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Title: Joint associations of leisure time physical activity and screen sitting time with long-term sickness absence due to mental and musculoskeletal diseases : a registry linked follow-up study

Year: 2024

Version: Published version

Sarttila, K. H., Kuusela, M., Pohjola, V., Lundqvist, A., Hautala, A. J., Pesola, A. J., & Lahti, J. (2024). Joint associations of leisure time physical activity and screen sitting time with long-term sickness absence due to mental and musculoskeletal diseases : a registry linked follow-up study. Public Health, 233, 177-184. https://doi.org/10.1016/j.puhe.2024.05.016

Public Health 233 (2024) 177–184

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Original Research

Joint associations of leisure time physical activity and screen sitting time with long-term sickness absence due to mental and musculoskeletal diseases: a registry linked follow-up study

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ARTICLE INFO

Article history:
Received 24 November 2023
Received in revised form
24 April 2024
Accepted 15 May 2024

Keywords:
Exercise
Sedentary behavior
Population-based study
Sick leave
Work ability

ABSTRACT

Objectives: To examine joint associations of leisure-time physical activity (LTPA) and screen sitting time with subsequent sickness absence among the adult population.
Study design: Registry linked follow-up study.
Methods: A representative sample of Finnish adults ($n = 10,300$) were asked to fill out a questionnaire for the FinHealth 2017 survey. Self-reported LTPA was classified into three groups: inactive, moderately active, and active, and screen sitting time into two groups: 3 h or less and over three hours a day, yielding a six-category variable for the joint analyses. Questionnaire data were linked to the Finnish Social Insurance Institution's register data on sickness benefits (over 9 days), including diagnoses (follow-up 2.9 years). The analytical samples were restricted to working age (18–64 years), which included 5098 participants. Associations were examined using logistic regression analysis adjusting for covariates with SPSS 29.
Results: The inactive and high sitting time had a higher risk for sickness absence due to mental disorders (OR 2.07, 95% CI 1.03–4.18) compared with the physically active, low-sitting time group. Additionally, the inactive and low sitting time (OR 1.69 95% CI 1.12–2.55) and the moderately active and high-sitting time groups (OR 2.06 95% CI 1.15–3.67) had a higher risk. No significant associations were found for all-cause and musculoskeletal diseases sickness absence.
Conclusion: Employers and policymakers could support reducing sitting in front of a screen and increase LTPA outside working hours to prevent mental health problems and related sickness absences.

Introduction

Advances in technology have created opportunities and led to a significant increase in time spent sedentary in recent decades. An Australian Time Use study estimated that 90% of non-work time was spent sitting still, and of this amount, around 53% was spent on screen time (computer or television).[1] In Finland, almost half of men and more than a third of women spend over three hours a day in front of a screen in their leisure-time.[2] Lack of physical activity is increasingly common. It is estimated that two thirds of the adult population does not meet the current physical activity guidelines in Finland[2] and elsewhere.[3] Sedentary behavior, typically operationalized as sitting time, refers to behaviors of low energy expenditure, equal to or less than 1.5 metabolic equivalents (METs).[4] Physical inactivity means less moderate-to-vigorous physical activity than recommended for health benefits.[5] Both high sitting time and low physical activity levels are detrimentally associated with all-cause, cardiovascular and cancer mortality, with the combination of high leisure screen time and physical inactivity being particularly detrimental.[6,7] It appears that those who are least physically active also accumulate the most daily sedentary time.[8] Together, these harmful health behaviors are creating an increasingly significant health risk.[9]

As the demographic structure changes and working careers lengthen,[10] maintaining work ability of the population will become

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https://doi.org/10.1016/j.puhe.2024.05.016

increasingly important. Sickness, absence, and disability pensions are major social and economic problems in the Organisation for Economic Co-operation and Development (OECD) member countries, including Finland.[11] Mental disorders and musculoskeletal diseases are the most common diagnostic causes.[12] In Finland, anyone aged 16 to 67 who is unable to work normally due to their illness is eligible for sickness allowance, including those not in employment.[12] Sickness allowance compensates for loss of earnings caused by incapacity for work, and it is paid after 10 working days.[12] Sickness absence predicts functional capacity,[13] as well as of longer-term disability.[14] Register-based sickness absence is an important and reliable measure of work disability,[15] whereas self-reported sickness absence rates are prone to under-reporting and recall bias for longer periods.[16]

