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# **THE PERCEPTION OF PHYSICAL ACTIVITY IN AMBULATORY PERSONS WITH LATE EFFECTS OF POLIO: A QUALITATIVE STUDY**

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Short title: Late effects of polio and physical activity

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## **ABSTRACT**

Maintaining regular physical activity (PA) can be challenging for persons with late effects of polio. This qualitative study of ambulatory persons with late effects of polio explored their perceptions of PA, and facilitators of and barriers to PA. Semistructured interviews were conducted with 15 persons and analyzed with content analysis using the International Classification of Functioning, Disability and Health (ICF) as framework. The participants described positive perceptions of PA and its health benefits. PA was used to prevent further decline in functioning, and the type and frequency of activities had changed over time. Past experiences and personal characteristics impacted on PA. Support from close relatives, knowledgeable health care professionals, mobility devices and accessible environments facilitated PA, whereas impairments, inaccessible environments and cold weather were the main barriers. To perform PA regularly, persons with late effects of polio may benefit from individualized advice based on their disability, personal and environmental factors.

Keywords: Exercise; Interview; Post poliomyelitis syndrome; Qualitative research; Rehabilitation

## INTRODUCTION

Approximately 12% to 20% of the population in the world live with a disability (World Health Organization, 2014) and many of them are living years beyond retirement age (Kemp, 2005; World Health Organization, 2014). A central issue for persons aging with a disability is how to pursue a healthy and active lifestyle to maintain functional independence, avoid secondary complications and increase life satisfaction. In addition, there is a need to find a balance between the management of health conditions associated with the primary disability and the health effects associated with the aging process (Rimmer, 2005). An important component in a healthy lifestyle is physical activity (PA), defined as any bodily movement that increases the energy expenditure above a basal level (Caspersen, Powell, & Christenson, 1985). However, it may be challenging for persons with a disability to be physically active, partly because of their physical condition, but also due to personal and environmental barriers (Boslaugh & Andresen, 2006; Ellis et al., 2013; Mulligan, Hale, Whitehead, & Baxter, 2012).

One group of persons aging with a physical disability is those with late effects of polio. Around 20 to 40 years after the acute polio infection, new impairments such as muscle weakness, muscle fatigue, general fatigue and musculoskeletal pain may occur, partly due to the effects of neuromuscular aging (Lexell, 2014; Trojan & Cashman, 2005). It is estimated that 12-20 million persons worldwide have late effects of polio and in Sweden about 15 000 to 20 000 persons are living with this condition (Lexell, 2014). These new impairments can reduce the ability to perform daily activities and to be physically active. The possibility of being physically active is also influenced by the remaining impairments from the acute phase. Persons with late effects of polio can therefore be deconditioned because of a sedentary lifestyle due to their disability (Stuifbergen, Seraphine, Harrison, & Adachi, 2005).

Achieving and maintaining a healthy and active lifestyle with regular PA is emphasized in the management of their disability (Stuifbergen et al., 2005). PA is

recommended to be individually adapted, and this group may need longer time to recover after PA and pace themselves in order to manage fatigue and pain (Lexell, 2014). The level of PA varies considerably in this population and is mostly performed within low-level intensity activities such as household chores and leisure (Klein, Braitman, Costello, Keenan, & Esquenazi, 2008; Willen & Grimby, 1998; Winberg, Flansbjer, Carlsson, Rimmer, & Lexell, 2014). Previous studies have shown that self-reported impairments, in particular muscle weakness, walking ability, and fear of falling are only weakly to moderately associated with PA (Winberg, Brogardh, et al.; Winberg, Flansbjer, Rimmer, & Lexell). Fatigue and other impairments, as well as environmental barriers such as inaccessible environments and a lack of understanding among health care providers, have been reported as barriers to PA and health promotion in persons with late effects of polio (Becker & Stuifbergen, 2004; Harrison & Stuifbergen, 2001; Stuifbergen, 2005).

Thus, the weak to moderate association between impairments and activity limitations underscores the need to further explore the interaction between PA, functioning, disability, environmental and personal factors. This interaction can be conceptualized by the International Classification of Functioning, Disability and Health (ICF) (World Health Organization, 2001). The ICF has been used to describe the perceptions of PA in persons with Parkinson's disease (Ravenek & Schneider, 2009) and facilitators of and barriers to PA in persons with spinal cord injury (Vissers et al., 2008). To the best of our knowledge no study has described the interaction between PA, functioning and disability and contextual factors (environmental and personal factors) in persons with late effects of polio.

