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Year: 2022

Version: Accepted version (Final draft)

The effects of technology-utilizing rehabilitation on rehabilitees' physical activity: a prospective cohort study

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The views expressed in the submitted article are our own and not an official position of the institution or funder.

This work was supported by the Social Insurance Institution in Finland under Grant [Dnro84133112016].

Word count: 5116/article, 238/abstract

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Abstract

Purpose

The aim of this study was to investigate the effects of technology-utilizing rehabilitation on different intensities of physical activity (PA) and determine the explanatory factors of PA change.

Material and methods

This was a prospective cohort study. Cardiac, musculoskeletal and vocational rehabilitees (N=36) had six months of rehabilitation, which included guided training and counselling face-to-face as well as through distance technology. PA (total, light, moderate, vigorous) was measured by an activity tracker. Biopsychosocial questionnaires, waist circumference, PA measurements and m-coach activity were used to determine the factors that influence PA change.

Main results

Technology-utilizing rehabilitation improved light PA (+20 min/d, 95% CI 4-35min/d p=0.002). Within subgroups, only cardiac rehabilitees improved their light physical activity (LPA) (p=0.014), but the change was not significantly different compared with subgroups. There were no differences in the change in moderate, vigorous or total PA in either the study group or the subgroups. The improvement of LPA was related to lower age (p=0.004) and lower activity (p=0.004) at the baseline, impairments in experienced psychological health (p=0.016) and satisfaction with social relationships (p=0.014), improved satisfaction with environment (p=0.002), strengthened significance of exercise (p=0.037) and weakened pleasure of exercise (p=0.040). The model explained 47% of the variation in the change in LPA.

Conclusion

Technology-utilizing PA training seems to be a complex phenomenon in the rehabilitation context that is related to both biopsychosocial and environmental factors. This should be considered in future PA research and rehabilitation.

Keywords: distance technology, rehabilitation, physical activity, cardiac rehabilitee, musculoskeletal rehabilitee, vocational rehabilitee

Introduction

The benefits of reducing inactivity in society include enhancing productivity and decreasing health care costs (1,2). Recommendations for physical activity (PA) state that an adult should engage in moderate physical activity (MPA) for 150 minutes per week or engage in vigorous physical activity (VPA) for 75 minutes per week and strength training twice a week to diminish health risks substantially (1). PA recommendations can also be met by doing combination both MPA and VPA. Globally, 27.5% of people are insufficiently physically active. This insufficient PA rate has been stable since the turn of the century (3). The prevalence of insufficient PA is more than double in high-income countries (36.8%) compared to low-income countries (16.2%). Insufficient activity in high-income countries has increased over the last 15 years (3). For example, in Finland, only 10,8% of the population engages in the recommended amount of PA (4).

Recent studies have shown promising results regarding distance technology as an activator in the field of rehabilitation (1, 2, 5). There is only moderate or weak evidence for the effectiveness of distance technology in the physical activation of rehabilitees (2, 5). Based on previous studies, there needs to be some theory-based guidance for behavioural change combined with technology-based PA interventions (1, 2, 5). There is a lack of knowledge about the effects of technology-based interventions on different intensity levels of PA. Additionally, it is uncertain which type of distance technology is the most effective (2) and which rehabilitation groups would benefit the most from distance technology (1, 2, 5). There is limited evidence suggesting a positive effect of distance technology among individuals with type 2 diabetes and musculoskeletal disorders (1).

The purpose of this study is to examine the effect of technology-utilizing rehabilitation within and between cardiac, musculoskeletal and vocational rehabilitation patients. The effects were examined for LPA, MPA and VPA as well as for total PA. In addition, the study aimed to explore the factors that influence activity change during technology-utilizing rehabilitation.

Materials and methods

i. Study design and Setting

This was a prospective cohort study. Rehabilitees (n=36) had intervention, which included guided training and counselling face-to-face as well as through distance technology over 6 months. PA (total, light, moderate, vigorous) was measured by an activity tracker in the beginning and in the end of 6 months intervention. Biopsychosocial questionnaires, waist circumference, PA measurements and activity of using distance technology were used to determine the factors that influence PA change.

