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PHYSICAL ACTIVITY IN PERSONS WITH LATE EFFECTS OF POLIO – A DESCRIPTIVE STUDY

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Short title: Physical activity in persons with late effects of polio

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ABSTRACT

Background: To promote a healthy and active lifestyle there is a need to increase our knowledge of the level of physical activity (PA) among people with late effects of polio.

Objectives: To examine PA in people with late effects of polio and to assess the relationship between PA, life satisfaction and various sociodemographic factors.

Methods: PA was assessed in 81 persons with late effects of polio using the Physical Activity and Disability Survey (PADS) and by a pedometer. Life satisfaction was assessed with the Life Satisfaction Questionnaire (LiSat-11).

Results: The amount of PA varied considerably but on average the participants were physically active almost three hours per day, mostly in household activities. The mean value of the pedometer counts were 6212 steps per day (SD 3208). Sixty-nine percent (69%) of the participants rated themselves as satisfied with life as a whole. The sum of PADS was positively and significantly related to the number of steps ($r=0.39$, $p<0.001$), increasing age ($r=0.26$, $p<0.05$) and to the level of global satisfaction with life ($rho=0.23$, $p<0.05$). The number of steps was also positively and significantly associated with level of global satisfaction with life ($rho=0.37$, $p<0.001$).

Conclusion: Despite a progressive physical disability, people with late effects of polio are physically active, but much of the activities are performed as part of their household activities and not as traditional exercise. The relationship between PA, life satisfaction and age further supports the general contention that an active lifestyle is an important factor for perceived well-being among older people.

Physical activity in persons with late effects of polio – a descriptive study

Introduction

Regular physical activity (PA) is a central component in health promotion, prevention and treatment of diseases, maintenance of functional independence, and contribution to general well-being and life satisfaction (1, 2). PA is defined as any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level (3). Across all ages, PA includes sports or planned exercise, but also leisure-time activities, transportation, occupational and household chores (4). From a practical, clinical and research standpoint, there is a need to accurately assess PA and its many dimensions in disabled populations, because their rates of energy expenditure (i.e., physical activity) are often different compared to the general population. This is due to various impairments and different levels of access to community activities, such as work and leisure (5). To capture all aspects of PA, it has been recommended to use a combination of measures and instruments, such as self-reports questionnaires and pedometers (5).

According to the World Health Organization (WHO), PA is recommended to be performed 150 minutes per week or as moderate to vigorous PA a minimum of 30 min per day most days of the week (4). The recommendations for PA comprise able-bodied persons as well as those with disabilities, even though there is limited evidence associated with the benefits of PA in certain disability groups (6). It has been shown that only 38% of adults with a disability meet the international recommendations for PA compared to 49% in those without disability (7). In addition, there is a reduction in the levels of PA with increasing age (8). As the aging process itself is associated with a decline in overall functioning, this increases the risk of lower rates of PA in later life (9-11). In persons 65 years of age and older, only 15% of those with a disability met the recommendations for PA compared to 26% of those without a disability (11). With an increasing number of people around the world aging with a disability, there is a need to better understand the level of PA among specific groups and diagnoses in order to promote a healthy and active life-style. There is also a need for an understanding of the dynamic nature between the person and his or her environment (12). Health promotion has proven to be more efficient if individualized (13), and personal as well as environmental factors must therefore be addressed to achieve a healthy and active lifestyle (12).

A neurological condition leading to a life-long disability is late effects of polio, also referred to as post-polio syndrome. It is one of the most common neurological conditions and it

is estimated that over 10 million people worldwide will need health care and rehabilitation over the next decades as a result of their acute poliomyelitis infection (14). Late effects of polio are characterized by new symptoms or impairments, such as muscle weakness, muscle fatigue, general fatigue, cold intolerance, and musculoskeletal pain both at rest and during PA (14-17). These impairments can lead to activity limitations, such as reduced walking ability (18), both indoors and outdoors (19). This, in turn, can restrict perceived participation (20) and may lead to a more sedentary lifestyle, and ultimately impact on life satisfaction (21). In addition, persons with late effects of polio have an increased prevalence of coronary heart disease risk factors, which may be partly due to a sedentary lifestyle (22). However, many persons with late effects of polio may have difficulties or are unable to increase the amount of exercise to achieve desired levels of moderate PA because of their impairments and activity limitations associated with their disability (23). Instead, they have to engage in lower doses of activity in order to maintain an active lifestyle (24). Knowledge of the amount and type of PA in persons with late effects of polio (24) is very scarce and no study has described in detail the different dimensions of PA in this population and its association with sociodemographic factors and life satisfaction.

