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**DOES EMPLOYEE PARTICIPATION IN WORKPLACE HEALTH PROMOTION DEPEND ON THE WORKING ENVIRONMENT? A
CROSS-SECTIONAL STUDY OF DANISH WORKERS**

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ABSTRACT:

Objectives: To investigate if participation in workplace health promotion (WHP) depends on the work environment.

Methods: Questionnaire data on participation in WHP activities (smoking cessation, healthy diet, exercise facilities, weekly exercise classes, contact with health professionals, health screenings) and the work environment (social support, fatiguing work, physical, quantitative and emotional demands, job control and WHP availability setting) were collected cross-sectionally in 2010 in a representative sample (n=10,605) of Danish workers. Binary regression analyses of the association between work environment characteristics and participation in WHP were conducted, adjusted for age, gender and industry.

Results: WHP offered during leisure time was associated with lower participation in all measured activities compared to when offered during working hours. Low social support and very fatiguing work were associated with low participation in WHP. None of the measured work demands (quantitative, physical or emotional) were associated with lower participation in WHP. However, high physical demands/low job control and high emotional demands/low job control were associated with low participation.

Conclusion: Worker participation in WHP was associated with WHP availability during paid work time, as well as characteristics in the working environment. This suggests that to obtain proper effect of health promotion in a workplace setting, a good work environment is essential.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- Involves a large number of employees from several different occupations and industries in a representative sample of Danish employees.
- Self-reported information regarding work environment and the availability of health promotion represents the perceptions of the participants, which is known to impose risks of bias.

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- The reporting of participation reflects any level of participation in health promotion within the last year
- All data were collected concurrently and analyses performed in a cross-sectional design, which hampers interpretation of causality.

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INTRODUCTION:

Non-communicable diseases such as diabetes, heart disease and cancer are prevalent and increasing in Western countries[1]. These diseases have large consequences for the individual's life quality and function as well as for societal costs to health care and productivity loss[1]. The causes of these diseases are mainly related to lifestyle such as poor diet, physical inactivity and smoking[1], but also working environment features (i.e. high physical work demands)[2] and stress due to psychosocial job features[3, 4].

The workplace has therefore been suggested to be a suitable setting for health promotion. The suggestion is based on the notion that health promotion requires not just behavior change but also a supportive environment. Thus, safe, stimulating, satisfying and enjoyable working conditions are meant to support health-promoting activities[5]. A recent meta-analysis concluded that workplace health promotion (WHP) is primarily effective among white-collar workers and highly selected individuals[6]. Many WHP studies report low participation rates[7] and problems with implementation and sustainability associated with the organization of the work[8, 9]. Thus, the workplace may only be a suitable setting for health promotion under good work environment conditions.

Most likely, WHP interventions have been initiated without ensuring proper contextual work environment. The socio-ecological framework has been used theoretically to illustrate how the work environment may limit participation in workplace health promotion[10]. Factors that may impact individuals' participation involve both structural (i.e. quantitative demands, physical demands and organization of the work)[11] as well as interpersonal factors (i.e. social support)[12, 13]. For example, low job control may decrease the possibility to organize one's work to be able to participate in activities and WHP during paid working hours rather than during leisure may decrease barriers related to leisure time duties. However, it remains to be established how these factors are associated with participation in WHP.

Therefore, the aim of this study was to investigate the association between organizational, structural and interpersonal factors in the work environment and participation in workplace health promotion in a large

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representative sample of Danish employees. The following hypotheses were tested: 1) WHP offered within working hours is associated with higher participation than WHP offered outside working hours, 2) Structural factors of the job and the work environment (high quantitative, physical and emotional work demands, low job control and fatiguing work) are associated with lower participation in WHP and 3) Interpersonal factors in the working environment (i.e. low social support) are associated with lower participation in WHP.

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STUDY POPULATION:

In 2010, the fifth round of the Danish Work Environment Cohort Study (DWECS) was conducted[14]. This DWECS round featured a random sample of approximately 21.000 workers aged 18-59 years drawn from the Central Population Register of Denmark; of these, 53% (10,605) participated in the survey. Paper questionnaires were sent to their personal addresses and participants were asked to reply either to the paper questionnaire or to use a link for electronic response.

METHODS:

Participants responded to a self-administered questionnaire with items regarding availability and participation in workplace health promotion (WHP) activities as well as features of the work environment (physical work demands, physically fatiguing work, quantitative demands, emotional demands, social support from colleagues and supervisor and job control).

