

# The health paradox of occupational and leisure-time physical activity

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## ABSTRACT

**Background** Occupational and leisure-time physical activity are considered to provide similar health benefits. The authors tested this hypothesis.

**Methods** A representative sample of Danish employees (n=7144, 52% females) reported levels of occupational and leisure-time physical activity in 2005. Long-term sickness absence (LTSA) spells of  $\geq 3$  consecutive weeks were retrieved from a social-transfer payment register from 2005 to 2007.

**Results** 341 men and 620 females experienced a spell of LTSA during the period. Cox analyses adjusted for age, gender, smoking, alcohol, body mass index, chronic disease, social support from immediate superior, emotional demands, social class and occupational or leisure-time physical activity showed a decreased risk for LTSA among workers with moderate (HR 0.85, CI 0.72 to 1.01) and high (HR 0.77, CI 0.62 to 0.95) leisure-time physical activity in reference to those with low leisure-time physical activity. In contrast, an increased risk for LTSA was shown among workers with moderate (HR 1.59, CI 1.35 to 1.88) and high (HR 1.84, CI 1.55 to 2.18) occupational physical activity referencing those with low occupational physical activity.

**Conclusion** The hypothesis was rejected. In a dose–response manner, occupational physical activity increased the risk for LTSA, while leisure-time physical activity decreased the risk for LTSA. The findings indicate opposing effects of occupational and leisure-time physical activity on global health.

## INTRODUCTION

The hazard of sedentary lifestyle is widely acknowledged.<sup>1–3</sup> Physical activity in all settings (eg, occupational and leisure time) have therefore been considered to provide similar health-promoting benefits.<sup>4–6</sup> Accordingly, the international recommendations for health-promoting physical activity do not distinguish between occupational and leisure-time physical activity.<sup>7</sup>

While leisure-time physical activity is well documented to promote health,<sup>2,8</sup> the effects of occupational physical activity on health are characterised by conflicting findings.<sup>9–14</sup> In some cohorts, high occupational physical activity is shown to be associated with improved health,<sup>9–11</sup> while in other cohorts, high occupational physical activity is shown to impair health.<sup>13,16–20</sup> Therefore, whether occupational and leisure-time physical activity impose similar health effects remains unknown.

Long-term sickness absence (LTSA) is an acknowledged measure of global health,<sup>21</sup> and comprises an economic burden for the welfare in western

societies.<sup>22</sup> Therefore, we investigated whether occupational and leisure-time physical activities impose similar effects on the risk for LTSA.

## MATERIALS AND METHODS

### Data and the population

Data on work environment and health in the study population were obtained from the Danish Work Environment Cohort Study, DWECS,<sup>23</sup> which utilises both questionnaires and questionnaire-based telephone interviews for data collection. In 2005, a random sample of 12 413 people aged 18–74 years (response rate 63%, n=19 797) large enough to be representative for all job groups participated, and of these, 8116 were wage earners aged 18–64 not reported to have received sickness-absence compensation in the week prior to follow-up. Only those answering all questions, relevant for this study, of the questionnaire (n=5.466) and the interview (n=1.678) were included in the analyses. Thus, the final balanced sample consisted of 7.144 persons.

### Occupational physical activity

Which description most precisely covers your pattern of physical activity at work?<sup>24</sup>

1. You are mainly sedentary and do not walk much around at your workplace—for example, desk work, work including assembling of minor parts.
2. You walk around quite a bit at your workplace but do not have to carry heavy items—for example, light industrial work, non-sedentary office work, inspection and the like.
3. Most of the time you walk, and you often have to walk up stairs and lift various items. Examples include mail delivery and construction work.
4. You have heavy physical work. You carry heavy burdens and carry out physically strenuous work—for example, work including digging and shoveling.

In the analyses, group 1 is referred to as Low and group 2 as moderate; since only 5.0% belonged to group 4, groups 3 and 4 were pooled and are referred to as high.