Several sociodemographic and health factors, such as labor market status,[12] lower socioeconomic status,[17] and impaired general health and functional capacity,[13] have been shown to predict subsequent sickness absence. Higher amount of overall and leisure-time physical activity (LTPA),[18,19] high cardiorespiratory fitness, and lower sedentary behavior have been shown to predict lower sickness absence rates, as well as improved work ability.[20,21] Some studies have focused on sedentary behavior at work,[20,22] as well as the amount of time spent sitting when commuting to work or school,[23] and overall daily sedentary behavior.[24] Moreover, many previous studies in the field have focused on the phenomenon in cohorts of workers,[20,25,26] while there are fewer studies representing the working-age population. The aim of this study was to examine the individual and joint associations of LTPA and leisure screen sitting time with sickness absence among a representative sample of Finnish adult population. The further aim was to examine whether the association differed by the main diagnosis groups, i.e. musculoskeletal, and mental cause sickness absence.

Methods

Study population

The FinHealth 2017-baseline survey was conducted in 2016–2017 among the Finnish adult population aged over 18-years old (n = 10,305, response rate 68.8%).[27] The current study was restricted to adults aged 18–64 years to represent the Finnish working-age population.

The FinHealth 2017 Study has received approval from the Coordinating Ethics Committee at the Hospital District of Helsinki and Uusimaa. All participants gave their signed informed consent before entering the study. Respondents were also asked for permission to link to the Social Insurance Institute's register data on sickness benefit periods to the health examination survey data. The follow-up period of the survey was 2.9 years. The final analytical sample consisted of 5098 participants.

Leisure time, physical activity, and screen sitting time

Participants were asked to assess their weekly leisure-time physical activity in four categories, ranging from sedentary activities to vigorous physical activity. The question is a modification of the International Saltin-Grimby Physical Activity Level Scale.[28] The top two categories referring to very physically active people and competitive athletes were combined due to low number of competitive athletes. A three-category physical activity variable was formed: inactive, moderately active, and active, based on previous procedures.[29]

The respondents were asked about their average amount of sitting time (hours and mins) spent at home in front of the TV, computer, or mobile device on a weekday. This question is part of the Marshall Sitting Questionnaire which is an accepted, reliable, and valid measure for domain-specific sitting.[30] Time spent sitting at the screen was categorized as low sitting time (three hours or less per day) and high sitting time (more than 3 h per day) based on previous procedures.[29] For the joint analyses, a six-category variable was yielded, where the reference group was a predefined best group: the most active and the least sedentary.

Sickness absence

Periods of sickness absence over 9 working days and their diagnoses were provided from the Social Insurance Institute of Finland register from the time the questionnaire was returned and limited to the end of 2019, before the start of the COVID-19 epidemic in Finland. The follow-up time ended before the end of 2019 if a person retired or died. First, we examined whether the participants had sickness absences or not. This dependent variable was dichotomized into those who had at least one long-term sickness absence period during follow-up and those who did not. Then we examined the number of sickness absence days per year among those with sickness absence during the follow-up; the total number of days during the follow-up was divided by the individual follow-up time in years. The analyses were made separately for all-cause (n = 945), musculoskeletal (ICD-10 M00–M99) (n = 289), and mental (ICD-10 F00–F99) (n = 225) causes. The Social Insurance Institute of Finland requires a medical certificate and a diagnosis from a doctor to provide sickness absence benefits. The employer bears the cost of short periods of sick leave of less than 10 days.[12] In Finland, sickness allowance can be paid not only to employees and self-employed persons but also to students, unemployed persons, and family caregivers on a case-by-case basis.[12]

Covariates

Data on the demographic characteristics of the participants, such as age, sex, and marital status, were obtained from the Finnish Population Register Centre.[27] Other information on participant characteristics, i.e. educational level, limiting long-term illness (LLI), marital status, and labor market status, smoking, and body mass index (BMI) were collected via a self-reported questionnaire. Age variable categorized by 10-year age group was used. Marital status was dichotomized into those who were married or in a registered partnership, and others. The educational level was categorized into low, middle, and high based on the self-report of the highest completed education. LLI was considered a confounding factor as it can affect the ability to be physically active. Participants were asked if they had a limiting long-term illness or other long-term health problem. The variable was dichotomized into those with and those without LLI. Smoking was dichotomized into current smokers (daily or occasional smokers) and non-smokers (those who did not smoke or had quit at least 1 month ago). A current labor market status was dichotomized into employed or self-employed, and others, including i.e. unemployed, students, retired, apprentices, and those on family leave.