Independent variables:

WHP availability

Availability of WHP programmes was determined by the question (modified from Grosch and co-workers [15]) and previously reported in Jorgensen et al.[14]: 'During the last year, have you been offered health promotion via your workplace?' with the response categories 'No', 'Yes, during working hours' and 'Yes, outside working hours'. The following six types of WHP were covered: Smoking cessation, Healthy diet, Exercise facilities, Weekly exercise classes, Contact with health professionals (physiotherapy, psychologist or the like) and Health screenings. Availability timing (during working hours vs. outside working hours (termed leisure time)) was asked for each specific activity.

Physical work demands

Physical work demands were measured by 10 items on typical duration of physical postures and activities at work: 'Does your job require that...' 'you are sitting down?', 'you are standing at the same place?', 'you work with your back bent ... forward without supporting with your arms or hands?', 'you twist or bend your back many times per hour?', 'you lift your arms at or above shoulder height?', 'you do the same finger movements many times per minute (i.e. typing work)?', 'you do the same arm movements many times per minute (i.e. packing work, mounting, machine feeding, cutting)?', 'you squat or kneel, when you work?', 'you push or pull?', 'you lift or carry?'. Answer categories were given points corresponding to: Almost all the time (100), approximately ¾ of the time (75), approximately ½ of the time (50), approximately ¼ of the

time (25), seldom/very little (6), never (0). Answer categories for the item for sitting time was reversed.

The sum of all physical work demand scores was calculated and categorised into quartiles of the total score.

Fatiguing work

Fatiguing work was measured with a question inspired by the Need for Recovery scale[16, 17]: How physically exhausted generally in your body are you after a typical work day?. The six answer categories were categorised into three levels of fatigue: Not fatigued (Not exhausted, a little bit exhausted), moderately fatigued (somewhat exhausted) and very fatigued (very exhausted, totally exhausted).

Quantitative demands

Quantitative demands were determined by three questions replied to on one scale (Always, Often, Sometimes, rarely, never/almost never): 'How often...' '...is your work unevenly distributed, so that it piles up?', '...do you not have time to complete all your work tasks?' and '...do you have to do overtime?'. Each answer was converted to a scale from 0-100 at equal 20-point increments (0=never, 100=always). The mean of these was generated by dividing the sum of the items by the number of items, and this variable was dichotomized at the median value into high/low.

Work pace

Work pace was determined by the question: 'How often do you have to work very fast' (Always, Often, Sometimes, rarely, never/almost never)? The answer was converted to a scale from 0-100 at equal 20-point increments (0=never, 100=always) and dichotomized at the median value into high/low.

Emotional demands

Emotional demands was measured with three questions with one answer scale (To a very high degree, to a high degree, partly, to a low degree, to a very low degree): ‘To what degree ...’ ‘...is your work emotionally demanding?’, ‘...do you get emotionally involved in your work?’ and ‘...do you have to deal with other people’s problems at work?’. The answer was converted to a scale from 0-100 at equal 20-point increments (0=to a very low degree, 100=to a very high degree) and dichotomized at the median value into high/low.

Control

Control was determined by two items regarding influence: ‘Are you involved in the planning of your work (i.e. how it’s done, or who you work with)?’ (always, usually, usually not, never) and ‘Do you have a large degree of influence concerning your work?’ (always, often, sometimes, rarely, never/almost never). The answers were converted to a scale from 0-100 at equal 25-point increments (0=never, 100=always) for the question regarding involvement in planning and at equal 20-point increments for the question regarding influence (0=never/almost never, 100=always) and dichotomized at the median value into high/low.

Job demands/control ratios

Three ratios were computed to represent the effect of qualitatively different types of job demands, relative to the degree of decision latitude available to choose how to respond to those demands. Thus the numerator varied but the denominator in each case was the job control scale above. *Psychosocial job strain* was the ratio of quantitative demands to control, dichotomised into high/low at the median value. *Physical demands and control ratio*: The ratio of physical work demands (above score from 0-100) to job control was calculated. *Emotional demands and control ratio*: The ratio of emotional demands to control was calculated with emotional demands in the nominator and control in the denominator.

Social support

Social support was measured with four questions on one answer scale (Always, often, sometimes, rarely, never/almost never, not relevant): 'How often...' '...are your colleagues willing to listen to your problems at work?', '...do you get help and support from your colleagues?', '...is your nearest supervisor willing to listen to your problems at work?', '...do you get help and support from your nearest supervisor?'. The answers were converted to a scale from 0-100 at equal 20-point increments (0=never/almost never, 100=always) and dichotomized at the median value into high/low.

