment from participation in physical activity, social support, fatigue, and health-related quality of life including functional mobility, ADL, emotional well-being, stigma, social support, cognition, communication, and bodily discomfort in persons with PD with a focus on gender.

Table 3. Gender-specific physical activity regression models. Variables with $p < .25$ in the initial multivariate analyses.

Independent variables	Women (n = 88) ß	*p*	Men (n = 153) ß	*p*
Age (years)	−0.224	0.005*	−0.213	0.000*
Living with partner (yes/no)			0.036	0.535
University education (yes/no)	0.174	0.044*	0.101	0.072
Time since diagnosis (years)	−0.149	0.068		
Enjoyment of physical activity	0.236	0.004*		
Self-efficacy for physical activity			0.191	0.007*
Social support, family			0.117	0.052
Domains of the PDQ-39:				
Mobility	−0.196	0.077	−0.437	0.000*
ADL	−0.265	0.014*	−0.237	0.008*
Stigma			0.083	0.173
Cognitions			−0.081	0.340
Communication			0.129	0.090
Bodily discomfort			0.183	0.007*
	Adj $R^2 = 0.525$, $F(6,81) = 17.03$, $p = .000$.		Adj $R^2 = 0.554$, $F(11,141) = 18.14$, $p = .000$.	

ADL = Activities of Daily Living, PDQ-39 = Parkinson´s Disease Questionnaire 39,
B = Standardized beta coefficient, R^2 = adjusted R square, *$p \le 0.05$.

Older age was consistently associated with a lower level of self-rated physical activity. This was expected and is in line with several other studies in the general population (> 65 years of age) (Harris et al., 2009) and in persons with PD (de Carvalho Lana, de Araujo, Cardoso, and Rodrigues-de-Paula, 2016; Dontje et al., 2013).

Self-efficacy is a prominent determinant of successful outcomes in health care. Higher self-efficacy results in a greater commitment to achieving established goals (Bandura, 2006). Self-efficacy for physical activity explained self-rated physical activity level in the whole sample and in men. Similar results have been found in older people (> 65 years) (Harris et al., 2009) and in PD (Ellis et al., 2011), but self-efficacy for exercise did not explain the level of physical activity in sedentary persons with PD (Dontje et al., 2013). Different psychosocial influences on physical activity between the genders are discussing in a recent review and showing that men reported higher levels of physical activity and higher levels of self-efficacy and social support (Edwards and Sackett, 2016).

Barriers to physical activity in PD were found to be low outcome expectations, lack of time, fear of falling, lacking someone to motivate them, fatigue, and depression (Afshari, Yang, and Bega, 2017; Ellis et al., 2013). No gender differences were evaluated in these studies. Our study showed that older age and more limitations in ADL were barriers to physical activity in both men and women. However, only for men mobility limitations explained the physical activity level. We do not know the reason for this, one possible explanation could be that the women´s total physical activity level consisted of a larger amount of activities at a lower intensity where the mobility restrictions did not restrain the physical activities as much. Lack of social support might be considered as a barrier to physical activity. A qualitative study showed that family commitment and support was perceived as an important element for mainly women with PD to maintain an exercise program (Khalil, Nazzal, and Al-Sheyab, 2016). However, this study was performed in Jordan, and can not easily be compared to Sweden due to the different cultural situation for women in these countries.

Fall-related self-efficacy and fear of falling, rated as "Yes" or "No" did not explain the physical activity level in this study. The different measures used in our study are not interchangeable and measure somewhat different aspects of fear of falling. Fear of falling was found to be a barrier to exercise in PD as measured with a question from the barrier's subscale of the Physical Fitness and Exercise Activity Levels of Older Adults scale (Ellis et al., 2013). However, falls within the previous six months did not explain the level of exercise in persons with PD (Ellis et al., 2011). Falls are common in PD, and the results of a meta-analysis showed that the 3-month fall rate is around 46% in PD (Pickering et al, 2007). Persons with PD who fall tend to have low fall-related self-efficacy (Rahman, Griffin, Quinn, and Jahanshahi, 2011) and low balance confidence (Mak and Pang, 2009).

Our study showed that social support from family was a factor explaining the self-rated physical activity level in the whole sample. A previous study showed that social support was not important for explaining the exercise level in persons with PD when measured as living alone or not (Ellis et al., 2011), and also, in our study living alone or not did not influence the level of self-rated physical activity. One explanation for the different relationships to physical activity if family, or living alone or not, was evaluated, could be that support from family might come from family members not living together, such as grown-up children. In a qualitative investigation of persons with PD, the most salient forms of support for physical activity provided by the participants' families were instrumental support (e.g. spouses participating in physical activities alongside their partner with PD) and emotional support (e.g. encouragement to participate in physical activity) (Ravenek and Schneider, 2009).

Intrinsic motivation, or being active simply for the pleasure it brings, was the type of motivation that most strongly predicted long-term exercise adherence in a previous review (Teixeira et al., 2012). To our knowledge, no studies have examined enjoyment in relation to physical activity in persons with PD. However, enjoyment of music was described as one reason for the improved gait in persons with PD that was seen in a small meta-analysis of music-based movement therapy (de Dreu et al., 2012). It was also shown in a large study of less active adults, consisting mostly of women (87%), that enjoyment was an even stronger predictor of physical activity behavior than self-efficacy for physical activity (Lewis, Williams, Frayeh, and Marcus, 2016). However, the relation between enjoyment and physical activity found in this study needs to be confirmed in future studies with psychometrically evaluated measure.

