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ORIGINAL ARTICLE

Physical activity after inpatient occupational rehabilitation: Secondary outcomes of two randomized controlled trials

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Objectives: To assess whether inpatient multicomponent occupational rehabilitation, including physical activity (PA), increases the PA level of participants more than an outpatient program without PA, and whether changes in PA are associated with future work outcomes.

Methods: A total of 265 participants were included in one of two randomized clinical trials. Participants had been sick listed 2-12 months with a musculo-skeletal, psychological, or general/unspecified diagnosis. We measured PA by questionnaires at the start of the programs and at 3, 6, and 12 months of follow-up. Between-group differences in PA were assessed using linear mixed models. Associations between change in PA and future work outcomes were assessed by logistic and linear regression.

Results: There was no difference in change in PA between the inpatient and outpatient programs during 12 months of follow-up. We did not find any associations between the amount of PA and future work outcomes. However, intensity of PA was positively associated with return to work (RTW); participants reporting increased vigorous PA had an odds ratio (OR) for RTW of 4.1 (95% confidence interval [CI] 1.1-15.7) whereas participants reporting consistently high intensity of PA had an OR of 3.1 (95% CI 1.0-9.7), compared to participants reporting low-intensity PA.

Conclusion: Inpatient occupational rehabilitation, including PA, did not increase PA-level in the follow-up period more than a less comprehensive program without PA. The amount of PA was not associated with future work outcomes. However, vigorous PA showed a positive association with RTW.

KEYWORDS

chronic pain, exercise, mental health, return to work, sick-leave

1 | INTRODUCTION

Physical activity is a key component of occupational rehabilitation programs.[1-4] Studies have suggested a favorable association between physical activity and the most common reasons for sick-leave, such as—pain, depression and anxiety,[5-7] type 2 diabetes, coronary heart disease, cancer, and overall mortality.[8-11] Interventions aimed at increasing healthy individuals' physical activity level have shown to be effective,[12,13] while the results for individuals with chronic disorders are more inconsistent.[14-16] Furthermore, such interventions seem to be more effective when they emphasize change in physical

activity only, rather than aiming at multiple health-related behaviors.[17,18]We are not aware of studies assessing whether occupational rehabilitation programs can increase participants' physical activity level. Studies on occupational health suggest an inverse relation between leisure-time physical activity and both disability pension [19] and sick-leave.[20-23]However, we are not aware of any studies investigating whether an increased physical activity level is associated with increased work participation.

Cognitive behavioral therapy is a common component in occupational rehabilitation programs. In the current study, acceptance and commitment therapy (ACT), a new form of cognitive behavioral therapy, was an important part of the rehabilitation program. ACT emphasizes acceptance, mindfulness, and commitment processes, and the main goal is to increase psychological flexibility.[24] During the program, participants worked actively on identifying their own values, which often included health and fitness. It is therefore plausible that ACT could have an effect on participants' physical activity habits, particularly when combined with supervised physical exercise. Recent studies support a possible effect of ACT on increasing physical activity.[25,26]

We recently evaluated the effect of two inpatient multicomponent occupational rehabilitation programs on sickness absence compared with a less comprehensive outpatient program.[2,27] In the current study, we assessed whether participants in the two different inpatient occupational rehabilitation programs, both including physical activity, became more physically active during 12 months of follow-up than participants in the outpatient program without physical activity (secondary outcomes). In a combined analysis of all trial groups, we also assessed whether changes in physical activity were associated with future work participation.

2 | METHODS

2.1 | Study design and participants

We conducted two linked open label randomized clinical trials (RCT), with parallel groups. Each trial compared an inpatient multicomponent occupational rehabilitation program to less comprehensive outpatient rehabilitation. The "long trial" compared a 3.5 weeks inpatient program (hereafter the long program) to a less comprehensive outpatient program. The "short trial" compared a 4 + 4 days inpatient program (hereafter the short program) with the same outpatient program. Several articles have been published from this project previously, and the description in this section is therefore partially overlapping.[2,27,28] This study includes analysis of physical activity as secondary outcomes. The study was approved by the Regional Committee for Medical and Health Research Ethics in Central Norway (No.: 2012/1241) and is registered at clinicaltrials.gov (No.: NCT01926574). The results are presented according to the CONSORT statement.[29]

Eligible participants were individuals aged 18-60 years who had been sick listed 2-12 months with a diagnosis within the musculo-skeletal (L), psychological (P), or general and unspecified (A) chapters of ICPC-2 (International Classification of Primary Care, Second edition). The current sick-leave status had to be at least 50% off work. Exclusion criteria, assessed by a questionnaire and an outpatient screening performed by a physician, physiotherapist and a psychologist, were as follows: (a) alcohol or drug abuse; (b)serious somatic (eg, cancer and unstable heart disease) or psychiatric disorders (eg, high suicidal risk, psychosis, and ongoing manic episode); (c) specific disorders requiring specialized treatment; (d) pregnancy; (e) currently participating in another treatment or rehabilitation program; (f) insufficient oral or written Norwegian language skills to participate in group sessions and fill out questionnaires; (g) scheduled for surgery within the next 6 months; and (h) serious problems with functioning in a group setting.