Dependent variables:

Participation in workplace health promotion

Participation in WHP was calculated only among those who reported to have it available and was determined by the question 'Have you used it [the specific WHP activity asked for availability of]? (If you did, please mark)'. The following six WHP activities were requested: "Smoking cessation", "Healthy diet", "Exercise facilities", "Weekly exercise classes", "Contact with health professionals (physiotherapy, psychologist or the like)" and "Health screenings".

Covariates:

Age and gender were obtained from the Central Population Register and industry from Statistics Denmark's registers. Age was categorised into the following categories 18-29, 30-39, 40-49 and 50-59. Industry was categorised into: Manufacturing, Construction, Graphics, Transportation and Retail, Trading, Service, Agriculture, Social and health care, Teaching and research, Finance/public administration, and Business administration.

Statistical analyses

Spearman correlation coefficients were calculated for all pairs of independent variables. Variables with high collinearity were either collapsed or presented in separate models. Binomial logistic regression models

were used to estimate odds ratios for participation in WHP according to work environment factors. Job strain, the emotional demands/control ratio, social support, fatigue, physical work demands and availability timing were added into the same regression model to investigate their mutually adjusted associations with participation. The ratio of physical work demands/job control was investigated in a separate model with the same covariates, where it replaced the other two ratios.

All models were adjusted for age, gender and industry. Furthermore, the model investigating participation in smoking cessation was restricted to those with current/previous smoking status. The statistical analysis was performed using the SAS statistical software 9.2 for Windows. An alpha level of 0.05 was defined as representing statistical significance.

RESULTS:

The two social support indices (i.e. colleague support and supervisor support) were highly correlated (Table 1) and therefore collapsed. Physical work demands and lifting and carrying were highly correlated. There were 9835 (93%) employees providing data on availability and participation of WHP included in the analyses.

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TABLE 1: Correlation matrix with an overview over single measures of work environment and their correlation with each other in a representative sample of Danish workers

	Physical Work	Fatiguing work	Lifting and carrying	Job control	Quantitative demands	Work Pace	Emotional demands	Social support from colleagues	Social support from supervisor
Physical work demands									
Spearman rho	1	0.37	-0.68	-0.19	-0.25	0.01	0.02	0.00	-0.04
p=	.	<.0001	<.0001	<.0001	<.0001	0.196	0.1089	0.6939	0.0004
Fatiguing work									
Spearman rho	.	1	-0.34	-0.22	-0.01	0.17	0.06	-0.13	-0.15
p=	.	.	<.0001	<.0001	0.2515	<.0001	<.0001	<.0001	<.0001
Lifting and carrying									
Spearman rho	.	.	1	0.18	0.16	-0.04	0.06	0.06	0.07
p=	.	.	.	<.0001	<.0001	0.0005	<.0001	<.0001	<.0001
Job control									
Spearman rho	.	.	.	1	0.09	-0.07	0.09	0.20	0.30
p=	<.0001	<.0001	<.0001	<.0001	<.0001
Quantitative demands									
Spearman rho	1	0.33	0.20	-0.16	-0.17
p=	<.0001	<.0001	<.0001	<.0001
Work Pace									
Spearman rho	1	0.15	-0.11	-0.14
p=	<.0001	<.0001	<.0001
Emotional demands									
Spearman rho	1	0.01	-0.03
p=	0.4414	0.0041
Social Support from colleagues									
Spearman rho	1	0.55
p=	<.0001
Social support from supervisor									
Spearman rho	1
p=

p = level of significance

A little more than half of the study population were male (54%) and the most prevalent age group were 40-49 year olds (32%). Further descriptive information on the gender distribution, age group, industry, work environment and availability of health promotion is presented in Table 2. The most prevalent WHP was contact to health professional (33%) and the least prevalent WHP available in the population was smoking cessation (16%) and among those with WHP available, the WHP with highest participation was healthy diet (53%) and the lowest participation was smoking cessation (10%). Further descriptive detail regarding availability and participation is given in table 3.

TABLE 2: Descriptive information regarding distribution of age, gender, industry and work environment in a representative sample of Danish workers.