Rehabilitation intervention included standard rehabilitation course by The Finnish Social Insurance Institution supplemented with rehabilitation through distance technology. The standard rehabilitation course is an outpatient program that lasts 9 or 12 months, and this study covered the first part of the rehabilitation (0-6 months). Rehabilitation courses are including 2 rehabilitation periods with face-to-face health education and PA exercise sessions. Those rehabilitation periods last 1 day at workplace or 5 days in a row if rehabilitation is conducted at a rehabilitation center. Rehabilitation periods are at baseline and after 6 months. For the interim period between rehabilitation meetings, all study participants received guidance and PA motivation through distance technology. Distance technology included an activity tracker (Polar A360, Finland) and a tablet with m-coach internet software (Movendos mCoach, Finland) for contacting rehabilitation team. Rehabilitation team sent messages and task concerning PA once a week and rehabilitee was also able to contact rehabilitation team through the software. Activity tracker was used independently by rehabilitee to gain information of his or her own PA. The content of the rehabilitation was carried out by a multidisciplinary team, but the remote connection (e.g., tasks, guidance and counselling) was mainly done by physiotherapists and nurses from the rehabilitation centre.

Data was collected in the baseline and after 6 months. Participants used an activity tracker throughout rehabilitation, but 2-week periods of rehabilitation (at baseline and after six months) were chosen for analyses. In addition to the activity tracker, there data collected through questionaries and waist circumference measures.

ii. Selection of Participants

The participants were 18-65 years old work-aged cardiac, musculoskeletal and vocational rehabilitees who were approved to have rehabilitation course provided by the Finnish Social Insurance Institution. Rehabilitation courses have been held all over Finland for decades now. The application for courses in continuous. Person who wants to attend rehabilitation course, must see a physician who determines if a rehabilitation course fits in the treatment plan of the patient. Patient applies for the course and The Finnish Social Insurance Institution makes final decision of the inclusion if rehabilitees' application and doctors' recommendation meet the inclusion criteria. Inclusion criteria for rehabilitation courses is a reduced ability to work or perform everyday tasks at the moment, or threat of losing these abilities over the next two years. The evaluation of ability to work and perform everyday tasks is not standardized and the evaluation is based on physician's consideration. Cardiac and musculoskeletal rehabilitees must also have proper diagnoses for the rehabilitation course in question (e.g., coronary artery disease or heart failure in the cardiac course).

The research team was not involved in rehabilitee recruitment. This study included courses that matched timewise (1.9.2016-1.9.2018) and by location (Central Finland) to study timetable. The election of study courses was made before the participants were able to register to courses. In the enrolment phase research team member evaluated the eligibility of each rehabilitee. Exclusion criteria for the study was inability to perform every-day tasks independently. No one was excluded based on exclusion criteria.

Rehabilitees' consent was asked individually and in case of denial rehabilitee had an option to join the standard rehabilitation course (without distance technology). Rehabilitees were able to discontinue the participation in the study in any point. There were no refusals or discontinuity. Personal information of rehabilitees was converted in random IDs by data collector before analysis. The study data was stored in locked and protected archives during the study and handled only by research team. Rehabilitation followed the national standards stated by the Finnish Social Insurance Institution. The research was approved by the ethics committee of Central Hospital of Central Finland (1/2017).

iii. Variables and measurements

The main objective and main outcome were PA (min/d), which was measured by a wrist activity tracker (Polar A360, Finland). The Polar A360 uses a 3D-acceleration sensor, which analyses wrist movement and converts it to MET-values. MET values describe the intensity of PA: MET values from 1 to 3 indicate LPA, MET values from 3 to 6 indicate MPA and MET values over 6 indicate VPA (1). The reliability of all kind of activity trackers has been shown to be high: CC 0.71-0.97 (6). The validity of all kind of activity trackers varies because wrist trackers tend to underestimate activities that involve limited arm movements (e.g. biking). It has been shown that a heart rate sensor, which Polar A360 has, increases validity (7).

Other measurements were based on variables in the following questionnaires: quality of life (WHOQOL-BREF), ability to work (part of the Work Ability Index), capability to exercise (Self-Efficacy to Regulate Exercise Scale, SERES) and exercise motivation (Behavioral Regulation in Exercise Questionnaire, BREQ-3). All questionnaires described above are widely used in Finnish health care and have been shown to have sufficient reliability and validity. The questionnaires were done self-administered on paper. The waist circumference was measured by measuring tape horizontally on the midline between bottom rib and iliac crest. The literature states that the reliability of waist circumference measures can be weaker with obesity, but the validity is acceptable (8). The communication activity on Movendos m-Coach coaching platform was measured as the number of responses on given assignments and it was recorded by the m-Coach program itself. Demographic characteristics such as age, gender, marital status, career and education were collected at baseline.

iv. Statistics

All analyses were conducted using SPSS (IBM SPSS Statistics, version 24). The significance level was set to 0.05. Before analyses, individual questions from the SERES and BREQ-3 were developed for sum variables to combine questions that clarify the same theme. Sum variables were assessed using Cronbach's alpha and principal component analysis. PA variables were calculated by calculating the average amount of PA per day from a two-week period at baseline and after 6 months. The change in PA was measured by calculating the difference in PA variables at baseline and after 6 months.