2.2 | The rehabilitation programs

The inpatient rehabilitation programs consisted of group-based ACT,[24] physical activity and exercise, lectures, mindfulness, and individual meetings with the coordinators in work-related problem-solving sessions and creating a RTW plan. The patient-groups at the rehabilitation center consisted of maximum eight participants. Both programs consisted of full workdays (6-7 hours). Participants in the short program were at home for 2 weeks between the two 4 day periods. These 2 weeks included at least two contacts with the team coordinator (in person or by telephone) and a meeting with the employer, when considered relevant. The inpatient programs were offered at Hysnes rehabilitation center, located in central Norway. The physical exercise component consisted of both individual and group-based exercises, supervised by a physiotherapist or exercise physiologist. During the stay at the rehabilitation center, the participants made an individual plan for training, intended for use both during and after the program, in collaboration with the instructor. Participants in both programs were encouraged to try different forms of physical exercise during their stay, for example, running, strength training, spinning, hiking, aerobics, and yoga.

The outpatient program consisted primarily of group-based ACT at the Department of Physical Medicine and Rehabilitation, St.Olavs University Hospital. The sessions were led by a physician or a psychologist (supervised by the same ACT instructor as the coordinators in the inpatient program) and offered once a week for 6 weeks (each session lasting 2.5 hours). The participants were offered two individual sessions with a social worker experienced in occupational rehabilitation and trained in ACT to clarify personal values

and work-related issues. In addition, a physiotherapist led a motivational group discussion on the benefits of physical training, but there was no physical exercise.

2.3 | Questionnaires

Participants answered questionnaires via the Internet about their physical activity level at the start of the program and at 3, 6, and 12 months of follow-up. The physical activity questionnaire was adopted from the Norwegian HUNT-study[30] and consists of three questions on frequency, duration, and intensity of physical exercise activities per week. The questionnaire is validated against measurements of maximal oxygen consumption and found to perform well.[31] The frequency question has five response options: (0, <1, 1, 2-3, and ≥4 times per week; coded 0,0, 1, 2.5, and 5). Participants reporting to be physically active less than once a week were classified as inactive. Individuals who reported exercising once a week or more were asked about the average duration of the sessions (<15, 15-30, 31-60, and >60 minutes; coded; 10, 25, 45, and 75) and intensity ("no sweat or losing my breath," "sweat or losing my breath," "near-exhaustion"; coded 1, 2, and 3). We categorized "no sweat or losing my breath" as "low intensity," while the other two were collapsed into "medium and high intensity".[32] Based on this, we calculated minutes of exercise per week (frequency × duration) and an index including the intensity item (frequency × duration × intensity).[31] We included the different physical activity measurements both as continuous and categorical variables. We dichotomized the following variables: (a) frequency as "3 times or less per week" or "above three times per week," (b) the physical activity index as "low physical activity" or "medium or high physical activity" based on the median, and (c) minutes per week using the "Global recommendations on physical activity for health" from the World Health Organization[33] as cut-off, that is, 150 minutes or more per week. Based on this classification, we computed four categories according to the participants' physical activity at the start of the program and at 6 months follow-up: (a) consistently low, (b) increasing, (c) decreasing, and (d) consistently high.

In addition, the participants answered The International Physical Activity Questionnaire (IPAQ) short form at the start of the program and at 3, 6, and 12 months of follow-up. The IPAQ consists of seven questions concerning physical activity during the last 7 days.[34] The questions include sedentary activity, walking, vigorous, and moderate intensity activity. The questionnaire covers several domains of physical activity, however, results on validity has been inconsistent.

Information on factors such as gender, age, anxiety and depression symptoms (measured using The Hospital Anxiety and Depression scale [HADS][35]), pain, length of sick-leave, and education was obtained from the baseline questionnaire (at inclusion). In addition, subjective health was measured by a question asking the participants to rate their general health on a four-point Likert scale, ranging from 1 "poor" to 4 "very good."

2.4 | Sick-leave register data

Follow-up data on sick-leave was obtained by a linkage with the National Social Security System Registry, which contains data of all sickness and disability benefits given to individuals in Norway, registered by their social security number. Medically certified sick-leave is compensated 100% the first 12 months. Thereafter, it is possible to apply for more long-term benefits, compensated 66% of the income. Based on the registry data, we constructed two RTW outcomes (a) number of sickness absence days between 8 and 12 months of follow-up and (b) sustainable RTW defined as 1 month without receiving medical benefits during month 8-12 in the follow-up period (yes/no). The number of sickness absence days was adjusted for graded sick-leave, employment fraction, and calculated as a 5-day workweek.

2.5 | Randomization

Participants were randomized twice. First, sick listed individuals identified in the social security system were randomized to receive an invitation to either the long or the short trial. Invited participants completed a short initial questionnaire assessing eligibility. Next, eligible individuals were invited to an outpatient screening assessment. Those who passed the screening were randomized to either the inpatient or the outpatient program (Figure 1). A project coworker performed the first randomization. In the second allocation, a flexibly weighted randomization procedure was provided by the unit of Applied Clinical Research (third party) at the Norwegian University of Science and Technology, to ensure that the rehabilitation center had enough participants to run monthly groups in periods of low recruitment. It was not possible to blind neither the participants nor the caregivers to the group allocation. The researchers were not blinded.