N=9835	n	%
Gender (%)		
Female (%)	3925	45.9
Male (%)	4627	54.1
Age (%)		
18-29 years	1429	16.7
30-39 years	1944	22.7
40-49 years	2703	31.6
50-59 years	2476	29.0
Industry (%)		
Manufacturing (%)	910	10.6
Construction (%)	244	2.9
Graphics (%)	64	0.7
Transportation and Retail (%)	621	7.3
Trading (%)	243	2.8
Service (%)	392	4.6
Agriculture (%)	57	0.7
Social and health care (%)	1683	19.7
Teaching and research (%)	684	8.0
Finance/Public administration (%)	629	7.4
Business administration (%)	425	5.0
Unknown	2600	30.4
High emotional demands	4940	51.6
High emotional demands/control ratio	4641	49.9
Low social support	4306	45.8

High physical workdemands	4769	50.0
High jobstrain	4639	49.7
High quantitative demands	5146	53.6
High work pace	6477	67.7
High physical workdemands/control	4581	49.9
Low Control	5723	60.1
Fatigue		
No (%)	5971	62.3
Moderate (%)	2594	27.1
Very (%)	1023	10.7

TABLE 3: Availability and participation during the past year for six different categories of health promotion among a representative sample of Danish workers.

	Availability		Participation	
	n	%	n	%
Smoking cessation	1600	16.3	156	9.8
Healthy diet	1948	19.8	1027	52.7
Exercise Facilities	3263	33.2	919	28.2
Weekly exercise	1784	18.1	457	25.6
Contact to health professional	3230	32.8	1260	39.0
Health check	1676	17.0	752	44.9

The association between work environment and participation

The results of the regression models are presented in Table 4 and described below.

TABLE 4: Binary regression mutually controlled for gender, age and industry on the association between work environment and participation in workplace among a representative sample of Danish workers.

Estimate	Contact with health professional			Health check			Exercise facilities			Weekly exercise			Healthy diet			Smoking cessation*		
	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate
	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher
Emotional demands (high)	1,25	1,00	1,58	1,04	0,76	1,41	0,99	0,77	1,26	0,91	0,64	1,30	1,20	0,90	1,61	0,51	0,25	1,04
Physical Workdemands (high)	0,98	0,83	1,16	1,23	0,97	1,54	0,96	0,81	1,15	0,91	0,70	1,17	0,81	0,66	1,01	1,00	0,62	1,62
Quantitative demands (high)	1,03	0,88	1,21	0,99	0,79	1,24	0,97	0,82	1,16	0,83	0,55	1,07	1,13	0,92	1,39	0,87	0,55	1,37
Work pace (high)	1,01	0,85	1,20	0,88	0,70	1,12	0,92	0,76	1,11	0,96	0,73	1,25	1,02	0,83	1,26	0,91	0,56	1,49
Social Support (Low)	1,12	0,95	1,31	0,99	0,79	1,24	0,81	0,68	0,96	0,86	0,67	1,11	0,86	0,70	1,06	1,07	0,67	1,70
Emotional demands/control ((High)	0,72	0,57	0,91	0,86	0,62	1,17	0,96	0,75	1,24	0,90	0,63	1,29	0,65	0,48	0,87	1,10	0,54	2,21
Physical workdemands/control (high)a	0,96	0,82	1,12	1,15	0,93	1,41	0,95	0,80	1,11	0,95	0,75	1,20	0,80	0,66	0,97	0,97	0,64	1,47
Jobstrain (ratio (high/low)) (high)	0,95	0,81	1,11	0,99	0,79	1,25	1,03	0,87	1,22	0,83	0,55	1,07	1,10	0,90	1,36	0,93	0,58	1,51
Availability setting (leisure time) ^b	0,70	0,60	0,82	0,34	0,26	0,43	0,75	0,62	0,90	0,56	0,43	0,73	0,27	0,20	0,36	0,54	0,44	0,85
Moderately fatigued	1,25	1,03	1,51	0,93	0,72	1,21	1,06	0,87	1,29	0,93	0,70	1,24	1,00	0,78	1,28	1,74	1,06	2,87
Very fatigued	1,20	0,90	1,60	0,86	0,54	1,38	0,79	0,57	1,11	0,54	0,31	0,94	1,16	0,78	1,73	1,53	0,70	3,34

Significant (p>0.05) associations are highlighted (bold), borderline significant associations are highlighted (italics), a=separate model controlled for gender, age, control and industry, b=ref=working hours, *=only among smokers and previous smokers

Availability timing

Availability timing of WHP during working hours vs. leisure time was highly associated with participation in WHP. WHP offered during leisure time was associated with lower participation in all measured WHP activities compared to when offered during working hours (Odds ratio (OR) (Confidence interval (CI)) = 0.70 (0.60-0.82) for contact with health professional, 0.34 (0.26-0.43) for health screening, 0.75 (0.62-0.90) for exercise facilities, 0.56 (0.43-0.73) for weekly exercise, 0.27 (0.20-0.36) for healthy diet, and 0.54 (0.34-0.85) for smoking cessation.