### Leisure-time physical activity

Which description most precisely covers your pattern of physical activity in leisure time?<sup>24</sup>

1. You are mainly sedentary—for example, you read, watch television, go to the pictures. In general, you spend most of your leisure time performing sedentary tasks.

2. You go for a walk, use your bicycle a little or perform activity for at least 4 h/week. For example, light gardening, leisure-time building activity, table tennis and bowling.
3. You are an active athlete, run, play tennis or badminton for at least 3 h/week. If you frequently perform heavy gardening, you also belong to this group.
4. You take part in competitive sports, swim, play European football, handball or run long distances regularly, that is, several times/week.

In the analyses, group 1 is referred to as Low and group 2 as Moderate; since only 3.3% belonged to group 4, groups 3 and 4 were pooled and are referred to as High.

### Sex and age

Sex and age were extracted from register data.

### Smoking

Smoking status was divided into two categories: 'Never and former' and 'Current.'

### Alcohol consumption

Alcohol consumption was measured by means of the question 'On average, how much alcohol do you drink during the day? (Number of bottles of beer/liquor: drinks per day/glasses of wine per day)<sup>25</sup>: with answers dichotomised in 'no or moderate consumption' versus 'heavy consumption', with heavy consumption defined as drinking more than two (women) or three (men) units per day, respectively.

### Chronic disease

If a participant reported a disease diagnosed by a doctor, we classified the participant as having a chronic disease.

### Body mass index

Body mass index (BMI) was based on self-reported body weight and height and measured as kg/m<sup>2</sup>.

### Psychosocial factors

'Social support from immediate superior' was measured by means of two questions from the Copenhagen Psychosocial Questionnaire (COPSOQ) 'How often do you get help and support from your immediate superior?' and 'How often is your immediate superior willing to listen to your work related problems?' with response options (and values for the scale) 'Always' (100), 'Often' (75), 'Sometimes' (50), 'Seldom' (25) and 'Never/hardly ever' (0), and were combined into a scale with values from 0 to 100<sup>26</sup> with interitem correlation=0.75, and Cronbach's  $\alpha$ =0.86.

'Emotional demands' was measured by means of the following three COPSOQ questions: 'Does your work put you in emotionally disturbing situations?', 'Is your work emotionally demanding?' and 'Do you get emotionally involved in your work?' with the response options (and values for the scale) 'To a very large extent' (100), 'To a large extent' (75), 'Somewhat' (50), 'To a small extent' (25) and 'To a very small extent' (0) and were combined into a scale with values from 0 to 100<sup>26</sup> with interitem correlations=0.64–0.75, and Cronbach's  $\alpha$ =0.88.

### Social class

The respondents were classified into five social classes according to employment grade, job title and education.<sup>27</sup> Social class I included executive managers and academics; social class II comprised middle managers and persons with 3–4 years of higher education. Social class III consisted of other white-collar

workers, and social class IV comprised skilled blue-collar workers. Social class V covered semiskilled or unskilled workers.

### Questionnaire method

The respondents were classified according to mode of data collection, being either postal questionnaire or telephone interview.<sup>28</sup>

### Sickness absence

Data on sickness absence were obtained from the Danish Register for Evaluation of Marginalisation (DREAM) at the National Labour Market Authority and linked to the DWECs.<sup>29</sup> DREAM contains weekly information on granted sickness absence compensation for all citizens in Denmark. Sickness absence compensation is given to the employer, who can apply for a refund from the government for employees after a certain number of calendar days of sickness absence (up to 2007 >13 days, 2007–2008 >14 days). Because it is not necessary to report a reason for a spell of sickness absence, DREAM does not contain diagnosis data. LTSA was defined as receiving sickness absence compensation for a period of  $\geq 3$  consecutive weeks in the follow-up period from 1 January 2006 to 31 December 2007.

### Statistical analyses

In the present prospective cohort study, the data on the first event of LTSA correspond to survival times, which in most cases are censored, as the cohort is only followed for 2 years. Persons who retire, enter an early retirement pension scheme, emigrate or die during the period are censored at the time of the event. For LTSA beginning in 2006 or 2007, the survival time was non-censored and referred to as event time. The Cox proportional hazard model<sup>30</sup> was used for modelling the probability of LTSA in the follow-up period.