2.6 | Statistics

Under the intention to treat principle, we used multilevel mixed-effects linear regression models to estimate differences in change in physical activity levels over time between the inpatient and outpatient rehabilitation programs separately for the two RCTs. Repeated measurements (at the different time-points) were handled by including a random intercept for persons in the models (thereby allowing the participants to start out at different levels). The estimates from the analysis (fixed effects) were used to predict physical activity level at different time-points for the four different groups. As the IPAQ scores were not normally distributed,

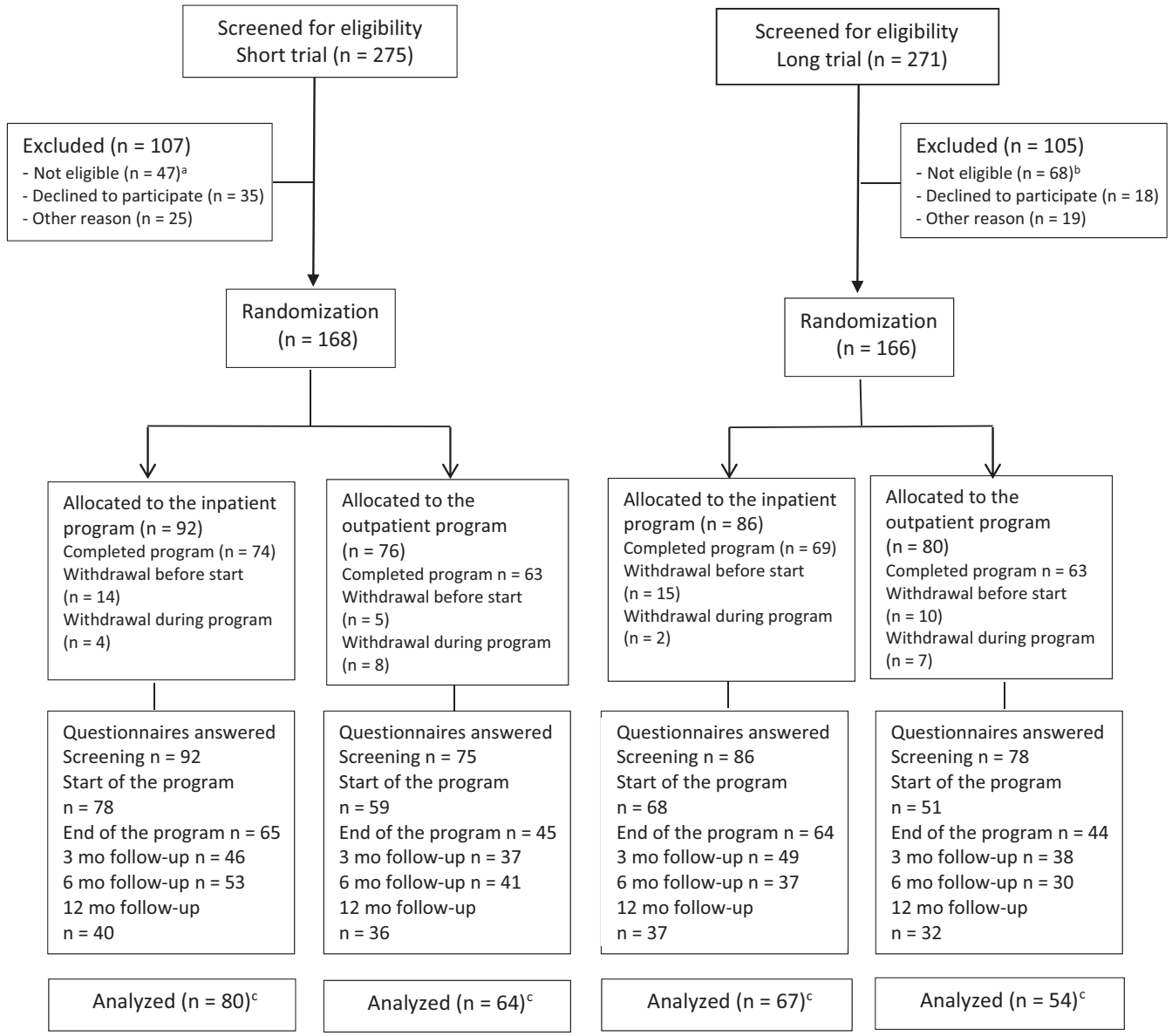

FIGURE 1 Flow of participants in the study. [a] Not eligible: Serious somatic/psychiatric illness (n = 20), a specific disorder requiring specialized treatment (n = 10), currently participating in another treatment program (n = 15), insufficient Norwegian comprehension (n = 1), scheduled surgery next 6 mo (n = 1). [b] Not eligible: Participating in another treatment program (n = 22), serious somatic/psychiatric illness (n = 11), returned to work (n = 10), specialized treatment needs (n = 4), problems with functioning in groups (n = 3), surgery scheduled next 6 mo (n = 2), insufficient language skills (n = 2), alcohol/drug abuse (n = 1), inability to participate in an inpatient intervention (n = 7), or lack of motivation (n = 6). [c] Answered HUNT physical activity questionnaire at one of the time-points (start of programme, 3 mo after program, 6 mo or 12 mo) and could then be included in the analysis

we used log transformed values in the regression models and then transformed back the estimated associations to the original scale.