Thus, the aims of this study were: i) to examine the PA levels in people with late effects of polio, and ii) to assess the relationship between PA, various sociodemographic factors (e.g., age, sex, marital status, living condition) and life satisfaction. Our hypotheses were that persons with late effects of polio do not reach the recommendations for PA, that the level of PA decrease with increasing age, and that there is an association between PA and life satisfaction

Methods and Materials

Study population

A convenience sample of community dwelling ambulatory persons with mild to moderate late effects of polio were selected from the database at a post-polio rehabilitation clinic in a university hospital. The database has existed since 2003 and at the time of recruitment (January 2012) included 300 persons (130 men and 170 women; mean age 69 (SD=7) years) with a confirmed history of acute poliomyelitis meeting the following inclusion criteria: 50 to 80 years of age; new symptoms after a period of functional stability; an electromyogram in the upper and lower limbs as verification of prior polio; no other conditions such as severe joint problems, cardiovascular or pulmonary diseases that could affect mobility and PA; ambulatory with or without mobility devices and not using a wheelchair as the main mode of transportation; living in ordinary housing; able to understand verbal and written instructions in Swedish. Of the 300 persons, 102 persons were randomly selected and invited to participate in the present study and 81 persons (43 men, 38 women; mean age 67 (SD=6) years) accepted the invitation. There was no significant difference regarding age between the 81 participants, and the 21 non-participants and the 198 eligible persons, respectively.

Before inclusion, written and oral information about the purpose of the study was provided and each individual gave their written informed consent to participate. The Regional Ethical Review Board in Lund, Sweden approved the study (Dnr 2013/427).

Assessments and measures

Data regarding the participants PA was collected during an interview by use of a self-report questionnaire (Physical Activity and Disability survey [PADS]) (25) and by a pedometer. Life satisfaction was assessed with the Life Satisfaction Questionnaire (LiSat-11) (26). Data on personal and environmental factors, such as age, sex, self-reported height and weight (to calculate their body mass index, BMI), marital status, housing, living condition and vocational situation, were obtained from the PADS and a study-specific questionnaire, and data regarding age at the acute polio infection were retrieved from the database at the rehabilitation clinic.

Physical Activity and Disability survey (PADS*)*

PADS is a 31-item self-report questionnaire developed to provide a measure of the day-to-day level of PA in people with disabilities (25). It consists of three parts, the first focusing on demographic data, the second comprising four subscales focusing on exercise, leisure, household activities, work/school, and the third part describing whether they received therapy or used a wheelchair. In the first part the participants rated their perceived use of their upper (UEX) and lower extremities (LEX), respectively, using the following three-point scale: no use (0); partial use (1); and full use (2). In addition the participants reported the type and use of mobility devices, and/or orthotics used during ambulation.

In the second part the participants were asked about their PA behavior in the four subscales which covered the following four areas: 1) structured exercise (exercising at a specific time of day on a regular basis with an emphasis on improving fitness); 2) leisure time physical activity (unstructured physical activity performed on an infrequent basis, such as bowling, going for an occasional walk, and not focused on fitness); 3) indoor and outdoor household activity (indoor activities, such as dusting, mopping floor, doing laundry, and outdoor activities such as gardening and maintenance); 4) work-related activity (activities during work) (27). The participants were asked to report the amount of time spent performing PA within each area during the last year. Data were then converted into minutes per day for each subscale. In the third part the participants reported whether they had received therapy or used a wheelchair for transportation. Since no participants received therapy or used a wheelchair regularly, these subscales were not included in the analysis.

The original PADS has displayed good psychometric properties and good test-retest reliability in persons with disabilities and chronic health conditions such as stroke, multiple sclerosis and diabetes (27, 28). The PADS has been shown to correlate significantly with peak oxygen uptake (25) and is sensitive to pre and post changes in PA levels after specific interventions (27). Cronbach's alpha (internal consistency reliability) has ranged from 0.67 (exercise) to 0.77 (household activities). Test-retest reliability (intra-class correlation coefficient, one-week interval) was 0.95 for leisure time PA and inter-rater reliability has ranged from 0.92 (household activities) to 0.99 (exercise, leisure time and total). PADS was translated and adapted into Swedish in collaboration with its developer (JH Rimmer) using a forward-backward translation and monolingual test (29).