Knowledge of the perception of PA and facilitators of and barriers to PA is important when providing health advice and recommendations on PA to persons with late effects of polio. Therefore, the aim of this qualitative study was to explore the perception of

PA and factors that could be perceived as facilitators of and barriers to PA in ambulatory persons with late effects of polio.

## **PARTICIPANTS AND METHODS**

### **Participants**

Fifteen participants, all with a confirmed history of acute poliomyelitis and with new impairments after a period of functional stability, were recruited from a post-polio clinic at a rehabilitation centre in the south of Sweden. The recruitment was made from a previous study including 81 participants (Winberg et al., 2014). To be included in that study the participant had to meet 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; ambulatory with or without mobility devices; living in ordinary housing; able to understand verbal and written instructions in Swedish. The exclusion criteria were: no other conditions such as severe joint problems, cardiovascular or pulmonary diseases that could affect mobility and PA; and not using a wheelchair as the main mode of transportation. The study was approved by the Regional Ethical Review Board in Lund, Sweden (Dnr 2013/403). The Consolidated Criteria for Reporting Qualitative Studies (COREQ) was used as guideline in design and analysis (Tong, Sainsbury, & Craig, 2007).

In the present study a wide range of experiences were sought by selecting participants of different gender, ages, functional level, PA level and vocational situation. Twenty potential participants were contacted by mail; eight men and seven women agreed to participate (aged 60 to 78 years, mean age 68 years). Five persons declined without giving a reason. In Table 1 the characteristics of the 15 participants are described. They were on average 4 years old at the time of their acute poliomyelitis and the time since onset of new symptoms was 6 to 31 years (mean 17 years). All participants were ambulatory, affected in

their lower limbs and four participants used a mobility device during walking. Two participants used an electric scooter outdoors. According to previously collected data (Winberg et al., 2014), the variation in PA was high, both regarding type of PA and the amount of time spent being physically active. The variation in daily number of steps ranged from 122 to 12 322 (mean 5918 steps) and were similar to the mean and range of the larger sample from which these participants were recruited. Three participants worked full-time or part-time and 12 received old age pension. All were cohabiting and of Scandinavian origin. Prior to study enrollment all participants signed an informed consent form.

*Insert Table 1 about here*

### **Data collection and procedure**

The data collection consisted of one individual interview with each participant. All interviews were undertaken during October to November 2013 and conducted by the first author. The first author had previously met all the participants and assessed them about their level of PA with a structured self-report measure (The Physical Activity and Disability Survey, Swedish version, PADS-S (Winberg et al., 2014)), but had no therapeutic relation with them. An interview guide (Appendix 1) with semi-structured open-ended questions was developed, based on the parts (and components) in the International Classification of Functioning, Disability and Health (ICF) – Functioning and Disability (Body Functions and Structures; Activities and Participation) and Contextual Factors (Environmental Factors, Personal Factors) (World Health Organization, 2001). The interviews focused on themes, such as the participants' perception of PA and factors perceived as facilitators of and barriers to PA. The interview guide was tested in two pilot interviews which resulted in minor modifications.



The interviews lasted between 30 and 60 minutes (mean 39 minutes) and were performed at a place chosen by the participant; eleven participants were interviewed in their own home and four participants at the first author's workplace. During one interview, the participant's spouse was present. At the end of each interview the first author summarized the interview and received feedback on the summary from each participant. They were also given the opportunity to add information and make clarifications if needed. The interviews were digitally recorded and transcribed verbatim, and then checked against the audiofiles for accuracy. After the 15 interviews, no new data emerged so the sample size was considered adequate to cover different aspects of PA in this population.