Physical work demands

Having high physical work demands was not associated with WHP participation with ORs ranging from 0.91-1.00 for most WHP activities. There were only weak, non-significant associations with higher participation in healthy diet (OR=1.23(95%CI=0.97-1.54) and lower participation in health check (OR=0.81(95%CI=0.66-1.01).

Physical Fatigue after work

Being moderately fatigued after work (compared to no fatigue) was associated with higher participation in contact with health professional (OR=1.25(95%CI=1.03-1.51)) and smoking cessation (OR=1.74(95%CI=1.06-2.87), but not with participation in other WHP activities. Being very fatigued after work was associated with lower participation in weekly exercise sessions (OR= 0.54(95%CI=0.31-0.94) referencing those not being fatigued.

Quantitative demands

Reporting high quantitative demands at work was not significantly associated with participation in WHP activities, with ORs ranging from 0.83-1.13.

Work pace

Reporting high work pace was not significantly associated with participation in WHP activities with ORs ranging from 0.88-1.02.

Emotional demands

Reporting of emotional demands at work was associated with higher participation in contact with health professional (OR=1.25 (95%CI=1.0-1.58). For the other WHP activities, the ORs were non-significant

between 0.99-1.20. There was a stronger, but also non-significant association between high emotional demands and lower participation in smoking cessation (OR=0.51 (95%CI=0.25-1.04), indicating lower participation.

Demands/control ratios

Demands and control ratios: High job strain was not associated with participation in any WHP activities, with ORs ranging from 0.83-1.10. A high ratio of physical demands to job control was associated with lower participation in healthy diet (OR= 0.80 (95%CI=0.66-0.97). The physical demands/job control ratio was not associated with the other WHP-activities, with ORs ranging from 0.95-1.15. A high ratio of emotional demands to job control was associated with a lower participation in contact with health professional (OR=0.72 (95%CI=0.57-0.91)) and healthy diet (OR=0.65 (95%CI=0.48-0.87)). This ratio was not significantly associated with any of the other WHP activities with OR's ranging from 0.86-1.10.

Social support

Low social support was significantly associated with lower participation in exercise facilities (OR= 0.81 (95%CI=0.68-0.96)). Low social support was not associated with participation in the other WHP activities, with ORs ranging from 0.86-1.12.

>>Table 4<<

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DISCUSSION:

In this study of a large representative sample of Danish employees, several characteristics of the work environment were associated with employee participation in WHP. In particular, WHP activities available only during leisure time had markedly lower odds of participation. Adverse work environment factors (i.e. low social support and very fatiguing work) were also associated with low participation. High demands at work (i.e. physical, emotional and quantitative demands) did not seem to be independent a barrier for participation. However, in combination with low control did high physical and emotional work demands seem to limit participation in WHP. In the following, the results are discussed and compared with previous studies on participation in WHP.

The most dominating factor associated with participation proved to be timing and/or setting of the availability of the WHP activity (i.e. during working hours or during leisure time). For all types of health promotion initiatives, being available only in leisure time meant a much lower probability for participation than for availability during working hours. A previous qualitative study suggested that accessibility of WHP was important for WHP participation and suggested that this may be due to WHP during paid work hours signals stronger management commitment[11]. Another explanation is that it is simply more feasible for the workers to fit the participation into everyday life (e.g. obligations to children or a second job may hamper participation outside working hours). The latter explanation is in line with previous explanations for participation in WHP. For example, the socio-ecological framework suggests that higher order structural factors are overarching determinants for workplace health promotion participation[10]. In the settings approach suggested by the Ottawa Charter for health promotion strategy, location and provider of health promotion were mentioned as important prerequisites for implementation[5]. However, these additional features were not measured in the current study. Furthermore, state of the art implementation techniques also take timing into consideration when mapping barriers and facilitators for implementation of a health

education initiative[18]. Thus, timing seems to be a highly important structural factor to consider when planning implementing WHP.

The actual production demands at work (emotional, quantitative and physical) were not independently associated with lower participation in WHP. This is in contradiction to previous studies suggesting that high physical work demands limit smoking cessation and weight loss[12, 13]. However, when combined with a concurrent low level of control, high physical work demands was associated with lower participation in WHP, which is in line with one previous study, indicating lower success in efforts for smoking cessation with high physical job strain[19]. Specifically, high physical demands combined with low control lowered the odds of participation in healthy diet, and the combination of high emotional demands and low control lowered the odds of contact with health professional and healthy diet.