The analyses were performed with and without stratification on gender. Independent variables of interest were occupational and leisure-time physical activity. In all analyses, control was made for age in years, smoking, alcohol consumption, BMI, chronic illness, questionnaire method, social support, emotional demands and social class. The non-stratified analyses were also controlled for gender. The applied estimation method was maximum likelihood, and the statistical computer program used was SAS (version 9.2), with the PHREG procedure.

### RESULTS

Three hundred and forty-one (10.0%) of the males and 620 (16.6%) females experienced at least one period of LTSA from 1 January 2006 to 31 December 2007.

Table 1 illustrates the demographic and lifestyle variables from the random sample of the Danish working population in 2005, stratified on gender and categorised in three levels of occupational physical activity. The most pronounced divergences between the three categories of occupational physical activity were the prevalence of smoking, low social class and LTSA. Table 2 illustrates demographic and lifestyle variables from the random sample of the Danish working population in 2005, stratified on gender and categorised in three levels of leisure-time physical activity. Also, in table 2, the most pronounced differences between the categories of occupational physical activity were smoking, low social class and LTSA; however, the prevalence was opposite that seen between the categories of leisure-time physical activity in table 1.

**Table 1** Lifestyle and other characteristics stratified on level of occupational physical activity among males and females

Gender	Males			Females		
	Low (n=1552)	Moderate (n=757)	High (n=1107)	Low (n=1660)	Moderate (n=1109)	High (n=959)
Level of occupational physical activity						
Age (years, mean (SD))	43.0 (10.3)	42.0 (11.3)	40.9 (11.3)	43.0 (10.2)	41.8 (11.3)	41.1 (11.5)
Leisure-time physical activity (%)						
Low	16.9	13.7	18.0	16.7	11.9	14.7
Moderate	53.0	58.8	53.1	64.2	69.1	65.7
High	30.2	27.5	28.9	19.1	19.0	19.6
Current smoking (%)	24.0	32.6	37.0	23.7	25.9	36.0
High alcohol consumption (%)	14.8	16.8	19.6	12.7	14.1	12.2
BMI (mean (SD))	25.7 (3.5)	25.7 (3.7)	25.9 (3.6)	24.0 (4.1)	24.1 (4.5)	24.6 (4.3)
Social support from immediate superior (mean (SD))	65.1 (24.3)	67.1 (25.4)	63.8 (26.1)	66.6 (25.2)	69.0 (25.2)	63.6 (26.9)
Emotional demands (mean (SD))	31.1 (22.3)	30.1 (24.5)	22.0 (20.4)	34.5 (22.9)	41.8 (24.4)	39.4 (24.3)
Low social class (classes IV/V) (%)	16.4	40.8	77.8	9.6	29.0	51.5
Long-term sickness absence (%)	6.2	10.6	14.9	12.7	18.4	21.4

Values presented are mean (SD) or frequency as a percentage.

**Table 2** Lifestyle and other characteristics stratified on level of leisure-time physical activity among males and females

Gender	Males			Females		
	Low (n=565)	Moderate (n=1855)	High (n=996)	Low (n=550)	Moderate (n=2462)	High (n=716)
Level of leisure-time physical activity						
Age (years, mean (SD))	41.7 (10.6)	43.9 (10.5)	38.9 (11.1)	42.0 (10.8)	43.1 (10.7)	39.2 (11.1)
Occupational physical activity (%)						
Low	46.4	44.3	47.0	50.4	43.3	44.3
Moderate	18.4	24.0	20.9	24.0	31.1	29.5
High	35.2	31.7	32.1	25.6	25.6	26.3
Current smoking (%)	40.7	31.7	21.3	35.8	27.4	21.7
High alcohol consumption (%)	21.1	15.7	16.5	12.9	12.9	13.3
BMI (mean (SD))	26.4 (4.2)	26.0 (3.6)	25.0 (2.9)	25.5 (5.4)	24.2 (4.1)	23.0 (3.6)
Social support from immediate superior (mean (SD))	65.6 (24.7)	65.1 (25.2)	64.9 (25.4)	65.6 (27.0)	66.4 (25.5)	68.0 (25.3)
Emotional demands (mean (SD))	26.0 (23.4)	28.2 (22.3)	28.6 (22.6)	35.3 (24.0)	38.6 (23.8)	37.6 (23.9)
Low social class (classes IV/V) (%)	49.0	43.1	34.8	29.2	25.9	25.0
Long-term sickness absence (%)	13.8	9.8	8.2	19.3	17.3	12.4