### **Data Analysis**

A qualitative content analysis was conducted (Hsieh & Shannon, 2005) and the analysis included several steps. The analysis was performed with an Excel spreadsheet, but no computer-assisted qualitative data analysis software was used. First, all interviews were read several times to acquire a sense of the essence (Graneheim & Lundman, 2004). Second, the text was divided into meaningful units consisting of a communicative act where the participants talked about their perception of PA and factors related to PA. An inductive approach was used to code each meaningful unit into a preliminary code, describing the perception of PA and facilitators of and barriers to PA. All the preliminary codes were studied and pooled into subcategories. In the next step a directed content analysis was used to sort the subcategories according to which part and component they mainly belonged to in the ICF. The interpretation of the text was carried out by the first author. The second author took part in the analysis process by having access to all raw data, and by discussing the findings with the first author throughout the process; her comments were accommodated throughout the analysis in order to refine the results and ensure the validity of the data. The findings were

validated several times by the other co-authors, and also discussed at a research seminar with other scientists with experience in qualitative methodology. Finally, the author and co-authors agreed on the findings. All authors are experienced in qualitative research, and the first author (who performed the interviews) has extensive experience interviewing patients with neurological disabilities.

## **RESULTS**

All subcategories that emerged from the transcripts could be fitted into the ICF parts and components. The results are schematically presented in Table 2 and further described below. The participants' number and age are added in brackets after each quote. Both positive and negative aspects of the different components (Body Functions and Structures, Activities and Participation, and Environmental and Personal Factors) are described.

*Insert Table 2 about here*

### **Functioning and Disability**

Four subcategories were identified as Functioning and Disability; the first was categorized as Body Functions and Structures while the remaining three were categorized as Activities and Participation.

### ***Impairments are the main barriers to PA***

The participants described the difficulty of staying physically active because of the progression of their late effects of polio. They experienced less flexibility, less endurance and had to rest more often because they were more tired and/or had more pain. *"I am reluctant to*

*walk, I like doing it but starting and getting going is difficult... suddenly I feel pain and then I have to sit down and rest somewhere.”(P#01, age 72)*

The participants emphasized that they were not afraid of being active, it was their impairments that were restraining them. They had to be physically active in other ways and had to adjust their PA with regard to their impairments due to their late effects of polio. It was important to find a balance, to adjust their activities and to find time to rest during the day in order to manage pain and fatigue. A woman described her thoughts regarding PA and her impairments.

*I try to rest. I try not to walk too far. I try to take the post-polio in consideration all the time. I am scared. What if I feel pain? What if my orthosis break? What if I forget my cane somewhere? It has happened. Then I can't move.” (P#10, age 64)*

### ***PA makes me feel in control of my disability***

A majority of the participants described how PA was used for maintaining health and the impact PA has on mental and physical health. They considered this as common knowledge and identified several health benefits, such as maintaining weight and a normal blood pressure and avoiding pain. PA was used to stay healthy but also to prevent further decline in functioning. They described the positive feelings about being physically active, both when they were performing PA and afterwards. It made them feel alert, happy and more content with themselves. *“I believe it's good to move, I think it's good for both your body and mind to be active and that's why I stay active.”(P#14, age 63)*

Several of the participants were afraid that if they stopped being physically active they would become sedentary and would then have to face the consequences of being sedentary which they perceived as unnecessary and scary. A woman who walked several days a week

described her rationale for being physically active. *“Of course I move, if not, I’ll stay sedentary and feel even more pain.”* (P#01, age 72)

### ***Changes in PA over time***

To enable PA, the type and frequency of activities had changed over time. The participants were not physically active as much as they used to be. For example, one participant who went for a swim every week, told how the distance had decreased over the past ten years. Some participants had stopped doing the type of PA they had done before. They had stopped dancing and playing tennis and now preferred other activities such as aquatics and going for a walk. These changes were described as consequences of increasing age and with the onset of their late effects of polio. The increasing impairments had made them change their performance. They were now less physically active, they chose shorter and more accessible paths to walk and they walked slower. *“It’s harder; we are walking but not as far as we used to and I’m trying to find other paths that are more suitable.”* (P#07, age 78)

### ***Finding time for PA***

The participants struggled to find time to be physically active. Those who were employed had to prioritize their work. After being at work they were tired and had no energy left for PA.