Descriptive and categorical variables are represented as sums and frequencies. Quantitative variables are represented as amounts (N), means (M), standard deviations (SD) and ranges.

The change in PA over six months was analysed in four different categories (light, moderate, vigorous and total activity) in the total group of participants as well as within three different rehabilitation subgroups. If the Shapiro-Wilk test showed that a variable was normally distributed, a paired-samples t-test was used. If a variable was not normally distributed, analyses were performed by Wilcoxon's signed rank test.

When statistically significant differences in PA were found, the changes were compared between the three rehabilitation groups. One-way variance analysis or the Kruskal-Wallis test was used to examine differences for normally distributed and non-normally distributed variables, respectively. Levene's test was used to examine the inequality of variances. In the case of a significant difference between groups, pairwise analysis was used to compare rehabilitation groups (post hoc Bonferroni).

Linear regression was carried out to examine the variables that influence the change in PA. In the beginning, the linear regression had 22 biopsychosocial variables, including sociodemographic variables, quality of life, work ability and PA participation. The model was refined by removing variables that were strongly correlated with each other (>0.5) or variables that diminished the coefficient of determination, statistical significance or sample size. To examine the correctness of the complete model, the confidence intervals, multicollinearity indicators and outliers were assessed.

Results

i. The description of the study group at the baseline

The group of participants included 46 rehabilitees. The data from 36 rehabilitees were analysed: 14 were in cardiac rehabilitation, 14 in musculoskeletal rehabilitation and 8 in vocational rehabilitation. Participant's activity data was accepted to analyses if the activity tracker was used in minimum for 10 hours/day and 4 days/measuring period (14 days). These limits were determined based on previous studies (9) to prevent interpreting the disuse of the tracker as inactivity. The activity data from 10 participants (22%) were insufficient for statistical analyses because of disuse. Flow chart is seen in Figure 1.

In the whole study group, the mean age of participants was 50.5 (SD 8.5) years, ranging from 36 years to 65 years. The majority of participants had rather similar socioeconomic backgrounds. At baseline, the majority (79,4%) were working full-time, and 17,6% were no longer working. Academic education was rare among participants (2,9%); the majority of participants had vocational school education (38%). Regarding marital status, 67,6% of participants were married or cohabitating, while the rest were single. Participants had a wide range of diagnoses. The most common diseases among participants were high blood pressure (7,8%), coronary artery disease and asthma (5,2%). Diabetes, arthritis and psoriasis were reported in 2,6% of participants. The mean waist circumference for participants was high (99 cm, SD 11.5). In the WHOQOL-BREF questionnaire, the quality of life was low in physical, psychological and environmental aspects, while relationships were strongly valued among our sample. At baseline, participants engaged in PA for an average of 5 hours 38 minutes per day. Mean MVPA values were enough to fulfil the recommendation for PA (1). The majority of participants reported being motivated to exercise because it was important, fun or beneficial. Participants reported that they could keep up with their exercise goal on average, but some reported that other things interfered with their exercise routine. Precise descriptive baseline outcomes are presented in table 1 and 2.

ii. The change in PA between baseline and six-month measurements

In the whole study group, the daily amount of LPA was significantly higher (+20 minutes/d, 95% CI 4min–35min, p=0.002) after six months of rehabilitation compared to baseline measurements. In other categories of PA (total, moderate, vigorous), there were no statistically significant differences between baseline and six-month measurements. When changes within rehabilitation subgroups were examined, only the cardiac rehabilitation group showed significant differences (t(13)=-2.850; p=0.014) in LPA compared to baseline measurements. After six months, cardiac rehabilitees engaged in 29 additional minutes of LPA per day. Among the musculoskeletal and vocational rehabilitees, there were no statistically significant differences among baseline and six-month measurements (table 3). When comparing the change in PA between rehabilitation subgroups, there were no statistically significant differences (table 4).

iii. Variables influencing the change in LPA.