Statistical methods

The associations between LTPA and screen sitting time to subsequent sickness absence were examined in two-parts. First, we examined the likelihood of having sickness absence during the follow-up by calculating odds ratios (OR) with 95% confidence intervals (CI) using binary logistic regression. In the second part, we calculated the means and 95% confidence intervals for sickness absence days per year among those with sickness absence using linear regression. Three regression models were adjusted for key

confounders: model 1 for age and sex, model 2 for age, sex, educational qualification, marital status, labor market status, limiting long-term illness and smoking, and model 3 for the confounders used in model 2 and BMI. Other physical activity categories and sitting categories were compared with the most physically active and the least sedentary (≤3 h) group. We examined the association in the total working-age population and separately for those in employment. Stratified sampling was considered, and non-participation was corrected by weighting. Analytical weights were generated using sociodemographic variables and data on hospitalization from national administrative registers.[27] Participants with missing values in any study variables were removed from each model. Statistical analyses were done with IBM SPSS Statistics (version 29.0).

Results

During the follow-up period (mean follow-up of 2.9 years), a total of 945 (18.5%) participants had at least one sickness absence period. Among those with sickness absence the mean number of sickness absence was 28 days per year (Table 1). Of the participants, 289 (5.7%) had been absent due to musculoskeletal disorders and 225 (4.4%) due to mental health problems. Women had more often long-term sickness absence (21%) than men (15%) but a lower number of sickness absence days per year during the follow-up. The sickness absence in all disease groups by 10-year age categories showed that those aged 45–54 had the highest sickness absence occurrence (24%) compared to other age groups, whereas the number of sickness absence days increased with age. Of the other covariates, higher BMI, having LLI, being employed, and smoking associated with a higher occurrence of long-term sickness absence. Among those with sickness absence the mean number of sickness absence days per year also varied according to covariates, e.g. low educated, those with LLI and those not in employment had a higher amount of sickness days per year.

In Table 2, the occurrence of all-cause, musculoskeletal, and mental-cause sickness absence varied according to LTPA and sitting time (Table 2). The mean number of sickness absence days was higher among the lower LTPA in all diagnosis groups. However, only mental causes sickness absence days showed higher for those who were sitting more. The risk for sickness absence occurrence due to mental disorders was higher among those who had less LTPA after adjustment for potential confounders (OR 1.77 CI 1.14–2.74) (Fig. 1). Association to all-cause long-term sickness absence (LTSA) was

Table 1
Sample characteristics and distributions of participants' long-term sickness absence by background variables.

Descriptives	Long-term sickness absence						
	Study population N^c (%[d])	All cause		Musculoskeletal		Mental disorders	
		N^c (%[d])	Days/year[c] (SD)[e]	N^c (%[d])	Days/year[c] (SD)[e]	N^c (%[d])	Days/year[c] (SD)[e]
Sex	5098	945 (18.5)		289 (5.7)		225 (4.4)	
Men	2576 (50.5)	391 (15.2)	30.4 (37.0)	120 (4.7)	8.2 (22.4)	79 (3.1)	8.7 (25.6)
Women	2522 (49.5)	554 (22.0)	25.6 (33.2)	169 (6.7)	6.8 (19.4)	146 (5.8)	8.4 (23.4)
		<0.001		0.002		<0.001	
Age (as of November 2016)	5098						
18–24	725 (14.2)	95 (13.1)	29.0 (30.3)	20 (2.8)	3.5 (13.4)	37 (5.1)	15.3 (30.8)
25–34	1068 (20.9)	175 (16.4)	21.0 (30.0)	39 (3.6)	3.6 (13.6)	50 (4.7)	8.3 (22.0)
35–44	1109 (21.8)	218 (19.7)	24.6 (31.5)	53 (4.8)	6.2 (18.1)	63 (5.6)	9.1 (24.7)
45–54	1148 (22.5)	283 (24.7)	29.9 (37.6)	115 (10.0)	9.3 (22.7)	51 (4.4)	8.1 (25.8)
55–64	1048 (20.6)	175 (16.7)	33.4 (39.8)	62 (6.0)	11.6 (27.6)	24 (2.3)	5.0 (18.3)
		<0.001		<0.001		0.002	
Marital status[a]	5098						
Married	2862 (56.1)	503 (17.6)	28.9 (35.1)	138 (4.8)	7.0 (21.1)	128 (4.5)	10.1 (27.1)
Unmarried	2236 (43.9)	442 (19.8)	26.1 (34.7)	150 (6.7)	7.8 (20.2)	97 (4.3)	6.7 (20.6)
		0.044		0.004		0.819	
BMI[b]	4938						
Normal	2150 (43.5)	345 (16.0)	25.8 (32.8)	81 (3.8)	5.4 (17.8)	92 (4.3)	10.2 (26.5)
Overweight	1733 (35.1)	318 (18.3)	29.1 (36.7)	105 (6.1)	8.0 (21.1)	73 (4.2)	8.3 (24.6)
Obese	1056 (21.4)	253 (24.0)	28.1 (35.2)	95 (9.0)	8.9 (22.7)	55 (5.2)	7.2 (22.0)
		<0.001		<0.001		0.406	
Educational qualification	5024						
Low	579 (11.5)	87 (15.0)	30.9 (35.3)	41 (7.1)	16.5 (30.9)	14 (2.4)	5.4 (17.9)
Middle	2172 (43.2)	418 (19.2)	27.9 (34.1)	146 (6.7)	9.0 (23.0)	87 (4.0)	5.9 (19.6)
High	2273 (45.2)	422 (18.6)	24.6 (33.7)	98 (4.3)	4.0 (13.9)	113 (5.0)	9.8 (25.9)
		0.063		<0.001		0.18	
Limiting long-term illness	5098						
No	3527 (69.2)	559 (15.8)	23.4 (31.7)	129 (3.7)	3.9 (14.8)	129 (3.7)	8.4 (24.1)
Yes	1571 (30.8)	386 (24.6)	33.7 (39.3)	160 (10.2)	12.4 (26.3)	96 (6.1)	8.6 (24.7)
		<0.001		<0.001		<0.001	
Labor market status	5022						
Employed or self-employed	3299 (65.7)	721 (21.9)	24.3 (32.8)	238 (7.2)	7.5 (20.3)	148 (4.5)	6.3 (20.5)
Other	1723 (34.3)	206 (12.0)	35.1 (37.1)	46 (2.7)	7.4 (22.7)	65 (3.8)	12.0 (28.4)
		<0.001		<0.001		0.233	
Smoking	4861						
Yes	1079 (22.2)	224 (20.8)	30.1 (36.2)	84 (7.8)	11.8 (27.2)	46 (4.3)	8.1 (24.2)
No	3782 (77.8)	671 (17.7)	25.7 (33.4)	192 (5.1)	6.2 (18.2)	155 (4.1)	7.3 (22.0)
		0.024		<0.001		0.810	