Pedometer

A pedometer (Yamax SW 200) was used to measure the number of steps during three ordinary days (weekdays as well as weekends). The Yamax pedometer is considered to have good validity and reliability (30). Although no study has validated the use of a pedometer for people with late effects of polio, available evidence suggests that pedometers are valid for use in clinical and research settings in people with physical disabilities (31, 32). The participants were carefully instructed on how to wear the pedometer, clipped to their clothing (either side) and close to the anterior iliac spine, from the time they woke up to the time they went to bed. The participants recorded their daily counts and then reset the pedometer each morning. The pedometers were returned by post in a prepaid envelope, together with the records of their daily counts. From these counts, the mean number of steps per day was calculated.

Life Satisfaction Questionnaire (LiSat-11)

LiSat-11 is an 11-item generic self-report checklist that assess the level of global satisfaction with life in one item and the level of domain-specific satisfaction in 10 items (26). Only the item assessing level of global satisfaction with life was used here. Responses were given on a six-graded scale: very satisfied (6), satisfied (5), rather satisfied (4), rather dissatisfied (3), dissatisfied (2), and very dissatisfied (1). Higher scores indicated a higher level of global satisfaction with life. In agreement with the developer the responses were dichotomized for each participant as “satisfied” (very satisfied and satisfied) and “not satisfied” (from rather satisfied to very dissatisfied). LiSat-11 has a stable construct and is pragmatically sound (26), and has been used to assess life satisfaction in Swedish persons with late effects of polio (17, 20, 21).

Procedure

All participants were interviewed by the first author. The interview took 30 to 45 minutes. The interview started with the study-specific questionnaire, followed by LiSat-11 and ended with PADS. After the interview, each participant received information about the pedometer, how to use it and how to record their daily counts.

Data analysis

All variables were analyzed with descriptive statistics. From PADS, the sum of PADS and data from the four subscales (exercise, leisure, household activities and work) were used in the

statistical analyses. For the sum of PADS and data from the four subscales, the number of steps, and the level of global satisfaction with life (LiSat-11), differences between groups (sex, marital status, housing, living condition, vocational situation and use of mobility device) were tested with the independent samples t-test for continuous variables and Mann-Whitney U Test for ordinal variables. Relationships between sum of PADS and the four subscales, number of steps, level of global satisfaction with life (LiSat-11), and age were calculated with Pearson's correlation coefficient for continuous variables and Spearman rank correlation coefficient for ordinal variables. Significance levels less than 0.05 represented statistical significance, whereas values greater than 0.05 were considered not significant. All data were analyzed using IBM SPSS Statistics version 20 (IBM Corporation, Armonk, New York, United States).

Results

Characteristics of the study population

Table 1 presents the sociodemographic characteristics of the 81 men and women with late effects of polio. The mean age of the participants was 67 years, 47% were women, 61% received an old age pension, 35% were employed and 75% were married or cohabiting. About half of the participants rated that they had full use of their LEX and 72% they had full use of their UEX. Twenty-six percent used mobility devices and 26% used ankle foot orthotics during ambulation.

Insert Table 1 about here

PADS

In Table 2, the levels of PA, as assessed by the PADS and the pedometer, are presented. There was a large variability between the participants in their amount of PA. All participants reached the recommended level of 150 minutes of PA per week as stated by the WHO. When combining all forms of PA (exercise, leisure, household, work-related), the participants were active on average 158 minutes per day (SD 91); 73% of the activities were performed within household activities (mean value 116 minutes), 16% in leisure time activities (mean value 26 minutes), 6% in exercise (mean value 9 minutes), and 5% in work (mean value 8 minutes). Forty-nine participants (60%) reported regular exercise; the most common exercises were aquatics, and aerobics and strength training classes. Fifty-five participants (68%) reported regular leisure activities, mostly walking and biking.

There were significant differences between men and women for the leisure ($p<0.01$) and household subscales ($p<0.05$); men spent significantly more time in leisure activities and women significantly more time in household activities. In addition, participants living in a single family house spent significantly ($p<0.05$) more time in household activities than participants living in an apartment. The sum of PADS as well as all subscales were significantly ($r=0.22$ to -0.40, $p<0.05$) related to increasing age; the level of PA was higher in persons who were older.

The participants walked on average 6212 steps per day (SD 3208, 122 to 16 016). A majority (86%) walked less than 10 000 steps per day and 37% walked less than 5000 steps per day, but there were no significant relationship between the number of steps and age. There was a significant difference in the number of steps between persons who used or did not use a mobility

device ($p<0.05$); persons who did not use a mobility device walked more than those who used a mobility device.