*“Work is the barrier, I would like to get out today in this nice weather, but work is a part of my life and I have to prioritize.”* (P#11, age 60)

The participants also acknowledged the possibilities to be physically active during work and how they tried to find opportunities to be physically active at work. They used to climb the stairs and to walk between meetings. Commuting to and from work was a facilitator as they had to walk to and from the train/bus station. One participant described that she was allowed to perform PA during work but that there was rarely time to do it. Several participants had busy schedules, regardless of whether they were working or were retired. The retired participants planned and tried to fit in PA in the form of leisure activities,

as they did not want to have too much planned but still prioritized PA. *“But I do not want to have too much planned, I think it is enough with the two planned activities (strength training and aquatics, authors’ remark) I have during the week.”* (P#05, age 66)

### **Contextual Factors**

Six subcategories were identified as Contextual Factors; the first four were categorized as Environmental Factors while the remaining two were categorized as Personal Factors.

#### ***Support from others keeps me active***

Support and relationships were important for being physically active. Spouses, friends and family members encouraged the participants to be physically active. Their spouses could tell them to take a walk and get them out of the house even if they did not want to. *“As long as we are two everything works, but if I was alone...nothing would work because then I would not have the same discipline.”* (P#07, age 78)

Having a dog was also a facilitator of PA and something that forced the owner to get out. Support from health care professionals was another facilitator of PA whereas lack of support was a barrier to PA. Some participants had received good support from health care professionals with knowledge of late effects of polio and advice how to be physically active with their disability. Other participants lacked this support and expressed that they wanted to be coached. They were afraid of over-exerting themselves and not sure what kind of PA to do. One participant described that when she went to the gym, she was left alone and lacked support from the instructor. As no one told her what exercises to do she felt uncertain and she only went to the gym once. *“At the gym someone was supposed to show me what to do but they did not bother and it felt bad, that may have affected me as I did not get what I needed.”* (P#09, age 64)

#### ***Accessible physical environments promote PA***

The physical environment was a facilitator of but also a barrier to PA. Being outdoors and having the opportunity to be physically active outdoors was considered a facilitator, and the closeness to an accessible nature was also appreciated and perceived as a facilitator to PA.

*“The forest near to our house is a fantastic opportunity with cycle tracks and paths for walking, it’s an advantage. Even in our neighborhood we have good opportunities to move around freely.” (P#11, age 60)*

The participants were physically active outdoors, mostly walking and biking. A man used the slope outside his home to increase his PA as he walked it up and down several times every day in order to increase his cardiovascular function.

The physical environment was also a barrier when it was inaccessible and the participants described how they had to focus on the ground in front of them when walking outdoors in order to avoid tripping and falling. They needed to be prepared for and avoid uneven surfaces. An accessible home was important and made it easier for the participants to be physically active when they were cleaning the house or cooking. One participant, who was sedentary, could not go to the gym since the dressing room was too large. He could not use the walls for support and because of that he could not get dressed or take a shower.

### ***Season and climate impact PA***

Seasonal changes and the climate were recognized as both facilitators of and barriers to PA.

The participants described their experience of the nature: the feeling of the wind on their cheeks, the warmth of the sun and the air. One participant who walked the dog daily described being outdoors as “charging the batteries”. On the other hand, the cold climate, the snow, the rain and the wind were perceived as barriers. One woman who was very active and walked daily tried to walk more frequently in the summer and the autumn as she was afraid to walk outside in the winter, because of ice on the ground and the low temperature. The slippery

surface made the participants tense and increased their fear of falling. *“When the snow comes it gets worse, I can’t walk as much even with ice creepers... I get more tense and my back starts hurting.”* (P#07, age 78)

Several of the participants were troubled by cold intolerance which had an impact on their possibility to be outdoors when the temperature was low. Others were physically active regardless of the weather and they wore clothes that were suitable for any type of weather.

### ***Mobility devices support PA***

Several participants used mobility devices, such as Nordic walking poles, canes and orthoses, that made them feel safe during PA. The mobility devices also made it possible for them to stay physically active and to continue to perform the activities they preferred; none of the participants specifically described that the mobility device impeded on their PA. *“Being outside in the nature makes it difficult to walk but I have a walking pole in my car that I use, three points that stick in the ground are better support than two.”* (P#03, age 61)