In the combined analyses of participants from both trials that answered the questionnaires on physical activity at both time-points (baseline and 6 months), we estimated associations between changes in physical activity and future work outcomes. Logistic regression was used to estimate adjusted odds ratios (ORs) for sustainable RTW, whereas linear regression was used to compare mean number of sickness absence days. All associations were adjusted for gender, age (continuous), and education (dichotomized as high (college/ university) or low). To take into the account that some participants had a longer waiting period between inclusion and starting the rehabilitation program, we also performed sensitivity analyses on future work outcomes at 9-12 months and 10-12 months. Furthermore, we performed a sensitivity analysis adjusting the association between vigorous physical activity and future work participation for subjective health measured at 6 months (poor/not very good or good/very good).

TABLE 1 Baseline characteristics of the participants

	Short program		Long program	
	Short inpatient program (n = 92)	Short outpatient program (n = 76)	Long inpatient program (n = 86)	Long outpatient program (n = 80)
Age, mean (SD)	45.0 (8.7)	45.1 (9.6)	46.3 (8.7)	45.2 (10.4)
Women, n (%)	71 (77%)	62 (82%)	70 (81%)	61 (76%)
Higher education, n (%)[a]	44 (48%)	30 (39%)	32 (37%)	34 (43%)
Diagnosis				
A-general and unspecified, n (%)	8 (9%)	6 (8%)	4 (5%)	9 (11%)
L-musculo-skeletal, n (%)	43 (47%)	39 (51%)	55 (64%)	39 (49%)
P-psychological, n (%)	41 (45%)	31 (41%)	26 (30%)	32 (40%)
HADS[b]				
Anxiety (0-21), mean (SD)	7.8 (4.4)	7.4 (4.3)	7.4 (3.9)	8.6 (4.1)
Depression (0-21), mean (SD)	6.7 (4.3)	6.0 (4.1)	5.9 (4.2)	6.6 (3.9)
Length of sick-leave at inclusion, median (IQR)[c]	224 (189-262)	229 (187-275)	204 (163-265)	216 (177-265)
Pain level, mean (SD)	4.7 (2.3)	4.6 (1.9)	5.0 (2.0)	4.8 (2.2)
HUNT physical activity questionnaire Min per wk, mean (SD)	124 (92)	142 (76)	123 (81)	119 (91)
HUNT physical activity questionnaire Min per wk × intensity, mean (SD)	223 (201)	260 (192)	211 (159)	227 (211)

[a]Higher education: college or university.
[b]HADS: Hospital anxiety and depression scale.
[c]Number of d on sick-leave during the last 12 mo prior to inclusion. Measured as calendar d, not adjusted for partial sick-leave. Based on data from the National Social Security System Registry.

Precision of the estimated associations were assessed by a 95% confidence intervals (CI). All analyses were done using Stata 14.2 (StataCorp.2016. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP).

3 | RESULTS

Of the 12 007 individuals identified in the National Social Security System meeting the inclusion criteria, 3318 received an invitation to the short trial and 3808 to the long trial. Of these, 275 and 271 accepted the invitation, respectively. Figure 1 illustrates the subsequent flow of participants through the study. The number of participants who answered the questionnaires decreased steadily through the study, from 100% at the start to approximately 50% at 12 months of follow-up (see Figure 1).

3.1 | Participants' characteristics

Of the 334 (168 in the short trial + 166 in the long trial) randomized participants, 79% were women, the mean age was 45 years (SD 8.9), and 42% held higher education (college/university). About half (55%) had a musculo-skeletal diagnosis, 37% a psychological diagnosis, and 9% had a general and unspecified diagnosis. The median number of sickness absence days in the year before inclusion was 218 days (interquartile range (IQR) 179-268). About 40% reached the recommendations of more than 150 minutes of moderate physical activity per week at the start of the program, and the mean number of minutes spent on physical activity per week was 127 minutes (SD 85). Baseline characteristics for the participants randomized to the inpatient and the outpatient program were similar in all the groups (Table 1).

In total, 265 of the 334 participants in the RCT filled out the physical activity questionnaire at least once and were included in the analyses. The 265 included participants had similar baseline values as the total sample. Participants that responded to the questionnaire at 12 months had a similar number of sick-leave days during the follow-up period (median 34; (IQR 0-69), as the participants not responding at 12 months (median 41; IQR 0-78).

3.2 | Comparison of physical activity levels over time between the interventions

Overall, there were no statistically significant between-group differences over time, for neither the long (19 minutes, 95%