Since a statistically significant change was found in LPA, the explanatory model was conducted for the change in LPA. The change in daily LPA ranged from a reduction of 1 hour 54 minutes to an increase of 1 hour 53 minutes.

All tested explanatory variables are shown in appendix 1. The model included nine biopsychosocial explanatory variables. The explanatory variables for the positive change in LPA were a positive change in satisfaction with the environment, a lower age of rehabilitation, lower activity at baseline, a negative change in experienced social relationships or psychological health, less pleasure-based motivation for exercise and more importance-based motivation for exercise. Two variables were part of the model, but they were not statistically significant explanatory variables: musculoskeletal rehabilitation group and fun-based motivation for exercise. The final complete model explained (R^2 adjusted) 47,1% of the variation in the change in LPA. The model was a good fit for the data (F(9,23)=4.171; p=0.003) (table 5).

The strongest explanatory variable was the change in **satisfaction with the environment.** The more a rehabilitee was satisfied with his or her environment, the greater the increase in LPA during six months of rehabilitation (ß=0.544, p=0.002). A one-point increase in the score for the environmental domain on the WHOQOL-BREF questionnaire led to a 15-minute increase in daily LPA over six months (B= 15.34). The scale for domains in the WHOQOL-BREF questionnaire ranged from 4 to 20.

At baseline, the strongest explanatory variables for the change in LPA were the rehabilitee's **LPA and age**. Both variables had a negative effect. The less LPA a rehabilitee had in his or her day at baseline (ß=- 0.544, p=0.004) or the younger the rehabilitee was (ß=-0.527, p=0.004), the more LPA increased during rehabilitation. A one-minute decrease in LPA at baseline led to a 20-second increase in daily LPA after six months of rehabilitation (B=-0.34). A one-year decrease in age at baseline led to a three-minute increase in daily LPA after six months of rehabilitation (B=-2.86).

Having worse **psychological health** (ß=-0.401, p=0.016) **or social** (ß=-0.422, p=0.014) **relationships** increased the amount of LPA. A one-point decrease in the score of the psychological domain on the WHOQOL-BREF questionnaire led to a nine-minute increase in daily LPA after six months (B= -8.97). A one-point decrease in the score of the social domain on the WHOQOL-BREF questionnaire led to an approximately six-minute increase in daily LPA after six months (B= -5.67). The scale for domains in the WHOQOL-BREF questionnaire ranged from 4 to 20.

Exercise motivation also impacted changes in LPA. The less that the **pleasure of exercise** was emphasized as a motivation during rehabilitation, the more that LPA was increased (ß=-0.485, p=0.040). Conversely, the more that the **significance of exercise** was emphasized as a motivation during rehabilitation, the more that LPA increased during rehabilitation (ß=0.398, p=0.037). A one-point decrease on the measure assessing the pleasure of exercise on the Behavioral Regulation in Exercise Questionnaire led to a 30-minute increase in LPA after six months of rehabilitation (B=-30.70). A one-point decrease on the measure assessing the significance of exercise on the same questionnaire led to a 27-minute increase in LPA (B= 27.01). Response options for the measures of both sources of exercise motivation ranged from 0 to 4 on the Behavioral Regulation in Exercise Questionnaire.

Discussion

i. Key results

The purpose of this study was to clarify how distance technology affects different intensity levels of PA (light, moderate, vigorous and total) during six months of rehabilitation. In addition, the purpose was to examine whether the changes in PA differed within and between rehabilitation groups and to determine the biopsychosocial factors that explain the change in PA.

In this study, technology-utilizing rehabilitation significantly increased LPA among rehabilitees. The cardiac rehabilitees were the only group that reported a statistically significant increase in their LPA over time; the between-group differences in LPA change were not significant. The rehabilitation group was not an explanatory factor in the increase in LPA, but instead, a lower age and lower amount of LPA at baseline predicted an increase in LPA. LPA also increased when rehabilitees reported higher satisfaction with the environment. Rehabilitees whose psychological health or social relationships weakened reported increases in LPA after six months of rehabilitation. An increase in LPA was also seen among rehabilitees who deteriorated the pleasure of exercise and those who emphasized the significance of exercise as the source of exercise motivation.

ii. Limitations

This was a prospective cohort study. The strength of this study was the fact that it took place in rehabilitees daily life, which is more relevant to everyday information than the clinical test setting environment. This study design cannot consider for confounding factors without a comparison group. Because of the small sample size, the results can be considered tentative and cannot be generalized to a larger population without strengthening the results first with future larger RCTs and quantitative analysis.