[a] Married = Married/registered partnership, Unmarried = Single/Divorced/separated/widowed/no information.
[b] Body Mass Index (kg/m^2).
[c] Presented as unweighted counts of observations.
[d] Proportions presented based on weighted counts.
[e] Mean sickness absence (sickness allowance) days per one year among those with long-term sickness absence.

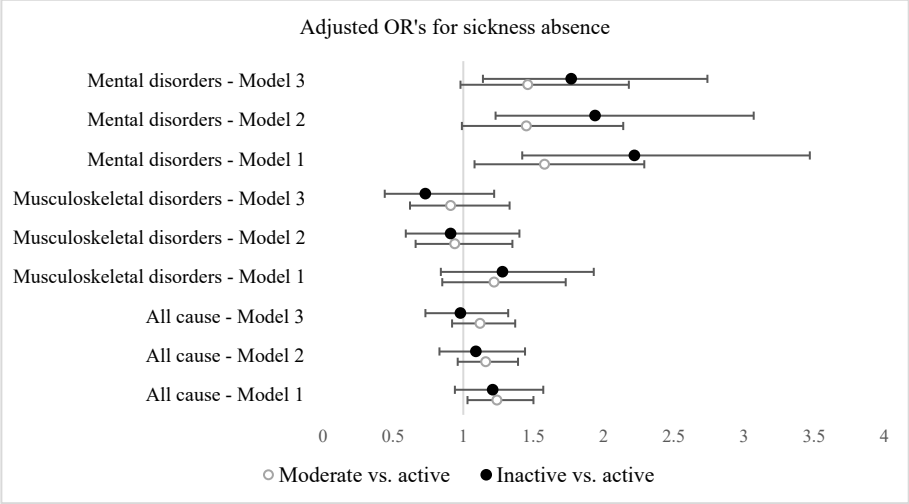
Table 2
Long-term sickness absence occurrence and days per year among those with sickness absence by physical activity and screen sitting time.