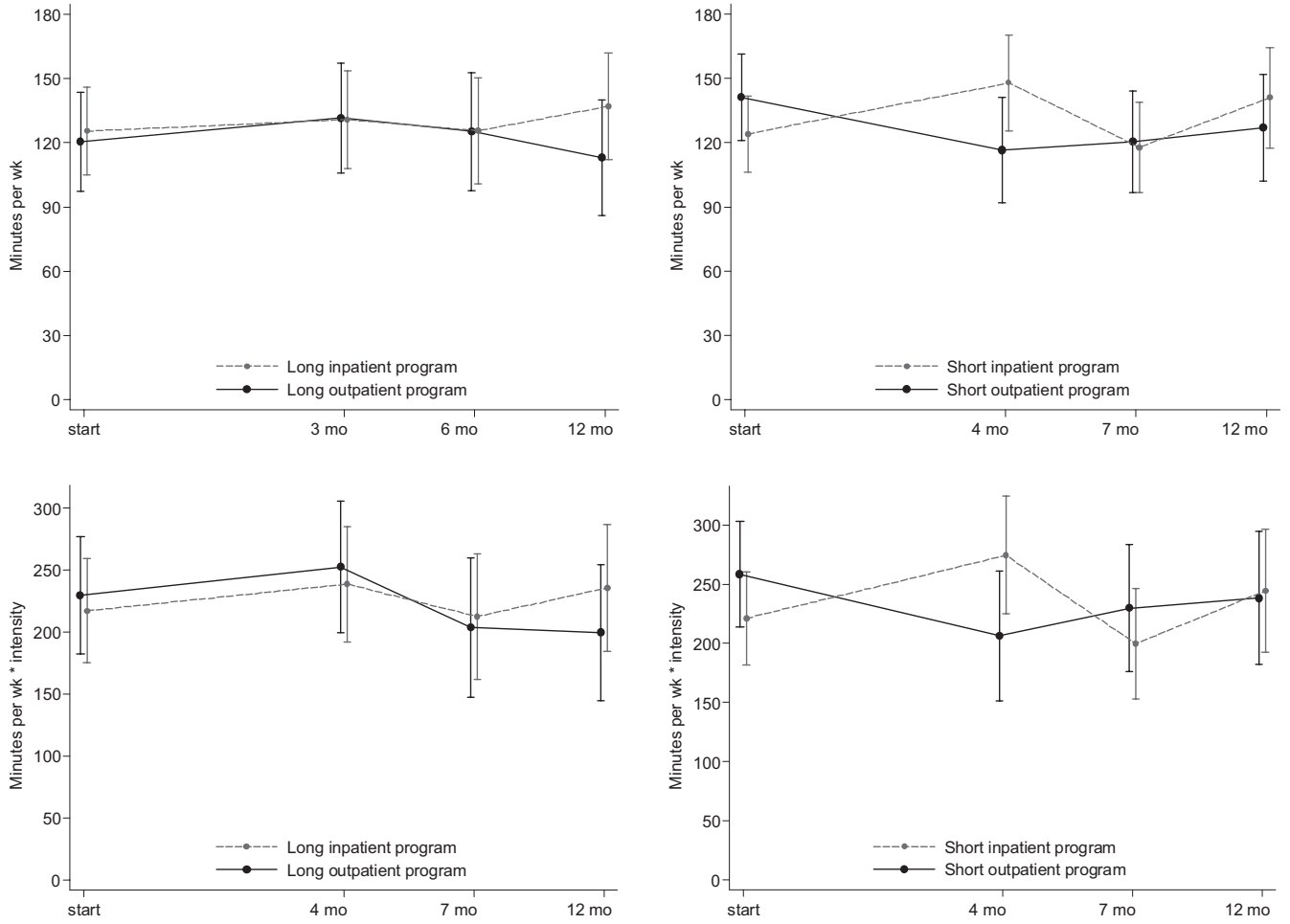

FIGURE 2 Mean changes in physical activity shown for both the long and the short trial. The left panels show the long program, whereas the right panels show the short program. Top panels are min per wk of physical activity, whereas bottom panels show physical activity as index including frequency, duration, and intensity. Vertical bars represent 95% confidence intervals

CI −15 to 53) nor the short trial (31 minutes, 95% CI −6 to 68). Participants in the long inpatient program increased their time spent on physical activity by 12 minutes (95% CI −12 to 35) on average from inclusion to 12 months, while the outpatient group decreased their time spent on physical activity by 8 minutes (95% CI −33 to 18)(Figure 2). In the short trial, participants in the inpatient program increased their physical activity by 17 minutes (95% CI −8 to 42)on average, while the participants in the outpatient program decreased their physical activity with 14 minutes(95% CI −41 to 13)(Figure 2).

The physical activity index, which includes the intensity of the activity, showed no difference between the groups during follow-up, neither in the long nor in the short trial (Figure 2). The analyses including IPAQ showed similar results as the HUNT physical activity questionnaire (results not shown).

3.3 | Associations between the change in physical activity and future work outcomes

Among the participants answering the physical activity questionnaires at both the start of the program and at 6 months of follow-up, 58% reported being physically active <150 minutes per week, while 15% reported above 150 minutes per week at both time-points. Only 9% increased their physical activity from less than 150 minutes per week to at least 150 minutes per week, and 17% reduced their physical activity from at least 150 minutes per week to <150 minutes per week. There were no associations between the change in amount of physical activity, measured as minutes per week, from the start of the program to 6 months of follow-up and future work outcomes (Table 2 and Table 3).The results were similar for analyses of physical activity incorporating intensity into a physical activity index.

In analyses of intensity of physical activity as a separate factor, participants who reported increasing intensity had slightly fewer sickness absence days (−14 days, 95% CI −36 to 7) and were more likely to achieve sustainable RTW (OR 4.1, 95% CI 1.1 to 15.7) than participants with consistently low intensity (reference group). Similarly, participants reporting consistently high intensity showed fewer sickness absence days (−12 days, 95% CI −30 to 6) and higher odds for sustainable RTW (OR 3.1, 95% CI 1.0 to 9.7) compared

TABLE 2 Associations between change in physical activity from start of rehabilitation to 6 mo of follow-up and number of sickness absence d between 8 and 12 mo after inclusion