The other limitation was that participants used the main indicator, activity tracker, independently. Participants were given instructions about the usage before-hand and whenever needed. Though possible selected use in certain everyday situations could have influenced the results of daily PA. Those participants who used PA trackers less than the accepted amount were excluded from the analysis to cover this hypothetical problem. The activity data from 10 participants (22%) were insufficient for statistical analyses. There is a possibility in some selection bias, if these participants whose PA data was insufficient and excluded represent different characteristics than the analysed group.

The linear regression model in this study meets the assumptions of linear regression. There are no indications of multicollinearity: the correlation matrix, tolerance values and VIF values are acceptable. The residuals were not autocorrelated according to the Durbin-Watson coefficient (2.041 on range 1.6-2.4). A Cook’s distance of 0.056 indicates that the change in regression coefficient would be fairly small if one observation is removed. Residual patterns do not show linearity in the distribution, but the equivalence of residual variance does not seem to be fulfilled due to the abnormal values. Significantly abnormal values stem from the variable of social quality of life and are explained by variations in the small sample. The function of the model does not disturb abnormal values, but confidence intervals might include small unreliability. The model was a good fit for the data (F(9,23)=4.171; p=0.003). The standard error was 33.89, which is moderate when compared to the range. While the range of the change in LPA was almost 4 hours, slightly more than 30 minutes of this cannot be explained by the model.

iii. Interpretation and generalisability

Because of the limitations mentioned above, these results can not be generalized before strengthening them by future high-quality research with larger sample sizes and multiple methods. The results raise questions and guide future research.

In this study, an increase was not found in total PA, unlike in a previous meta-analysis (2, 5). However, the change in total PA was close to statistical significance (p=0.051). With a larger sample size, statistical significance could have been seen. In previous studies (1, 2, 5), technology-based rehabilitation has been proven to positively affect PA, but this study is the first to describe the change in different intensity levels. This study suggests the PA change that technology-based rehabilitation produces focuses purely on LPA. LPA is described as activity with a MET value of 3 or below, such as housework, shopping or easy walking (1). New recommendations for PA (1) have stated the benefits of LPA are focusing on sedentary people; however, remarkable health benefits are reached with MPA or VPA. Additionally, working ability is linked to MPA and VPA (10, 11). In this study participants mean PA values met recommendations at the baseline, so increased LPA was not enough to gain better health or working ability. Future studies concerning technology-based rehabilitation and PA, should measure the effect on different intensity levels to be sure the PA is intensive enough to gain wanted benefits. Since recommendation for PA state sedentary people to gain health benefits from increased LPA, the study setting described in this study could be beneficial to conduct with sedentary participants.

Satisfaction with the environment was the most significant explanatory variable for changes in LPA. The environmental factors that were assessed in the WHOQOL-BREF questionnaire were feeling of safety, healthy physical environment, financial security, knowledgeable enough to manage daily life, satisfied with neighbourhood conditions and possibilities in spare time, health care and transport. The framework of the International Classification of Functioning, Disability and Health biopsychosocial model (ICF) emphasizes the importance of body structures, activity and participation together with contextual factors, which consist of environmental factors and individual factors (12). Environmental factors are often ignored, even though other aspects of individuality are implemented well in rehabilitation. The importance of environmental factors highlights the importance of developing rehabilitation so that it takes into account individual, organizational and social aspects equally. More focused research is needed to determine which environmental factors and how environmental factors can improve the effect and effectiveness of technology-supported PA, physiotherapy and rehabilitation.

This study states that technology-utilizing rehabilitation increases LPA and emphasizes the significance of exercise, not the pleasure of exercise. Compared to Vallerand's motivation theory (13), this phenomenon indicates that technology-based rehabilitation is related to compulsive and performance-oriented exercise and external motivation. Motivation to exercise does not come from enjoying the performance itself but from the high valuation of its effects. Nevertheless, self-regulation is still high, and the compulsion to exercise is a person's own decision. This study shows that internal motivation was associated with a decrease in

LPA in six months of rehabilitation. Internal motivation is connected to long-term commitment, so it might be relevant in a longer perspective of the rehabilitation process.

Notably, in this study, psychosocial well-being was not associated with changes in LPA. In previous studies (14,15), internal motivation was connected to better mental well-being. It is still unclear whether the increase in external motivation and decrease in internal motivation are associated with a decrease in psychosocial well-being. There is a need for high-quality research to examine the effect of technology-based rehabilitation on all aspects of wellbeing.