Insert Table 2 about here

LiSat-11

Fifty-six participants (69%) rated themselves as satisfied with life as a whole. Participants that were married or cohabitant rated significantly higher life satisfaction ($p<0.01$). Participants living in a city were significantly more satisfied with life than those living in a small town or a rural surrounding ($p<0.05$). There was no significant relationship between life satisfaction and age.

Relationship between variables

The sum of PADS was positively and significantly related to the number of steps ($r=0.39$, $p<0.001$) and with the level of global satisfaction with life ($rho=0.23$, $p<0.05$). The number of steps was also positively and significantly associated with level of global satisfaction with life ($rho=0.37$, $p<0.001$).

Discussion

PA, including sports or planned exercise as well as leisure-time activities, transportation, occupational and household chores, is an important factor for improving health and preventing secondary conditions across all ages and level of functioning. In this study, our main aim was to describe levels of PA among community dwelling ambulatory persons with mild to moderate late effects of polio. We also examined relationships between PA, sociodemographic factors and life satisfaction. The amount of PA varied considerably but on average the participants were physically active almost three hours per day, mostly in indoor and outdoor low-level activities such as doing laundry and gardening. The amount of steps also varied considerably. Their perceived level of global satisfaction with life was higher the more active the participants were, and older participants also tended to be generally more active.

Promoting a healthy and active lifestyle in persons with late effects of polio is recommended, but due to their disability many individuals are unable to participate in more moderate or vigorous level of PA. However, several studies have shown that low levels of PA spread across the day can have substantial health benefits (33, 34). Therefore, many people with late effects of polio can benefit from lower intensity PA across the day. The average daily PA time, as assessed with PADS, indicates that persons with late effects of polio who are able to walk are physically active mostly within household activities which is consistent with one previous study (23). The recommendations about PA by the World Health Organization (WHO) include household chores, but they have to be at least moderate in intensity and performed in bouts of at least ten minutes in order to be beneficial for health (4). Many domestic activities can, however, be as strenuous as walking, and women in this age group seem to spend more time in domestic activities (35). It is reasonable to assume that for many of the participants, especially those with more pronounced disability, engaging in household activities can contribute a fairly large volume of PA across the day. Thus, questionnaires that do not measure activities of domestic life will probably underestimate total daily PA, especially among older women (36).

Based on the total sum of PADS, all participants met the WHO recommendations of 150 minutes per week and 43% of the participants were active more than 30 minutes per day in the exercise and leisure activities combined. However, since most of the activities are indoor and outdoor low-level activities, we believe that this is not sufficient to reject our hypothesis that persons with late effects of polio do not reach the WHO recommendations. Since the intensity of

the activity is only rated in the exercise subscale, and it is not clear whether they met the health recommendations of engaging in moderate to vigorous PA a minimum of 30 min per day most days of the week (4). Although two thirds of the participants exercised regularly, the average volume was quite low (9 min per day day). Aquatic exercise was the most frequent form of exercise but was only performed by 35% of participants for one hour once a week. Aquatic exercise is commonly recommended for persons with late effects of polio because the water provides resistance but minimizes biomechanical stress on muscles and joints (37).

Previous studies using PADS in persons with different disabilities have reported widely varying rates of total PA time. People with osteoarthritis (38) reported a mean total PA time of 186 minutes per day compared to only 27 minutes per day in a stroke population (27). These differences may be related to a number of factors, including severity of the disability and associated health conditions, interest and motivational level, and environmental factors. The recall period for PADS is one year which may affect the accuracy of data, but on the other hand makes it possible to compare levels of PA during all seasons of the year. Seasonal differences in activity have been shown in persons with late effects of polio and the winter is usually the least active season (39).

An interesting finding was that the level of PA was generally higher with increasing age. This indicates that older people with late effects of polio tended to be more, not less, active with increasing age. Thus, our hypothesis of decreased levels of PA with increasing age could not be supported. We also found a significant and positive correlation between increasing age and the amount of time spent in leisure. Two-thirds of the participants took part in leisure activities and the most frequently reported leisure activity was walking. This rate of participation was higher than a previous study on younger persons (mean age 56 years) with late effects of polio, which reported a lower rate of leisure participation (51%) (40). One possible explanation for the higher amount of leisure PA reported by our cohort with late effects of polio is that fatigue is a common and disabling symptom (17). This has been shown to contribute to the prediction of physical functioning in persons with late effects of polio (41). After retirement, people with late effects of polio could possibly spend more time in leisure activities as they have more energy than at the time they were working. It is notable that increasing age may not necessarily lead to a less active life style, despite a disability.