		Number of sickness absence days[a]				
Domain	**Change**	**n**	**Mean**	**Mean difference**	**Adjusted mean differences[b]**	**95% CI**
Frequency	Consistently 3 times or less per wk	99	41	0 (ref.)	0 (ref.)	0 (ref.)
	Decreasing	21	42	1	0	−18-18
	Increasing	16	45	4	0	−19-20
	Consistently above 3 times per wk	18	38	−3	−2	−21-17
Min per wk	Consistently below 150 min/wk	80	44	0 (ref.)	0 (ref.)	0 (ref.)
	Decreasing	26	31	−13	−11	−27-5
	Increasing	14	39	−5	−5	−25-16
	Consistently above 150 min/wk	23	42	−2	−3	−20-14
Min per wk* intensity	Consistently low	39	43	0 ref.	0 (ref.)	0 (ref.)
	Decreasing	26	44	1	−1	−19-17
	Increasing	22	40	−3	−5	−24-14
	Consistently high	64	39	−4	−5	−20-10
Intensity (low vs med/high)	Consistently low	21	49	0 (ref.)	0 (ref.)	0 (ref.)
	Decreasing	26	52	4	2	−19-23
	Increasing	24	34	−15	−14	−36-7
	Consistently high	80	37	−12	−12	−30-6

[a]Estimated from linear regression analyses
[b]Adjusted for age, gender, and education

to participants with consistently low intensity. Participants decreasing the intensity of their physical activity showed no difference in number of sickness absence days (2 days, 95% CI −19 to 23), compared with the reference group, whereas the OR for sustainable RTW was 2.1 (95% CI 0.6 to 7.1). The sensitivity analyses, including sickness absences measured at later intervals and adjustments for subjective health, showed similar results (results not shown).

4 | DISCUSSION

There were no differences in the change in physical activity levels between the inpatient occupational rehabilitation programs with physical activity, and the outpatient occupational rehabilitation program without physical activity, during 12 months of follow-up. The amount of physical activity was not associated with work participation, but the results suggest a positive impact of vigorous physical activity on work participation.

Previous studies also suggest that it is difficult to change physical activity levels in individuals with chronic pain.[15,16] However, some studies have reported effects of interventions on physical activity levels in both healthy participants [12,13] and persons with chronic low back pain.[14] A meta-analysis by Conn et al[36] showed that interventions aimed at increasing physical activity was most effective when they targeted physical activity exclusively, compared with interventions that aimed to improve multiple health behaviors simultaneously. This has also been supported by studies on individuals with diabetes type 1.[18] As the inpatient programs contained multiple components and the main goal was to facilitate RTW, participants might have put less emphasis on increasing their physical activity level. A key component of all the programs was ACT. It has been suggested that ACT can be effective in increasing physical activity in healthy persons,[26] although the results are inconclusive.[25]As both the inpatient and the outpatient programs included ACT, an additional effect of the physical activity intervention may have been limited.

We are not aware of previous studies that have assessed whether changes in physical activity levels after occupational rehabilitation are associated with RTW. However, several studies suggest an inverse relation between leisure-time physical activity and sickness absence[20-23] and risk of disability pension.[19] A possible explanation for the lack of association in our study could be that although leisure-time physical

TABLE 3 Associations between change in physical activity from start of rehabilitation to 6 mo of follow-up and probability of sustainable return to work between 8 and 12 mo after inclusion

		Sustainable return to work[a]			
Domain	**Change**	**n**	**OR**	**Adjusted OR[b]**	**95% CI**
Frequency	Consistently 3 times or less per wk	99	1.0	1.0	1.0
	Decreasing	21	0.9	0.9	0.3-2.4
	Increasing	16	0.9	1.0	0.3-3.2
	Consistently above 3 times per wk	18	0.9	0.9	0.3-2.7
Minutes per wk	Consistently below 150 min/wk	80	1.0	1.0	1.00
	Decreasing	26	2.3	2.2	0.9-5.5
	Increasing	14	1.4	1.5	0.5-4.7
	Consistently above 150 min/wk	23	1.1	1.3	0.5-3.4
Minutes per wk* intensity	Consistently low	39	1.0	1.0	1.0
	Decreasing	26	1.5	1.7	0.6-4.9
	Increasing	22	2.1	2.2	0.7-6.8
	Consistently high	64	1.7	1.9	0.8-4.4
Intensity (low vs med/high)	Consistently low	21	1.0	1.0	1.0
	Decreasing	26	2.0	2.1	0.6-7.8
	Increasing	24	4.5	4.1	1.1-15.7
	Consistently high	80	3.2	3.1	1.0-9.7

[a]Estimated from logistic regression analyses
[b]Adjusted for age, gender, and education

activity might prevent long-term sick-leave in the general work force, returning to work after long-term sick-leave is a complex process heavily influenced by psychosocial factors. Moreover, it is possible that individuals who actually return to work have less time for leisure-time physical activity.