### ***Past experiences influence my view of PA***

PA was a habit for several of the participants and something they did not reflect upon, but when they did it, their past experiences had shaped their attitudes and views of PA. One participant did not take part in school gymnastics as a child and was sure that this had influenced her attitude to PA as she felt uncertain what to do. Several had been advised by health care professionals not to exercise as it may exacerbate their impairments and cause more harm than good. On the other hand, the majority of the participants had been brought up to be physically active. Their parents had wanted them to be physically active as children without polio. They had been active in terms of cycling, helping out on the farm, and walking in the forest with their parents. These experiences had shaped them to view PA as a normal

part of life. PA was acknowledged as something that persons without disability do, as something “normal”. They said that if they could do things that other persons could, it made them feel healthier. *“When my parents were asked about me taking part in school gymnastics they answered that of course he’ll participate, he should do everything that he’s able to do and I believe that’s shaped me because I’ve done everything.” (P#03, age 61)*

### ***My personal characteristics impact PA***

Personal characteristics were mostly described as facilitators for staying physically active. The participants expressed that they were motivated and had an interest in PA. They considered themselves as optimistic, stubborn and lively. *“I’m a positive person and don’t consider the negative side of things but try to see the positive side of everything.” (P#03, age 61)*

However, personality could also be a barrier, as some participants were not motivated to be active and considered PA as boring. Another barrier to PA, described by one woman, was an uncertainty of where to belong and a feeling of not fitting in. Exercising together with persons with a disability made her feel more disabled and exercising together with persons without a disability made her feel uncomfortable. When she had to change clothes in a public area she felt uncomfortable, as she did not want to show her orthosis.

## **DISCUSSION**

For persons aging with a physical disability, it may be challenging to be physically active, partly because of the disability itself, partly because of the interplay between the disability, and environmental and personal factors. This is, to the best of our knowledge, the first study that has explored the perception of PA and related factors in persons with late effects of polio. By using the ICF as a framework in the analysis the complexity of being physically active could be structured and elucidated. Both facilitators and barriers were identified and



sometimes described as opposites to each other in most of the components (Activities/Participation, Environmental and Personal Factors), except for Body Functions/Structures where only barriers were identified. The participants had in general a positive perception of PA and its health benefits. PA was used to prevent further decline in functioning, and the type and frequency of activities had changed over time. Past experiences and personal characteristics impacted on PA. Support from close relatives, knowledgeable health care professionals, mobility devices and accessible environments facilitated PA, whereas impairments, inaccessible environments and cold weather were the main barriers. Other general aspects that were of importance for performing and maintaining PA, were motivation, accessible environments and support from others.

Their increased impairments and the progression of their condition were the main barriers to PA and expressed as reasons for changing the type and frequency of PA. The consequences of the common impairments in this population, i.e., pain, fatigue and cold intolerance, were evident in the interviews. Impairments and the level of disability have previously been described as barriers to PA, both in persons with late effects of polio (Becker & Stuifbergen, 2004) and in persons with other disabilities (Mulligan et al., 2012; Phillips, Flemming, & Tsintzas, 2009). However, the impairments were also a reason for being physically active, as PA counteracted them and prevented further decline. PA was thereby a tool for maintaining health and for managing their health condition and well-being. The participants were well aware of the health benefits of PA, which also increased their motivation for performing it.

The participants' willingness to change their PA over time and the strategies they developed to enable PA also emphasize that motivation is an important facilitator of PA. Persons living with late effects of polio are experienced in using coping strategies (Atwal et al., 2014; Hollingsworth, Didelot, & Levington, 2002; Wenneberg & Ahlstrom, 2000), which

have been described in relation to daily activities (Thorén Jönsson, Möller, & Grimby, 1998) but not specifically in relation to PA. Adaptation processes in relation to PA and increasing impairments have, however, been described for older adults in general (Janssen & Stube, 2014). This warrants further research in order to explore coping strategies in relation to PA in persons with late effects of polio.