Descriptives	Long-term sickness absence						
	Study population N[a] (%[b])	All cause		Musculoskeletal		Mental disorders	
		N[a] (%[b])	Days/year[a] (SD)[c]	N[a] (%[b])	Days/year[a] (SD)[c]	N[a] (%[b])	Days/year[a] (SD)[c]
		945 (18.5)		289 (5.7)		225 (4.4)	
LTPA	4992						
Inactive	1238 (24.8)	240 (19.4)	32.9 (40.1)	78 (6.3)	9.1 (24.9)	74 (6.0)	10.7 (26.2)
Moderate	2018 (40.4)	414 (20.5)	25.7 (32.5)	129 (6.4)	7.1 (19.6)	89 (4.4)	7.2 (22.7)
Active	1737 (34.8)	272 (15.6)	22.3 (29.5)	77 (4.4)	6.2 (17.6)	50 (2.9)	5.4 (18.2)
		<0.001		0.020		<0.001	
Screen sitting time at home	4800						
3 h at most	3525 (73.4)	676 (19.2)	26.2 (34.0)	213 (6.0)	7.4 (20.4)	135 (3.8)	6.9 (21.9)
More than 3 h	1275 (26.6)	206 (16.2)	27.8 (34.2)	58 (4.6)	7.5 (21.9)	66 (5.2)	9.8 (25.1)
		0.017		0.048		0.040	
Joint variable 6-categories	4769						
1 Inactive, high sitting	490 (10.3)	81 (16.5)	35.3 (40.0)	25 (5.0)	11.5 (28.9)	33 (6.7)	11.7 (26.4)
2 Moderate active, high sitting	443 (9.3)	88 (19.9)	23.3 (29.4)	21 (4.8)	5.1 (16.9)	22 (5.1)	9.4 (26.0)
3 Active, high sitting	337 (7.1)	36 (10.7)	22.5 (28.8)	13 (3.8)	4.5 (10.9)	10 (3.1)	6.9 (19.7)
4 Inactive, low sitting	680 (14.3)	146 (21.5)	32.8 (41.2)	50 (7.4)	8.4 (23.5)	34 (5.0)	9.7 (26.3)
5 Moderate active, low sitting	1482 (31.1)	302 (20.4)	25.9 (32.8)	100 (6.7)	7.6 (20.2)	61 (4.1)	6.6 (21.8)
6 Active, low sitting	1337 (28.0)	227 (17.0)	22.2 (29.6)	63 (4.7)	6.5 (18.6)	39 (2.9)	5.4 (18.3)
		<0.001		0.032		0.006	

LTPA, leisure-time physical activity.
[a] Presented as unweighted counts of observations.
[b] Proportions presented based on weighted counts.
[c] Mean sickness absence (sickness allowance) days per one year among those with long-term sickness absence.

found in moderately physically active participants when adjusted for age and sex (OR 1.24 CI 1.03–1.50), but the statistical significance was lost after further adjustments. No association was found between the amount of LTPA and sickness absence due to musculoskeletal disorders. High leisure screen time sitting is associated with an increased risk of sickness absence due to mental disorders (OR 1.60 CI 1.05–2.43) compared to the low sitting (≤3 h) group (Fig. 2). The result remained the same regardless of the model adjustment. Leisure screen sitting time was not associated with sickness absences due to all-cause or musculoskeletal disorders.

The joint variable showed associations with all-cause, musculoskeletal, and mental-cause sickness absence occurrence and number of sickness absence days per year among those with sickness absence (Table 2). However, when adjusting for confounders in logistic regression analyses, no association was found for all-cause sickness absence and sickness absence due to musculoskeletal diseases. Those who were physically more active during leisure time and had lower levels of leisure screen sitting time were at lower risk of long-term sickness absence due to mental causes when adjusting for age and sex (Table 3). Compared with the low-sitting active group, the inactive high sitting (OR 2.71 CI 1.33–5.54) and moderately active high sitting groups (OR 2.04 CI 1.10–3.78) had a higher likelihood of sickness absence due to mental disorders. Also, the inactive, low sitting group had a higher likelihood of sickness absence due to