Although the observed associations between vigorous physical activity and work outcomes had low precision, there was some evidence that people who reported vigorous physical activity had a tendency for fewer sickness absence days and a higher probability for sustainable RTW than those who reported no vigorous activity. This is in line with Lahti et al[37] reporting that vigorously active individuals had lower risk of subsequent sickness absence compared to persistently inactive persons. In addition, other studies have reported that the intensity of physical activity is related to sick-leave[21-23] and disability retirement,[38] perhaps due to vigorous physical activity having a more potent effect on physical capacity and several health-related variables.[19]

Besides the randomized design, a strength of the study is the use of register data on sick-leave outcomes, ensuring no recall bias and no missing data. As participants were identified and invited by the National Social Security System, there was also no referral bias. However, some limitations should be addressed. Self-reporting physical activity is prone to information bias, particularly for low intensity activities.[39] In addition, the questionnaire may not be sensitive enough to detect subtle changes in physical activity. Another limitation is the use of categorical variables leads to loss of information and reduced statistical power. Furthermore, it is conceivable that RTW could influence the exercise volume as there is less leisure-time, but since RTW may give more structure to the day and create an opportunity for "active transportation"; this influence could probably be in either direction. The observed associations between change in physical activity and RTW could also be influenced by health status through its association with both physical exercise and RTW. However, sensitivity analyses where we adjusted for subjective health when assessing the association between high-intensity physical activity and future work participation did not change the estimates. Although it should be noted that adjusting for subjective health could introduce a collider bias. Another limitation is the response rate on the questionnaires, which decreased from 100% at the start of the program to about 50% at 12 months of follow-up. Although we used linear mixed models analyses, which uses all available data, it nonetheless relies on the assumption of missing at random. We cannot fully rule out possible bias due to loss to follow-up. Nevertheless, participants who did not respond to the questionnaire at 12 months showed a similar number of sick-leave days during follow-upas those who responded at

12 months. Finally, some participants had a waiting period before starting the program (due to the capacity at the rehabilitation center) and the follow-up period measuring physical activity could overlap with the measure of future work outcomes. However, sensitivity analyses including sickness absence measured at 9-12 months and 10-12 months did not change the conclusions.

In conclusion, individuals participating in inpatient occupational rehabilitation programs including physical activity did not become more physically active compared to those participating in a less comprehensive outpatient program without physical activity. Furthermore, there was no association between the amount of physical activity and future work outcomes. However, the results suggest that participating in vigorous physical activity was associated with fewer sickness absence days and increased likelihood of sustainable RTW.

4.1 | Perspectives

Despite physical activity being a key component in most occupational rehabilitation programs, we are not aware of studies investigating whether such programs increase participants' physical activity levels. This study found no difference in participants' physical activity after inpatient occupational rehabilitation with physical activity versus a less comprehensive outpatient program without physical activity. There was no association between the amount of physical activity and future work participation. However, there was a positive association between vigorous physical activity and sustainable RTW, strengthening the hypothesis that vigorous physical activity could improve work ability more than physical activity with lower intensity. Future research should evaluate these associations using objective measurements of physical activity.

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REFERENCES

1. Braathen TN, Veiersted KB, Heggenes J. Improved work ability and return to work following vocational multidisciplinary rehabilitation of subjects on long-term sick leave. *J Rehabil Med*. 2007;39(6):493-499.
2. Fimland MS, Vasseljen O, Gismervik S, et al. Occupational rehabilitation programs for musculoskeletal pain and common mental health disorders: study protocol of a randomized controlled trial. *BMC Public Health*. 2014;14(1):368.
3. Lambeek LC, Anema JR, van Royen BJ, et al. Multidisciplinary outpatient care program for patients with chronic low back pain: design of a randomized controlled trial and cost-effectiveness study [ISRCTN28478651]. *BMC Public Health*. 2007;7(1):254.
4. Norlund A, Ropponen A, Alexanderson K. Multidisciplinary interventions: review of studies of return to work after rehabilitation for low back pain. *J Rehabil Med*. 2009;41(3):115-121.
5. Rosenbaum S, Tiedemann A, Sherrington C, Curtis J, Ward PB. Physical activity interventions for people with mental illness: a systematic review and meta-analysis. *J Clin psychiatry*. 2014;75(9):964-974.
6. Josefsson T, Lindwall M, Archer T. Physical exercise intervention in depressive disorders: Meta-analysis and systematic review. *Scand J Med Sci Sports*. 2014;24(2):259-272.
7. Lahti J, Laaksonen M, Lahelma E, Rahkonen O. The impact of physical activity on physical health functioning–a prospective study among middle-aged employees. *Prev Med*. 2010;50(5–6):246-250.
8. Wen CP, Wai JP, Tsai MK, et al. Minimum amount of physical activity for reduced mortality and extended life expectancy: a prospective cohort study. *Lancet*. 2011;378(9798):1244-1253.
9. Lee IM, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet*. 2012;380(9838):219-229.
10. Villeneuve PJ, Morrison HI, Craig CL, Schaubel DE. Physical activity, physical fitness, and risk of dying. *Epidemiology*. 1998;9(6):626-631.
11. Haskell WL, Lee IM, Pate RR, et al. Physical activity and public health: updated recommendation for adults from the American college of sports medicine and the American Heart association. *Med Sci Sports Exerc*. 2007;39(8):1423-1434.
12. Greaves CJ, Sheppard KE, Abraham C, et al. Systematic review of reviews of intervention components associated with increased effectiveness in dietary and physical activity interventions. *BMC Public Health*. 2011;11:119.
13. Michie S, Abraham C, Whittington C, McAteer J, Gupta S. Effective techniques in healthy eating and physical activity interventions: a meta-regression. *Health psychol*. 2009;28(6):690-701.
14. McDonough SM, Tully MA, Boyd A, et al. Pedometer-driven walking for chronic low back pain: a feasibility randomized controlled trial. *Clin J Pain*. 2013;29(11):972-981.
15. Marley J, Tully MA, Porter-Armstrong A, et al. The effectiveness of interventions aimed at increasing physical activity in adults with persistent musculoskeletal pain: a systematic review and meta-analysis. *BMC Musculoskelet Disord*. 2017;18(1):482.
16. Oliveira CB, Franco MR, Maher CG, et al. Physical activity interventions for increasing objectively measured physical activity levels in patients with chronic musculoskeletal pain: a systematic review. *Arthritis Care Res (Hoboken)*. 2016;68(12):1832-1842.
17. Wdowik MJ, Kendall PA, Harris MA, Keim KS. Development and evaluation of an intervention program: "Control on Campus". *Diabetes Educ*. 2000;26(1):95-104.
18. Hasler TD, Fisher BM, MacIntyre PD, Mutrie N. Exercise consultation and physical activity in patients with type 1 diabetes. *Pract Diabetes Int*. 2000;17(2):44-48.
19. Fimland MS, Vie G, Johnsen R, Nilsen TIL, Krokstad S, Bjørngaard JH. Leisure-time physical activity and disability pension: 9 years follow-up of the HUNT Study, Norway. *Scand J Med Sci Sports*. 2015;25(6):e558-e565.
20. Holtermann A, Hansen JV, Burr H, Søgaard K, Sjøgaard G. The health paradox of occupational and leisure-time physical activity. *Br J Sports Med*. 2012;46(4):291-295.