Previous studies have not determined which rehabilitees benefit the most from technology (1, 2, 5). Based on this study, the target group that could benefit most from the distance technology is younger (36-63 years old) and less active rehabilitees (1 h 38 minutes to 7 h 46 minutes of LPA per day). Different age groups might have experienced technology use differently, which might affect the results. It has been shown that counselling in technology-utilizing rehabilitation among cardiac rehabilitees should be designed differently depending on people's feelings about technology, such as "feeling like an outsider", "being uninterested", "seeing benefit" and "being an enthusiastic user" (16). In this study, rehabilitation groups did not have differences in changes in physical activity. The explanation could be that all groups consisted of working aged people with similar health histories. All had some health issues, and for example, cardiac rehabilitees might have musculoskeletal issues, while musculoskeletal rehabilitees may have cardiac issues. As the ICF model (12) states, instead of solely focusing on the diagnosis, the individual factors and rehabilitee's performance should be considered when planning the rehabilitation content and tools.

In the future, rehabilitations should be developed to consider which intensities of PA are targeted. In rehabilitation, the use of technology and theory-based guidance, counselling and motivation methods best support individuals' biosocial functioning, wellbeing and workability. This study showed that age, activity level and psychosocial well-being need to be considered in the estimation of individual suitability for technology-utilizing rehabilitation. Target group research should focus on examining more of these groups. The increase in LPA was related to external motivation, and the causal connection needs to be studied in future research.

CONCLUSION

In this study, six months of technology-utilizing rehabilitation significantly increased light physical activity. Technology-utilizing rehabilitation did not facilitate health and work ability benefits of moderate and vigorous physical activity. In the rehabilitation subgroups, there were no statistically significant differences in PA changes between the cardiac, musculoskeletal or vocational rehabilitation groups. The increase in LPA was explained by rehabilitees' lower age, lower amount of LPA at baseline, high satisfaction with environment, impaired psychological health, negative social relationships and emphasizing external exercise motivation more and inner motivation less. Technology-based rehabilitation was beneficial for increasing LPA among less active and younger populations. Technology-utilizing rehabilitation has complex effects on holistic well-being.

ACKNOWLEDGMENTS

We would like to thank Teemu Paajanen and Viivi Haapaniemi for statistical help. We would also like to thank the Peurunka Rehabilitation Center for allowing us to use its facilities and its personnel for the intervention. Thank you to all the rehabilitees for your contribution.

DISCLOSURE OF INTEREST

The authors report no conflicts of interest.

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TABLE 1. Descriptive variables based on self-reported data and measurements at the baseline (n=36)

		M	SD	Range
Age		50.5	8.5	[36, 65]
Waist circumference (cm)		99,0	11,5	[77,127]
Physical activity (h:min/d)	total	5:38	1:17	[2:18,9:38]
	light	4:20	1:14	[1:38,7:46]
	Moderate	0:52	0:20	[0:11, 1:39]
	Vigorous	0:26	0:17	[0:00, 1:09]
Quality of life (scale 4-20)	physical	13.9	2.6	[7.4, 18.9]
	Psychological	14.3	2.2	[8.7, 18.7]
	Social	15.1	2.6	[11.0, 20.0]
	Environment	14.9	1.9	[11.0, 18.5]
Ability to work (scale 0-10)		6.4	2.3	[0,9]
Exercise motivation (scale 0-4)	Enjoyment	2.9	0.7	[1.8, 4.0]
	Values & identity	2.3	1.0	[0.2, 4.0]
	Relevance	3.4	0.9	[0.8, 4.0]
	Guilty & shame	2.0	0.9	[0.0, 4.0]
	Fun & benefits	3.1	0.6	[2.0, 4.0]
	Pressure	0.9	0.9	[0.0, 3.0]
Capability to exercise (scale 0-100)	When feeling down	53,9	18,7	[11.3,86.3]
	When other things to do	44,7	19,6	[4.0,88.0]
	After exercise break	58,9	18,4	[18.0,90.0]

M=Mean; SD=Standard deviation

TABLE 2. Descriptive variables by rehabilitation groups based on self-reported data and measurements in the baseline