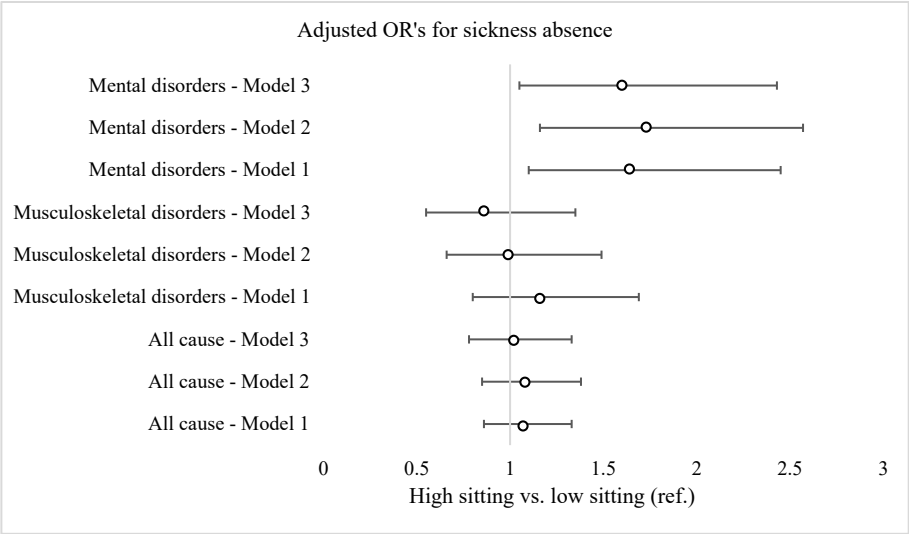


[1] adjusted for age and sex

[2] adjusted for age, sex, educational qualification, marital status, labor market status, limiting long-term illness and smoking

[3] adjusted for the confounders used in model 2 and BMI.

Fig. 1. Leisure-time physical activity associations on long-term sickness absence.



[1] adjusted for age and sex

[2] adjusted for age, sex, educational qualification, marital status, labor market status, limiting long-term illness and smoking

[3] adjusted for the confounders used in model 2 and BMI.

Fig. 2. Leisure screen sitting time associations on long-term sickness absence.

mental disorders (OR 1.72 CI 1.08–2.73). Additionally, calculating the mean number of sickness absence days per year among those with sickness absence showed that the inactive high sitting (34.9 sickness allowance days) and the inactive low-sitting (32.0 days) groups had a significantly higher number of sickness absence days compared with the active low-sitting group (22.5 days). For musculoskeletal and mental causes, the patterns were similar; however, differences did not reach statistical significance. Adjusting for sociodemographic and other factors (model 2) had only minimal effects on the estimated OR's; those who were less active and more sedentary in their leisure time were still at higher likelihood of sickness absence due to mental disorders. However, the differences in all-cause sickness absence days lost statistical significance. The associations attenuated further when adjusting additionally for BMI in model 3, after which the inactive high sitting group (OR 2.31 CI 1.09–4.88) still had a significantly higher risk of sickness absence due to mental disorders.

Sensitivity analysis

Sensitivity analyses were conducted, limiting the analyses for the population currently employed ($n = 3144$). From the analytical sample ($n = 5098$) 65% of participants reported that they were currently working or self-employed. The associations remained mainly similar, but for sickness absence due to mental disorders, the association was weaker and non-significant in the inactive high-sitting group. Also, for the moderate active and high-sitting group, the association with all-cause sickness absence was reduced to a statistically non-significant level in model 2. The results are shown in Appendix (A1).

Discussion

The aim of this study was to examine the joint associations of LTPA and leisure screen sitting time with long-term sickness absence among representative Finnish adult population and whether the association differed by main diagnosis groups. The inactive high-sitting group had a higher risk of sickness absence due to mental disorders compared to those with high physical activity and low leisure screen sitting time. Also, those inactive and low-sitting and the moderately active high-sitting had a higher risk on absence due to mental causes. The joint analyses showed no associations for having all-cause and musculoskeletal-cause sickness absence. However, among those with sickness absence, the mean number of sickness absence days per year was higher among those inactive with high or low leisure screen sitting time. These findings suggest that reducing sitting time in front of screens and increasing physical activity during leisure-time may reduce the risk of mental health-related sickness absence.

Relatively few previous studies have examined joint associations between leisure screen sitting time and LTPA and the risk of sickness absence. Tamminen et al.[29] found that LTPA and prolonged screen sitting time at home were independently related to lower positive mental health. Lahti et al. showed in their study among younger Finnish municipal employees that high LTPA dominated the associations over total sitting-time in relation to work ability, mental wellbeing, and physical functioning.[24] There is strong evidence from previous research on associations between higher total daily sitting time with musculoskeletal conditions such as low back pain, knee pain, arthritis, and musculoskeletal pain conditions.[31]

LTPA has been shown to have a protective association with musculoskeletal conditions such as low back pain,[31] but there is also conflicting evidence.[32] Previous studies[26,33] have shown that low levels of LTPA are associated with a higher risk of sickness absence due to musculoskeletal diseases. The lack of association in our study may be partly explained by the fact that highly physically active people are more prone to injuries when exercising compared to less active people.[34] The inconsistency of the results may also be explained by differences in measures of exposure and response. Physical activity has been measured by different questions in previous studies. There are also differences in the categorization of LTPA, and some questions also consider the intensity of PA. The divergence in results may also be explained by the increasing

Table 3
Physical activity and sitting time groups associations with long-term sickness absence in main diagnostic groups. Presented as odds ratios (95% CI) of having sickness absence and mean number of sickness absence days per year (95% CI) among persons with sickness absence.