The demand-control model is known to be associated with health and well-being and built originally on the concept that high demands and low control could increase the risk of reduced participation in the society[4]. The current study expands that understanding of participation in a way that is logical and plausible but not previously documented. Furthermore, this study established a physical demand-control ratio as previously suggested by[19, 20]. In addition, an emotional demand-control ratio was established. Similarly to the other demand-control ratios, the ratio of emotional demands to control was calculated with emotional demands in the nominator and control in the denominator. The authors are not aware of previous studies that have done this. The association between high emotional demands/control ratio and low participation in contact with health professional is particularly interesting because emotional demands independently increased the odds of participating in contact with health professional. On explanation is that high emotional demands at work generate a need to seek help from health professionals [14] and thus elevates participation propensity, but that low control in the job limits the opportunities for participation and thus lowers participation. However, previously, negative affections have been shown to be highly

associated with the self-reporting of psychological job demands, so the results should be interpreted with caution and the finding tested in future studies.

Social support was positively associated with participation in WHP. This is in line with previous studies reporting that social support is a motivator for participation in health promotion[11]. Also, social support is a well-known important factor for well-being at work[21]. Furthermore, the socio-ecological framework supports the contribution of social support as an interpersonal factor determining participation [10]. In the current study, low social support was associated with low participation in exercise facilities. Exercise facilities do not necessarily include any personal contact with colleagues or other social obligation. Therefore, colleague and supervisor support may become particularly important for the participation in such initiatives. Thus, this finding indicates that when offering exercise facilities at the work place, inclusion of some component of social support should be considered.

One single adverse factor - being moderately fatigued after work - was associated with higher participation in contact with health professional and smoking cessation. Being moderately fatigued is not *per se* a feature of the work environment, but rather a short-term indicator of its effect on the person[22]. The simple fact of acknowledging that one is fatigued may distinguish those who are more willing to seek assistance. Thus, fatigue after work may motivate for individual counseling due to an individually perceived need. Previous analyses of data from the same cohort, indicated that some groups of unhealthy employees (i.e. individuals with elevated BMI) do choose to participate in workplace health promotion presumably based on their individual motivation to promote their health[14]. Thus, even though this study indicates that higher order factors in the work environment and organization are important for participation in workplace health promotion, individual motivation may still be an important mediator. However, reporting of being very fatigued after work was associated with lower participation in weekly exercise. An interpretation of this finding is that high fatigue after work is an important barrier for exercising.

STRENGTHS AND WEAKNESSES

This study has strengths since it involves a large number of employees from several different occupations and industries in a representative sample of Danish employees. However, the study also includes limitations. First, the self-reported information regarding work environment represents the perceived environment of the participants, which is known to impose risks of bias. For example, negative affect is shown to impact the reporting of psychological work demands[23]. Likewise, negative affect may be associated with participation in WHP. Such reporting biases would render the analyses vulnerable to confounding and reporting bias, which would increase the risk of finding false associations between adverse work environment and low participation. Therefore, the results should be interpreted in the light of this limitation. Second, the self-reported information regarding availability of health promotion represents the perceived availability of health promotion at the workplace. Therefore, it is possible that some workers have health promotion available without being aware of it, and that those aware of health promotion offers may be a selected group of workers. Third, the reporting of participation reflects any level of participation within the last year and thus there may be some misclassification since those participating only once may not be distinguishable from those not participating. In addition, the impact of work environment features on the frequency or intensity of the individual's participation cannot be determined in this study. Finally, all data were collected concurrently and analyses performed in a cross-sectional design. This hampers interpretation of causality. For example, it is possible that participation in workplace health promotion can positively impact the perception of the work environment.

Conclusion and implications for clinicians and policymakers

Adverse work environment factors such as low social support and very fatiguing work were associated with lower employee participation in WHP. High physical, quantitative and emotional demands were not associated with low participation, but high demands in combination with low control lowered the odds for participation in WHP. These findings suggest that to obtain proper implementation and effects of WHP,

initiatives for ensuring a good work environment is essential. Furthermore, the probability for participation in WHP seems to be elevated when the activities are offered during paid working hours. Therefore, a supportive work environment seems to be an important foundation for employees’ participation in WHP.