		Physical activity, total/d	Physical activity, light/d	Social quality of life (4-20)	Sex distripution Women / Men
Cardiac (n=14)	M	4:57	3:48	15.79	2 (14.3%)/12 (85.7%)
	SD	1:11	1:13	2.36	
	95% Cl	4:16-5:39	3:05-4:30	14.37-17.22	
	Range	[2:18, 7:25]	[1:38, 6:17]	[13.33, 20.00]	
Musculoskeletal (n=14)	M	6:22	4:55	15.62	9 (64.3%) / 5 (35.7%)
	SD	1:19	1:17	2.31	
	95% Cl	5:36 7:08	4:10 5:40	14.29-16.95	
	Range	[4:31, 9:32]	[3:10, 7:46]	[12.00, 20.00]	
Vocational (n=8)	M	5:25	4:07	12.92	4 (50%) / 4 (50%)
	SD	0:42	0:46	2.64	
	95% Cl	4:50-6:01	3:28-4:46	10.71-15.12	
	Range	[4:34, 6:14]	[3:16, 5:22]	[10.00, 16.00]	

M= Mean; SD=Standard deviation; 95% Cl = 95% confidence interval

TABLE 3. The changes in minutes in physical activity during 6 months of rehabilitation

	Whole sample				Cardiac				Musculoskeletal				Vocational			
	Total physical activity (N=36)	Light physical activity (N=36)	Moderate physical activity (N=36)	Vigorous physical activity (N=36)	Total physical activity (N=14)	Light physical activity (N=14)	Moderate physical activity (N=14)	Vigorous physical activity (N=14)	Total physical activity (N=14)	Light physical activity (N=14)	Moderate physical activity (N=14)	Vigorous physical activity (N=14)	Total physical activity (N=8)	Light physical activity (N=8)	Moderate physical activity (N=8)	Vigorous physical activity (N=8)
At the baseline	5:38	4:20	0:52	0:26	4:57	3:48	0:45	0:24	6:22	4:55	1:00	0:26	5:25	4:07	0:49	0:29
After 6 months	5:58	4:40	0:55	0:22	5:29	4:17	0:49	0:22	6:43	5:20	1:02	0:20	5:21	4:00	0:53	0:26
Difference	+0:20	+0:20	+0:03	-0:04	+0:32	+0:29	+0:04	-0:02	+0:21	+0:25	+0:02	-0:06	-0:04	-0:07	+0:04	-0:03
p-value	0.051	**0.002***	0.394*	0.117*	0.095	**0.014**	0.542*	0.903*	0.177	0.078	0.819	0.100	0.808	1.000*	0.591	0.533

P-value marked with * is from Wilcoxon's Signed Rank test, others form paired samples T-test.

TABLE 4. The difference of changes in physical activity between rehabilitation groups

	Statistical significance difference in whole sample	Mean difference		
		C versus M	M versus V	V versus C
Total activity	p=0.388*	C +0:10	M+ 0:25	V -0:36
Light activity	p=0.160**	C +0:08	M +0:32	V -0:27
Moderate activity	p=0.833**	C +0:02	M -0:02	V +0:01
Vigorous activity	p=0.799*	C +0:04	M -0:02	V -0:01