		Model 1[a]		Model 2[b]		Model 3[c]	
		OR 95% CI	Mean[d] 95% CI	OR 95% CI	Mean[d] 95% CI	OR 95% CI	Mean[d] 95% CI
All-cause LTSA	Inactive high sitting	1.02 0.70–1.48	34.9* 24.4–45.3	1.05 0.70–1.58	36.0 25.8–46.2	0.81 0.58–1.36	35.0 25.2–44.7
	Moderate active high sitting	1.24 0.89–1.72	24.0 17.5–30.4	1.41 0.99–1.99	27.14 19.6–34.7	1.11 0.94–1.96	27.5 19.8–35.2
	Active high sitting	0.70 0.42–1.16	22.0 12.6–31.4	0.81 0.47–1.42	25.0 14.3–35.6	0.68 0.41–1.14	25.2 14.6–35.8
	Inactive low sitting	1.24 0.92–1.66	32.0* 24.0–40.0	1.08 0.79–1.46	38.1 27.9–48.2	0.99 0.77–1.40	39.1 28.8–49.3
	Moderate active low sitting	1.13 0.92–1.40	24.7 21.2–28.2	1.07 0.85–1.33	30.1 25.4–34.9	1.03 0.81–1.30	30.7 26.1–35.4
	Active low sitting (ref)	1.00	22.5 17.0–27.9	1.00	30.6 23.0–38.2	1.00	31.0 23.0–39.0
Musculo-skeletal LTSA	Inactive, high sitting	1.08 0.63–1.85	11.35 2.78–19.92	0.89 0.50–1.58	13.89 5.15–22.64	0.59 0.34–1.04	12.95 5.07–20.83
	Moderate active, high sitting	0.95 0.48–1.94	5.37 1.59–9.15	0.97 0.49–1.90	9.09 4.23–13.95	0.66 0.34–1.28	9.50 4.49–14.51
	Active, high sitting	0.97 0.44–2.14	4.50 0.52–8.49	1.20 0.53–2.71	10.57 5.78–15.36	0.85 0.40–1.83	10.94 6.08–15.79
	Inactive, low sitting	1.40 0.81–2.39	7.88 4.17–11.58	0.97 0.56–1.66	10.41 5.35–15.48	0.91 0.53–1.55	10.90 5.75–16.05
	Moderate active, low sitting	1.23 0.82–1.85	6.79 4.17–9.40	0.99 0.65–1.50	10.34 6.99–13.69	0.99 0.65–1.52	10.86 7.36–14.36
	Active, low sitting	1.00	6.80 3.34–10.26	1.00	12.44 7.48–17.39	1.00	13.16 7.99–18.33
Mental disorders LTSA	Inactive, high sitting	2.71 1.33–5.54	11.77 5.26–18.28	2.82 1.42–5.62	11.56 5.21–17.90	2.31 1.09–4.88	12.08 5.49–18.68
	Moderate active, high sitting	2.04 1.10–3.78	8.98 3.21–14.74	2.15 1.14–4.05	9.74 3.49–15.99	1.66 0.90–3.09	9.63 3.04–16.22
	Active, high sitting	1.27 0.54–2.99	6.56 0.20–12.91	1.38 0.59–3.23	5.85 0.73–12.42	1.29 0.56–2.95	5.76 0.77–12.29
	Inactive, low sitting	1.72 1.08–2.73	9.03 3.98–14.09	1.66 1.04–2.65	11.13 5.17–17.09	1.42 0.86–2.34	11.52 5.43–17.60
	Moderate active, low sitting	1.38 0.88–2.17	5.61 3.13–8.09	1.37 0.87–2.16	7.27 3.83–10.71	1.24 0.78–1.97	7.34 3.87–10.82
	Active, low sitting	1.00	4.69 1.63–7.74	1.00	6.71 2.21–11.22	1.00	6.59 1.59–11.59

LTSA = Long-term sickness absence.
*Significantly different from the reference group ($P < 0.05$).
[a] Adjusted for age and sex.
[b] Adjusted for age, sex, educational qualification, marital status, labor market status, limiting long-term illness and smoking.
[c] Adjusted for the confounders used in model 2 and BMI.
[d] Mean sickness absence (sickness allowance) days per one year among those with LTSA.

mental health-related sickness absence[35] and in the past studies, associations have been studied with limited and not population-representative samples.