Past experiences and personal characteristics were personal factors that impacted two-fold. Past experiences had shaped their perception of and engagement in PA. However, the narratives concerning the participants' past experiences were contradictory. A majority had been raised to be physically active and told to do the same things as children without prior polio. On the other hand, many participants had been advised by health care professionals later on in life not to exercise as it was thought to exacerbate their impairments and cause more harm than good. This contradictory advice was evident in some reflections when the participants described an uncertainty about what to do and a fear of over-exerting themselves. Childhood experiences affect PA depending on the nature of the experiences; positive experiences have a positive impact as described above, whereas negative experiences, i.e., discomfort and lack of meaningfulness impact negatively (Sandstrom, Samuelsson, & Oberg, 2009; Schutzer & Graves, 2004). Their childhood experiences and their disability have affected their personality which is often characterized by overachievement and a strong will to fit in, commonly described as a "polio personality" (Atwal et al., 2014; Thoren-Jonsson & Grimby, 2001).

The participants wanted to achieve a lot during a day, which was evident when they reflected upon busy schedules and the need to prioritize PA. However, for persons with late effects of polio it is essential to find a balance and to plan ahead, as too much PA could impact on specific impairments (Willen & Grimby, 1998). It is therefore important to prioritize and plan carefully, which may result in a loss of spontaneity (Atwal, Giles,

Spiliotopoulou, Plastow, & Wilson, 2013). This needs to be taken into consideration by health care professionals when giving advice to persons with late effects of polio regarding PA.

Environmental factors also affected PA. Social support from family and friends directly facilitated participation and encouraged PA, and health care professionals gave advice and/or shared their knowledge, whereas the opposite constituted barriers. Advice about PA needs to be individualized for persons with late effects of polio and professionals need to have a detailed knowledge about the specific impairments that this group have (Tiffreau et al., 2010; Willen & Grimby, 1998). Fatigue, pain and overexertion have to be avoided and there is a need for regular evaluation and individual adaption (Tiffreau et al., 2010). Support from others facilitates PA in persons with neurological disabilities (Bauman et al., 2012; Fuller, Stewart Williams, & Byles, 2010; Vissers et al., 2008), whereas the opposite, i.e., lack of support and lack of knowledge, is a barrier to PA in persons with late effects of polio (Stuifbergen et al., 2005).

The physical environment and the seasonal changes were both facilitators of and barriers to PA. The participants preferred being physically active outdoors and in addition to health benefits they enjoyed experiencing nature and its diversity. Mobility devices were consciously used for support and none of the participants described that their mobility devices impeded on PA. Thus, mobility devices seem to improve activity, participation and increase mobility for persons with disability (Salminen, Brandt, Samuelsson, Toytari, & Malmivaara, 2009).

Well-being and self-perceived health are promoted by engaging in PA outdoors in a healthy population (Bowler, Buyung-Ali, Knight, & Pullin, 2010). Although the interplay between PA and the environment is well known, the physical environment as a facilitator of PA has not been described previously in persons with late effects of polio. The interplay

between PA, leisure activities and outdoor environments is therefore an interesting area for future research.

Inaccessible physical environments were described as a barrier to PA. This has previously been described for persons with late effects of polio (Becker & Stuifbergen, 2004) as well as for many other groups of persons with disabilities (Mulligan et al., 2012; Phillips et al., 2009). An accessible physical environment facilitates PA for several groups of persons with disabilities, which has to be considered in the planning of public areas. Another barrier was the seasonal changes that were considerable as this study was performed in Sweden, where seasonal variations are noticeable. Cold temperature, shorter daylight hours and the potential risk for ice and snow affect the possibility to be physically active for everyone. Persons with late effects of polio are often bothered by cold intolerance, which to a greater degree impacts on their possibility to be physically active during the winter. This was evident in the results and the level of PA was lower during the winter because of the interplay between cold intolerance and seasonal variations.

### **Methodological considerations**

All participants were ambulatory and between 60 and 80 years of age, but had different experiences of PA and the variation in PA level was high. The strength of this study is therefore the heterogeneity in PA level. However, all participants were ambulatory with a mild to moderate disability and this can be considered a limitation. Participants with a broader spectrum of disability may have contributed to a greater understanding of the perception of PA and increased transferability. The participants were recruited from a larger study describing PA where they previously had been interviewed by the first author. This could be considered a strength as it most likely contributed to the depth in the interviews.

Data were collected by semi-structured open ended questions during individual interviews. The semi-structured interview gave the participants the opportunity to freely describe their perceptions, and additional questions could be asked. At the planning stage the questions in the interview guide were discussed between the authors until consensus was reached. Individual interviews were considered more appropriate as it reduces the risk for social desirability because the participants are not influenced by thoughts and ideas from others (Streiner & Norman, 2008).