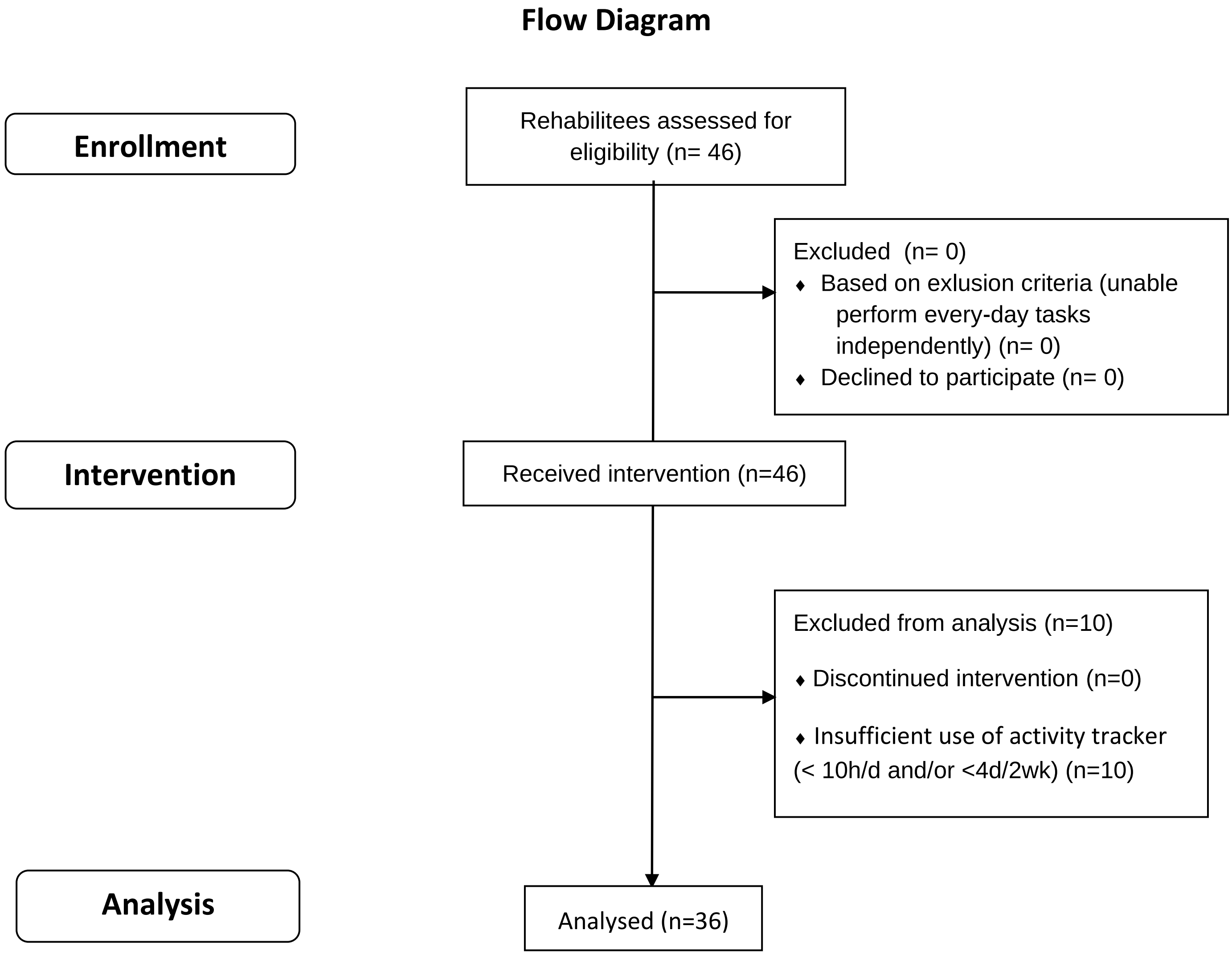
C= Cardiac; M= Musculoskeletal; V= Vocational
*One-way variance analysis; **Kruskall-Wallis

TABLE 5. The explanatory variables for the change in light activity (linear regression)

	B	95% Cl		ß	p-value
Change in environment	15.38	6.11	24.65	0.544	0.002
Mean light activity at the baseline	-0.34	-0.56	-0.12	-0.544	0.004
Age	-2.86	-4.74	-0.99	-0.527	0.004
Exerise motivation, pleasure	-30.70	-59.85	-1.56	-0.485	0.040
Change in social life	-5.67	-10.08	-1.27	-0.422	0.014
Change in psychological aspects	-8.97	-16.12	-1.83	-0.401	0.016
Excercise motivation, significance	27.01	1.79	52.24	0.398	0.037
F(9,23)=4.171; p=0.003; R^2=.620; R^2 adjusted=0.471; SE =33.89					

R^2 = the coefficient of determination; R^2 adjusted= adjusted coefficient of determination; B= the unstandardized beta; Cl = confidence interval; ß= the standardized beta; SE= the standard error for the unstandardized beta. The table represents only variables of the model that are statistically significant.

FIGURE 1. Flow diagram of participants.



APPENDIX 1

The 22 chosen variables for linear regression

Light physical activity at the baseline;
Age;
Gender;
Rehabilitation group – musculoskeletal (dummy variable);
Rehabilitation group – vocational (dummy variable);
Rehabilitation group – cardiac (dummy variable);
Messaging activity on distance technology;
The change in experienced working ability;
The change in waist circumference;
The change in experienced capability to exercise, when busy;
The change in experienced capability to exercise, when feeling down;
The change in experienced capability to exercise, after exercise break;
The change in physical aspects of life;
The change in psychological aspects of life;
The change in social aspects of live;
The change in environmental aspects of live;
The change in exercise motivation being more emphasized in pleasure of exercise;
The change in exercise motivation being more emphasized in values and identity;
The change in exercise motivation being more emphasized in significance of exercise;
The change in exercise motivation being more emphasized in shame and guilty;
The change in exercise motivation being more emphasized in fun and benefits of exercise;
The change in exercise motivation being more emphasized in pressure.