Previous research on the association between sedentary behavior and all-cause sickness and absence has been limited and has found contradictory associations. According to Drake et al.[20] and Høgsbro et al.,[36] greater sedentary time is associated with a higher risk of sickness absence. On the other hand, Hallman et al.[22] found that higher levels of occupational sitting compared to other physical behaviors were associated with lower levels of sickness absence due to pain. Additionally, longer time spent lying down during waking hours and longer total time spent in bed was associated with poorer work ability.[37]

There are differences in previous studies when assessing sedentary behavior. Most studies assessed sedentary time as sitting, standing, light physical activity and being in bed,[20,22] while others considered sedentary time at work,[36] which may correlate differently with health outcomes than sitting in front of a screen. To understand sedentary behavior and to provide a basis for public health interventions, it is important to obtain prevalence estimates not only of the total amount of sedentary behavior but also of the context in which this behavior occurs. In Finland, most of the everyday sitting is spent at work and at home in front of a TV or smart device.[2] In this study, we looked at the phenomenon from the perspective of leisure screen sitting time, which has been shown to be associated with poorer positive mental health[29] and with higher all-cause and disease-specific mortality.[6] Further studies should also look at sitting time in other contexts (e.g. occupational, commute, and total amount of sitting) and consider other forms of sedentary behavior.

Absences from work due to mental health or musculoskeletal issues represent significant social and economic challenges. Wherever possible, efforts should be made to reduce prolonged sitting in front of screens, as breaking up prolonged sitting time has positive effects on metabolic outcomes.[38,39] Everyday physical activity in leisure should be encouraged, such as using stairs instead of lifts, commuting, doing household chores, and other daily activities. In addition to population-level prevention, employers could alleviate the burden of mental health-related absences by offering support to decrease sedentary time and promote physical activity,[40] even during non-work hours, for example supporting commuting by bike.[23]

Study strengths and limitations

The study population consisted of a stratified random sample, which is a representative sample of the Finnish adult population. The sample included both women and men from different socioeconomic groups, both employed and unemployed, which can be considered a robust sampling method. Most previous studies focused on a working population cohort or in a particular sector. One of the strengths of this study is the population-based prospective design, which allows examination of subsequent long-term sickness absence from the register, which is more reliable than self-reports.[16] However, short-term absences of less than 10 days are not available from the national registers. The follow-up period was relatively long and comparable to previous register-based studies on sickness absence.[25,26] Sensitivity analyses were conducted with data restricted to the working population showing similar associations to the whole population.

Nonetheless, the study includes some limitations. Self-reported physical activity is prone to bias. Respondents may overestimate their physical activity.[41] On the other hand, questionnaires have been found to be a sufficiently accurate method of assessing physical activity in large population studies.[42] The use of self-reporting indicators is common in large population surveys because of the cost-effectiveness of the methodology. Objective measures have been shown to be more reliable and reproducible than subjective measures.[43] Accelerometer provides accurate and specific information about daily times spent lying, sitting, and standing.[44] In terms of measuring sedentary behavior, the inclinometer has been shown as the gold standard method.[41] To provide a more comprehensive picture on physical behaviors and their relation to health, objective measurements should also be implicated.

The results of this study can be generalized to the Finnish population and, to some extent, to other Nordic countries. However, the generalizability to other countries is limited due to different social security systems. The Nordic welfare model emphasizes equality, social cohesion, and economic security through national social welfare systems. Finland and other Nordic countries offer sickness allowances as part of their social security systems to support individuals unable to work due to illness or injury. This differs from countries without comprehensive national insurance for sickness absence, where employers or employees typically take out insurance themselves to secure a loss of earnings in case of long-term sickness.

Conclusion

This study showed that low LTPA combined with high leisure screen sitting time increased the risk of having sickness absence due to mental disorders and are associated with a higher number of sickness absence days. Alongside increasing LTPA, reducing screen sitting time can have a positive impact on sickness absence. These findings suggest that reducing sitting time in front of a screen and increasing physical activity could be used as alternative or additive targets to alleviate the burden of sickness absences. Employers, policymakers and other stakeholders could consider supporting the reduction of sedentary time and the increase of physical activity of the population outside working hours.

Author statements

Ethical approval

The FinHealth 2017 Study received approval from the Coordinating Ethics Committee at the Hospital District of Helsinki and Uusimaa (Reference 37/13/03/00/2016).

Funding

This study was supported by Juho Vainio Foundation, Finland (Grant #202400184).

Competing interests

The authors declare that they have no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2024.05.016.

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