Values presented are mean (SD) or frequency as a percentage.

Table 3 shows the results of Cox proportional hazard analyses from occupational and leisure-time physical activity on LTSA including different potentially confounding variables. In a dose-response manner, occupational physical activity increased the risk for LTSA. Workers with high level of occupational physical activity had an 84% increased risk for LTSA compared to workers with a low level of occupational physical activity. Contrary, increasing levels of leisure-time physical activity reduced the risk for LTSA. Workers with a high level of leisure-time physical activity had a 23% lower risk for LTSA compared with workers with a low level of leisure-time physical activity. Similar trends in the associations between occupational and leisure-time physical activity and LTSA were found among both genders.

## DISCUSSION

The hypothesis of the study was rejected. Occupational physical activity increased the risk for LTSA, while leisure-time physical activity decreased the risk for LTSA. These findings indicate opposing effects of occupational and leisure-time physical activity on global health.

In a dose-response manner, increasing levels of occupational physical activity increased the risk for LTSA. The 84% increased risk for LTSA among workers with high- compared with low occupational physical activity illustrates the

significance of high occupational physical activity for the risk of LTSA. This finding is in line with earlier documentation of high physical work demands as a predictor for LTSA.<sup>19</sup> Because register-based LTSA is shown as a valid measure for general health,<sup>21</sup> these findings highlight the detrimental effects of high occupational physical activity on general health.

While high occupational physical activity increased the risk for LTSA, increasing levels of leisure-time physical activity had the opposite effects on LTSA. The observation of a reduced risk for sickness absence from leisure-time physical activity is in accordance with previous studies,<sup>31-36</sup> supporting the health beneficial effects of leisure-time physical activity.<sup>2-8</sup> Because participation in leisure-time physical activity is negatively associated with both occupational class and occupational physical activity,<sup>37</sup> workers with high occupational physical activity ought to be particularly recommended and promoted to be physically active at leisure time.

These opposing effects of physical activity during work and leisure highlight the importance of type and setting of the physical activity for its influences on health. The activity patterns characterising occupational physical activity are heavy lifting, prolonged standing, highly repetitive work, working with the hands lifted to shoulder height or higher and working with the back twisted or bent forward.<sup>19</sup> In contrast, the activity patterns characterising the health-promoting

**Table 3** Occupational and leisure-time physical activity and risk for long-term sickness absence from 2006 to 2007 among males and females stratified into levels of occupational and leisure-time physical activity

	Gender			
	Both		Males	Females
	HR (95% CI)†	HR (95% CI)‡	HR (95% CI)§	HR (95% CI)§
Occupational physical activity				
Low	1¶	1¶	1¶	1¶
Moderate	1.60 (1.36 to 1.88)***	1.59 (1.35 to 1.88)***	1.57 (1.15 to 2.14)**	1.58 (1.29 to 1.93)***
High	2.04 (1.75 to 2.37)***	1.84 (1.55 to 2.18)***	2.03 (1.52 to 2.72)***	1.71 (1.37 to 2.12)***
Leisure-time physical activity				
Low	1¶	1¶	1¶	1¶
Moderate	0.80 (0.68 to 0.95)**	0.85 (0.72 to 1.01)	0.73 (0.56 to 0.96)*	0.93 (0.75 to 1.16)
High	0.60 (0.49 to 0.74)***	0.77 (0.62 to 0.95)*	0.81 (0.58 to 1.11)	0.76 (0.56 to 1.02)

Different adjustment criteria are applied in Cox proportional hazards regression analyses with forced entry of variables.