21. Lahti J, Laaksonen M, Lahelma E, Rahkonen O. The impact of physical activity on sickness absence. *Scand J Med Sci Sports*. 2010;20(2):191-199.
22. Proper KI, van den Heuvel SG, De Vroome EM, Hildebrandt VH, Van der Beek AJ. Dose–response relation between physical activity and sick leave. *Br J Sports Med*. 2006;40(2):173-178.
23. Bernaards CM, Jans MP, van den Heuvel SG, Hendriksen IJ, Houtman IL, Bongers PM. Can strenuous leisure time physical activity prevent psychological complaints in a working population? *Occup Environ Med*. 2006;63(1):10-16.
24. Hayes SC, Luoma JB, Bond FW, Masuda A, Lillis J. Acceptance and commitment therapy: model, processes and outcomes. *Behav Res Ther*. 2006;44(1):1-25.
25. Kangasniemi AM, Lappalainen R, Kankaanpää A, Tolvanen A, Tammelin T. Towards a physically more active lifestyle based on one's own values: the results of a randomized controlled trial among physically inactive adults. *BMC Public Health*. 2015;15(1):260.
26. Butryn ML, Forman E, Hoffman K, Shaw J, Juarascio A. A pilot study of acceptance and commitment therapy for promotion of physical activity. *J Phys Act Health*. 2011;8(4):516-522.
27. Aasdahl L, Pape K, Vasseljen O, et al. Effect of inpatient multicomponent occupational rehabilitation versus less comprehensive outpatient rehabilitation on sickness absence in persons with musculoskeletal- or mental health disorders: a randomized clinical trial. *J Occup Rehabil*. 2018;28(1):170-179.
28. Aasdahl L, Pape K, Vasseljen O, et al. Effects of inpatient multicomponent occupational rehabilitation versus less comprehensive outpatient rehabilitation on somatic and mental health: secondary outcomes of a randomized clinical trial. *J Occup Rehabil*. 2017;27(3):456-466.
29. Schulz KF, Altman DG, Moher D. CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials. *BMC Med*. 2010;8:18.
30. Krokstad S, Langhammer A, Hveem K, et al. Cohort profile: the HUNT study, Norway. *Int J Epidemiol*. 2013;42(4):968-977.
31. Kurtze N, Rangul V, Hustvedt BE, Flanders WD. Reliability and validity of self-reported physical activity in the Nord-Trondelag health study: HUNT 1. *Scand J Public Health*. 2008;36(1):52-61.
32. Mork PJ, Holtermann A, Nilsen TIL. Effect of body mass index and physical exercise on risk of knee and hip osteoarthritis: longitudinal data from the Norwegian HUNT study. *J Epidemiol Community Health*. 2012;66(8):678-683.
33. Warburton DE, Charlesworth S, Ivey A, Nettlefold L, Bredin SS. A systematic review of the evidence for Canada's physical activity guidelines for adults. *Int J Behav Nutr Phys Act*. 2010;7:39.
34. Lee PH, Macfarlane DJ, Lam T, Stewart SM. Validity of the international physical activity questionnaire short form (IPAQ-SF): a systematic review. *Int J Behav Nutr Phys Act*. 2011;8:115.
35. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand*. 1983;67(6):361-370.
36. Conn VS, Hafdahl AR, Brown SA, Brown LM. Meta-analysis of patient education interventions to increase physical activity among chronically ill adults. *Patient Educ Couns*. 2008;70(2):157-172.
37. Lahti J, Lahelma E, Rahkonen O. Changes in leisure-time physical activity and subsequent sickness absence: a prospective cohort study among middle-aged employees. *Prev Med*. 2012;55(6):618-622.
38. Lahti J, Holstila A, Manty M, Lahelma E, Rahkonen O. Changes in leisure time physical activity and subsequent disability retirement: a register-linked cohort study. *Int J Behav Nutr Phys Act*. 2016;13(1):99.
39. Shephard RJ. Limits to the measurement of habitual physical activity by questionnaires. *Br J Sports Med*. 2003;37(3):197-206; discussion.

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