Data were analysed using a directed content analysis where the main strength is that an existing model can be supported and extended (Hsieh & Shannon, 2005). The ICF framework has previously been used to describe facilitators of and barriers to PA in persons with various neurological conditions (Mulligan et al., 2012; Ravenek & Schneider, 2009; Vissers et al., 2008). The ICF covers all aspects of a disability and is therefore suitable for describing the complexity in PA, as well as the interplay between PA and contextual factors (Rimmer, 2006). The complexity of PA and the interplay were challenging throughout the analysis when forming the subcategories based on the ICF. Throughout the process the authors have been transparent in the data collection and the data analysis in order to achieve trustworthiness and neutrality (Graneheim & Lundman, 2004). The results are presented with the participants' quotes in order to attain dependability and are well grounded in data, thereby achieving confirmability (Graneheim & Lundman, 2004).

### **Summary and conclusion**

Persons with late effects of polio described positive perceptions of PA and its health benefits despite their disability. PA was used to prevent further decline in functioning, and over time the type and frequency of activities had changed. The participants also reflected upon their energy left for PA and struggled to find time to be physically active. Personal factors, such as

past experiences and personal characteristics, had an impact on PA. Environmental factors, such as support from close relatives, knowledgeable health care professionals, mobility devices and accessible environments, were reported as facilitators of PA. The impairments, inaccessible environments and cold weather were the main barriers to PA. Thus, the perception of PA and related factors is complex and multifactorial. To perform PA regularly, persons with late effects of polio may benefit from individualized advice based on their disability, personal and environmental factors. Individual advice may comprise increased knowledge about: the positive effects of PA, that activities that increase energy expenditure are considered as PA, the importance of finding a balance between PA and rest, the need of adjusting the intensity level of PA if fatigue and pain occur after PA, and that strength training for muscle groups not affected by polio may be beneficial.

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### **Declaration of interest**

The authors declare that there were no competing interests in the current study.

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**Table 1.** Characteristics of the 15 participants with late effects of polio

Participant	Gender	Age (years)	BMI <sup>a</sup>	Age at onse t of polio	Years with late effects of polio	Mobility device	Orthosis	Amount of daily physical activity <sup>b</sup> (minutes)	Daily steps <sup>c</sup> (mean number)
01	Female	72	24	12	20			438	10798
02	Female	71	23	3	23		AFO <sup>d</sup>	188	10158
03	Male	61	21	6	22			180	12322
04	Male	62	32	4	18	rollator	AFO	63	122
05	Female	66	27	9	27			204	4814
06	Male	74	27	0	16			30	498
07	Female	78	23	1	11			222	6399
08	Male	73	26	3	16			193	3964
09	Female	64	23	6	18			51	4387
10	Female	64	28	5	21	cane		57	6633
11	Male	60	23	6	10	rollator		106	1861
12	Male	73	19	7	15			244	4286
13	Male	65	30	2	6		AFO	163	10778
14	Female	63	25	1	31	cane	AFO	92	3430
15	Male	64	28	1	13			156	8325

<sup>a</sup> BMI, Body Mass Index<sup>b</sup> Assessed by PADS, Physical Activity and Disability Survey (Winberg et al, 2014)<sup>c</sup> Assessed by a pedometer<sup>d</sup> AFO, Ankle Foot Orthoses

**Table 2.** An overview of the perception of physical activity (PA), and factors that could be perceived as facilitators of and barriers to PA in 15 participants with late effects of polio. The International Classification of Functioning, Disability and Health (ICF) was used as a framework when data were analyzed.

ICF Parts		Functioning and Disability		Contextual factors	
ICF Components	Body Functions and Structures	Activities and Participation	Environmental factors	Personal factors	
Subcategories	<i>Impairments are the main barriers to PA</i>	<i>PA makes me feel in control of my disability</i>	<i>Support from others keeps me active</i>	<i>Past experiences influence my view of PA</i>	
		<i>Changes in PA over time</i>	<i>Accessible physical environments promote PA</i>	<i>My personal characteristics impact PA</i>	
		<i>Finding time for PA</i>	<i>Season and climate impact PA</i>		

*Mobility devices*

*support PA*

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