An unexpected finding in the present study was that greater communication limitations explained a higher level of self-rated physical activity in the whole sample. Speech disorders are common in PD, and more than 70% of all persons with PD exhibit some deterioration of speech features (Ho et al., 1999). One explanation for our result could thus be that persons with communication problems avoid social situations and have more time for physical activities such as walking. Another possible explanation for our result could be that physical activity facilitated speech, leading to persons with communication limitations wanting to be more physically active. This is supported by the study by McCaig, Adams, Dykstra, and Jog (2016) in which it was shown that concurrent walking increased the speech intensity in persons with PD. Clinical implications of this fact is that persons with PD should get information about the positive effects of physical activity on speech and a combination of speech- and physical activity training can be advantageously.

Fatigue did not explain the self-rated physical activity level in this cross-sectional study. The effects of physical activity on non-motor symptoms in PD were recently reviewed by Cusso, Donald, and Khoo (2016) including six studies evaluating fatigue, only one of which showed an improvement in fatigue as a result of high levels of physical activity (Cugusi et al., 2015). More research on physical activity in relation to fatigue is needed.

The somewhat different factors explaining physical activity for the genders in this study and other studies showing gender differences in the symptoms of PD (Roland, Jakobi, Powell, and Jones, 2011), in the effects of physical activity in reducing the risk of developing PD (Yang et al., 2015), and in the importance of psychosocial influences on physical activity levels (Edwards and Sackett, 2016) imply a need for more research. Future studies should thus consider gender differences when evaluating factors explaining physical activity levels and when evaluating the effects of physical activity in persons with PD.

Limitation and generalization

When interpreting our result some limitations should be considered. Physical activity level was self-rated in this investigation and not objectively measured by, for example, an accelerometer, which brings about a risk for memory bias and for over-rating physical activity. However, the PADS-R is validated and developed for persons with disabilities and measures a broad spectrum of physical activities (Kayes et al., 2009).

The enjoyment scale, that was developed by our research group, and has not yet been psychometrically evaluated. The enjoyment scale was structured as a standard Likert-type scale such as those commonly used in research where the participant rates a feeling or opinion. In this scale the participants rated their opinions using a visual analogue scale (Polit, 2006). Another limitation is that we used only a small part of the social support scale SIPA and that there was a relatively large amount of missing data for this scale. Thus, there is a need to confirm our results regarding enjoyment and social influences from family in future studies with higher-quality measures, and the present results should be interpreted with caution. Also, this is a cross-sectional study and thus no information about causal relationships between different factors can be drawn.

The total sample was 285 subjects in this study, which exceeded the estimated minimum sample size of 210. However, men and women were analyzed as subgroups based on the statistical reasoning that strong relationships can also be detected in small samples (Field, 2009).

In our study of persons with PD aged 18–80 years the male-to-female ratio was 1.82:1. This is greater than the male-to-female ratio (1.5:1) in a meta-analysis of studies from different countries (Taylor, Cook, and Counsell, 2007) and the prevalence male-to-female ratio (1.16:1) found in Sweden (Lokk et al., 2012). However, when we recalculated the male-to-female prevalence ratio from that study including persons <80 years old, the male-to-female ratio was 1.42:1 due to the proportion of women with PD increasing in the oldest ages. The non-respondents in our study were slightly younger than the respondents. Thus it should be noted when generalizing our results from the whole sample that our sample has a higher proportion of men and is somewhat older than the samples from other studies.

Our results explain 53–55% of the self-rated physical activity level. This indicates that other factors that were not measured also influence the physical activity level. Factors identified in other cross-sectional PD studies include physical fitness measured by the 6-Minute Walk Test (Dontje et al., 2013), outcome expectations from exercise (Ellis et al., 2013), and lack of time (Ellis et al., 2013). Additionally, possible factors could be depression and apathy, which were improved after a physical activity intervention in persons with PD (Cugusi et al., 2015; Swank, Medley, Thompson, and Jackson, 2016) or sleep disorders (Schapira, Chaudhuri, and Jenner, 2017). This study does not show how much different motor symptoms such as freezing of gait and postural instability contribute to the limitations in mobility and activity. Thus, it would be interesting to evaluate these factors in relation to physical activity level in future research.

Clinical implications

In PD Older age and limitations in mobility explained a lower self-rated physical activity level. Self-efficacy for physical activity, social support, and enjoyment explained the self-rated physical activity level. Strategies to enhance these factors might be implemented efforts to promote physical activity. Enjoyment of physical activity participation was more important for women, whereas self-efficacy for physical activity was more important for men.

`Conclusions

In this cross-sectional study, 53–55% of the self-rated physical activity level was explained. Older age and limitations in mobility or ADL explained a lower self-rated physical activity level in this study. Implementing strategies to increase self-efficacy for physical activity, social support for physical activity, and enjoyment of physical activity participation might also facilitate persons with PD to maintaining their participation in different physical activities. This study is one of the first studies focusing on factors explaining physical activity for men and women separately. An interesting difference was that for women enjoyment of physical activity participation explained more of the physical activity level, whereas for men it was self-efficacy for physical activity. More studies are needed preferably with prospective designs or intervention studies using objective measures of physical activity to support or contradict our findings.

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Declaration of Interest

The authors have no conflict of interest to report.

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