HR (95% CI) are presented.

\* $p \leq 0.05$ , \*\* $p \leq 0.01$ , \*\*\* $p \leq 0.001$ .

†Control made for gender and leisure time or occupational physical activity respectively.

‡Control made for § and gender.

§Control made for age, smoking, alcohol, BMI, chronic illness, questionnaire method, social support from immediate superior, emotional demands, social class and leisure time or occupational physical activity respectively.

¶Reference.

physical activity at leisure are dynamic contractions of large muscle groups increasing whole-body metabolism and cardiac output with ability to rest when fatigue requests so.<sup>38</sup> Consistent with this finding, leisure time and occupational physical activity were previously shown to provide contrasting effects on future physical functioning.<sup>14</sup> However, future studies ought to objectively measure characteristics of physical activity at work and leisure time (eg, type, intensity, variation, duration) and related physiological responses (eg, ambulatory blood pressure and heart rate variability) for determining the underlying mechanisms for their opposite effects on global health.

Gender differences in LTSA are well documented.<sup>39</sup> Therefore, stratified analyses on gender were also performed. The comparable trends in the associations between occupational and leisure-time physical activity and LTSA among both genders in this study indicate similar effects of occupational and leisure-time physical activity on general health.

Sickness absence may be considered to be more a measure of absence than sickness, influenced by factors such as attitudes and satisfaction to work. However, objectively measured sickness absence is shown to predict both disability pension<sup>40</sup> and mortality,<sup>21 41</sup> and is therefore recognised as an appropriate measure for global health. Moreover, a particularly strong relation is shown between longer spells of sickness absence periods and future illness,<sup>42</sup> and therefore a sickness absence of more than 3 consecutive weeks was used in this study as a measure of global health.

The advantages of the present study are that it is prospective, based on a representative population, and captures nearly all episodes of LTSA in the study population.<sup>29</sup> The questions on leisure time and occupational physical activity have been used in several studies from the Nordic countries.<sup>6 12 43 44</sup> However, a particular limitation of the study is the self-report of physical activities, and that physical activity was assessed only once at baseline. Self-assessment of physical activity invariably entails some degree of misclassification,<sup>45</sup> which could result in an under- or overestimation of the association between physical activity and the outcome. A general weakness of the present study is that all risk factors and covariates are self-reported.

A methodological aspect of this study is that Denmark differs from most other countries, as compensated sickness absence spells do not require a diagnosis. Therefore, we do not know the specific diagnosis causing the LTSA in this study.

#### POLICY IMPLICATIONS

- ▶ The large fraction of the working population being exposed to high occupational physical activity having a doubled risk for LTSA highlights the need for defining high physical work demands as a hazard for public health.
- ▶ The reduced risk of LTSA from leisure-time physical activity provides a good mean for preventing the considerable public health problem and economic burden of LTSA in western societies.

#### What is already known on the topic

- ▶ The hazard of sedentary lifestyle is well documented.
- ▶ Physical activity in all settings (eg, occupational and leisure time) is considered to provide similar health-promoting benefits.
- ▶ The international recommendations for health-promoting physical activity do not distinguish between occupational and leisure-time physical activity.

#### What this study adds

- ▶ This study indicates opposing effects of occupational and leisure-time physical activity on long-term sickness absence, where leisure-time physical activity decreases and occupational physical activity increases the risk for impaired global health.
- ▶ International recommendations for health-promoting physical activity ought to distinguish between occupational and leisure-time physical activity.



- International recommendations for health-promoting physical activity ought to distinguish between occupational and leisure-time physical activity.

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## The health paradox of occupational and leisure-time physical activity

A Holtermann, J V Hansen, H Burr, et al.

*Br J Sports Med* 2012 46: 291-295 originally published online April 1, 2011

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