Data sharing statement: The raw data from the survey is publicly available in Danish at the website of the National Research Centre for the Working Environment, Denmark

Contributors: MBI initiated the study and planned the analyses, interpretation and drafting of the paper. LP contributed to the planning of the analyses, EV conducted the analyses, AH and HB contributed to the interpretation of the results and drafting of the paper. All authors approved the final version.

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Ethics: According to Danish law, research involving questionnaire surveys only should not be reported to the local ethics committee.

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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(a) Cohort study—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up Case-control study—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants (b) Cohort study—For matched studies, give matching criteria and number of exposed and unexposed Case-control study—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) Cohort study—If applicable, explain how loss to follow-up was addressed Case-control study—If applicable, explain how matching of cases and controls was addressed Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses

Continued on next page

Results

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time <i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure <i>Cross-sectional study</i> —Report numbers of outcome events or summary measures
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

Discussion

Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results

Other information

Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based
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*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

DOES EMPLOYEE PARTICIPATION IN WORKPLACE HEALTH PROMOTION DEPEND ON THE WORKING ENVIRONMENT? A CROSS-SECTIONAL STUDY OF DANISH WORKERS

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DOES EMPLOYEE PARTICIPATION IN WORKPLACE HEALTH PROMOTION DEPEND ON THE WORKING ENVIRONMENT? A CROSS-SECTIONAL STUDY OF DANISH WORKERS

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Words count: 3,949

Key words: Social support, demand-control, exercise, smoking cessation, health screening

ABSTRACT:

Objectives: To investigate if participation in workplace health promotion (WHP) depends on the work environment.

Methods: Questionnaire data on participation in WHP activities (smoking cessation, healthy diet, exercise facilities, weekly exercise classes, contact with health professionals, health screenings) and the work environment (social support, fatiguing work, physical, quantitative and emotional demands, job control and WHP availability setting) were collected cross-sectionally in 2010 in a representative sample (n=10,605) of Danish workers. Binary regression analyses of the association between work environment characteristics and participation in WHP were conducted, adjusted for age, gender and industry.

Results: WHP offered during leisure time was associated with lower participation in all measured activities compared to when offered during working hours. Low social support and fatiguing work were associated with low participation in WHP. No associations with participation in WHPs were observed for physical work or quantitative demands, work pace or job strain. However, high physical demands/low job control and high emotional demands/low job control were associated with low participation.

Conclusion: Lower participation in WHP was associated with programs during leisure, low social support, very fatiguing work and high physical or emotional demands with low job control.. This suggests that to obtain proper effect of health promotion in a workplace setting, a good work environment is essential.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- Involves a large number of employees from several different occupations and industries in a representative sample of Danish employees.
- Self-reported information regarding work environment and the availability of health promotion represents the perceptions of the participants, which is known to impose risks of bias.

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- The reporting of participation reflects any level of participation in health promotion within the last year
- All data were collected concurrently and analyses performed in a cross-sectional design, which hampers interpretation of causality.

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INTRODUCTION:

Non-communicable diseases such as diabetes, heart disease and cancer are prevalent and increasing in Western countries[1]. These diseases have large consequences for the individual's life quality and function as well as for societal costs to health care and productivity loss[1]. The causes of these diseases are mainly related to lifestyle such as poor diet, physical inactivity and smoking[1], but also working environment features (i.e. high physical work demands)[2] and stress due to psychosocial job features[3, 4].

The workplace has therefore been suggested to be a suitable setting for health promotion. The suggestion is based on the notion that health promotion requires not just behavior change but also a supportive environment. Thus, safe, stimulating, satisfying and enjoyable working conditions are meant to support health-promoting activities[5]. A recent meta-analysis concluded that workplace health promotion (WHP) is primarily effective among white-collar workers and highly selected individuals[6]. Many WHP studies report low participation rates[7] and problems with implementation and sustainability associated with the organization of the work [8-10]. Thus, the workplace may only be a suitable setting for health promotion under good work environment conditions.

Most likely, WHP interventions have been initiated without ensuring proper contextual work environment. The socio-ecological framework has been used theoretically to illustrate how the work environment may limit participation in workplace health promotion[11]. Factors that may impact individuals' participation involve both structural (i.e. quantitative demands, physical demands and organization of the work)[12] as well as interpersonal factors (i.e. social support)[13-15]. For example, low job control may decrease the possibility to organize one's work to be able to participate in activities and WHP during paid working hours rather than during leisure may decrease barriers related to leisure time duties. However, it remains to be established how these factors are associated with participation in WHP.