Participants also wore a pedometer to obtain a more objective measure of PA. The mean value of 6212 steps per day among the participants is similar to a study by Klein et al. (39). They

assessed 65 persons with late effects of polio (mean age 63 years) and similar degree of disability, and the mean number of steps was 6450 per day (39). We also found that the number of steps was significantly lower in those who used a mobility device. This was expected as participants who used a mobility device have greater difficulty with ambulation, which would then explain their lower PA. In a review of studies assessing expected values for steps per day in persons with neuromuscular diseases, the mean number of steps varied between 4324 and 8756 (mean 6006) (42), which is in line with our results. Even though walking was the most common activity among the participants in the present study, only a small proportion actually met the proposed recommendations of 8000 to 10000 steps per day (43). The majority of our sample is thereby considered "low active" according to Tudor-Locke et al. (43). These authors suggested that 3000 to 4000 steps are needed for daily activities and that less than 5000 steps per day are considered sedentary in healthy adults. In the present study, 37% of participants had a mean value less than 5000 steps per day. Pedometers are considered less valid during slow walking which may have affected our results (30, 32). In addition, pedometers may undercount the number of steps in people with neurological disabilities (31), which means that the participants' daily number of steps could have been somewhat higher. Thus, based on proposed recommendations, a majority of people with late effects of polio do not reach this target.

Life satisfaction is defined as a person's experienced contentment with life (44). Sixty-nine percent of the participants were satisfied (very satisfied or satisfied) with life as a whole and their life satisfaction was positively related to both their PADS score and daily steps. This supports our third hypothesis of an association between PA and life satisfaction. PA is known to have an impact on health-related quality of life (11) and explain a small amount of variance in depression (45), but the association with life satisfaction is not as obvious in persons with chronic disabling conditions (11). Life satisfaction is a complex construct and how PA affects it is less evident (11). Given its importance as an overall goal in rehabilitation and in the management of people with life-long disabilities, further studies in this field are warranted (17).

There were a few limitations in this study. PADS has not been used in people with late effects of polio and have not been tested for reliability and validity in this population. However, PADS is developed for persons with disability and sedentary behaviour and considered generic. Our sample could be considered to have mild to moderate disability and was ambulant with or without mobility devices and/or orthotics, which restricts the generalizability of our results to the entire population of persons with late effects of polio.

Conclusion

Despite a progressive physical disability, people with late effects of polio are physically active, but much of the activities are performed as part of their household activities and not as traditional exercise. This knowledge is important when promoting PA among people with physical disabilities in their effort to adopt a healthy and active lifestyle. The relationship between PA, life satisfaction and age further supports the general contention that an active lifestyle is an important factor for perceived well-being among older adults.

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Table 1. Demographics of the 81 participants with late effects of polio

Sex, female (%)	47
Age, mean (SD)	67 (6)
Body Mass Index, mean (SD)	26.9 (4.1)
Age at acute poliomyelitis infection (years), mean (SD)	4 (3)
Self-rated perceived use (%)	
Full use of upper extremities	72
Full use of lower extremities	44
Mobility devices and orthotics (%)	
Walking aids	26
Ankle foot orthotics	26
Marital status (%)	
Married or cohabiting	75
Single living	25
Vocational situation (%)	
Working full time or part time	35
Disability pension	17
Old age pension	65
Type of housing (%)	
Single family house	69
Apartment	31
Living condition (%)	
City	38
Small town	47
Rural	15

Table 2. Physical activity described by the Physical Activity and Disability Survey (PADS) in minutes per day and by pedometer in number of steps per day in 81 persons with late effects of polio

	Men n=43			Women n=38			Differences between men and women
	Mean	SD	Range	Mean	SD	Range	
PADS							
Exercise	10	21	0-120	7	7	0-26	ns
Leisure	34	43	0-169	16	20	0-89	$p<0.05$
Household	100	65	17-300	133	78	26-397	$p<0.05$
Work	4	10	0-39	13	43	0-249	ns
Sum of PADS	151	88	17-383	167	95	48-438	ns
Pedometer							
Steps per day	6610	3541	122-16016	5772	2775	1047-11549	ns

ns; non-significant