Therefore, the aim of this study was to investigate the association between organizational, structural and interpersonal factors in the work environment and participation in workplace health promotion in a large

representative sample of Danish employees. The following hypotheses were tested: 1) WHP offered within working hours is associated with higher participation than WHP offered outside working hours, 2) Structural factors of the job and the work environment (high quantitative, physical and emotional work demands, low job control and fatiguing work) are associated with lower participation in WHP and 3) Interpersonal factors in the working environment (i.e. low social support) are associated with lower participation in WHP.

STUDY POPULATION:

In 2010, the fifth round of the Danish Work Environment Cohort Study (DWECS) was conducted[16]. This DWECS round featured a random sample of approximately 21.000 workers aged 18-59 years drawn from the Central Population Register of Denmark; of these, 53% (10,605) participated in the survey. Paper questionnaires were sent to their personal addresses and participants were asked to reply either to the paper questionnaire or to use a link for electronic response.

METHODS:

Participants responded to a self-administered questionnaire with items regarding availability and participation in workplace health promotion (WHP) activities as well as features of the work environment (physical work demands, physically fatiguing work, quantitative demands, emotional demands, social support from colleagues and supervisor and job control).

Independent variables:

WHP availability

Availability of WHP programmes was determined by the question (modified from Grosch and co-workers [17]) and previously reported in Jorgensen et al.[16]: 'During the last year, have you been offered health promotion via your workplace?' with the response categories 'No', 'Yes, during working hours' and 'Yes, outside working hours'. The following six types of WHP were covered: Smoking cessation, Healthy diet, Exercise facilities, Weekly exercise classes, Contact with health professionals (physiotherapy, psychologist or the like) and Health screenings. Availability timing (during working hours vs. outside working hours (termed leisure time)) was asked for each specific activity.

Physical work demands

Physical work demands were measured by 10 items on typical duration of physical postures and activities at work: 'Does your job require that...' 'you are sitting down?', 'you are standing at the same place?', 'you work with your back bent ... forward without supporting with your arms or hands?', 'you twist or bend your back many times per hour?', 'you lift your arms at or above shoulder height?', 'you do the same finger movements many times per minute (i.e. typing work)?', 'you do the same arm movements many times per minute (i.e. packing work, mounting, machine feeding, cutting)?', 'you squat or kneel, when you work?', 'you push or pull?', 'you lift or carry?'. Answer categories were given points corresponding to: Almost all the time (100), approximately ¾ of the time (75), approximately ½ of the time (50), approximately ¼ of the

time (25), seldom/very little (6), never (0). Answer categories for the item for sitting time was reversed.

The sum of all physical work demand scores was calculated and categorised into quartiles of the total score.

Fatiguing work

Fatiguing work was measured with a question inspired by the Need for Recovery scale[18, 19]: 'How physically exhausted generally in your body are you after a typical work day?'. The six answer categories were categorised into three levels of fatigue: Not fatigued (Not exhausted, a little bit exhausted), moderately fatigued (somewhat exhausted) and very fatigued (very exhausted, totally exhausted).

Quantitative demands

Quantitative demands were determined by three questions replied to on one scale (Always, Often, Sometimes, rarely, never/almost never): 'How often...' '...is your work unevenly distributed, so that it piles up?', '...do you not have time to complete all your work tasks?' and '...do you have to do overtime?'. Each answer was converted to a scale from 0-100 at equal 20-point increments (0=never, 100=always). The mean of these was generated by dividing the sum of the items by the number of items, and this variable was dichotomized at the median value into high/low.

Work pace

Work pace was determined by the question: 'How often do you have to work very fast' (Always, Often, Sometimes, rarely, never/almost never)? The answer was converted to a scale from 0-100 at equal 20-point increments (0=never, 100=always) and dichotomized at the median value into high/low.

Emotional demands

Emotional demands was measured with three questions with one answer scale (To a very high degree, to a high degree, partly, to a low degree, to a very low degree): ‘To what degree ...’ ‘...is your work emotionally demanding?’, ‘...do you get emotionally involved in your work?’ and ‘...do you have to deal with other people’s problems at work?’. The answer was converted to a scale from 0-100 at equal 20-point increments (0=to a very low degree, 100=to a very high degree) and dichotomized at the median value into high/low.

Control

Control was determined by two items regarding influence: ‘Are you involved in the planning of your work (i.e. how it’s done, or who you work with)?’ (always, usually, usually not, never) and ‘Do you have a large degree of influence concerning your work?’ (always, often, sometimes, rarely, never/almost never). The answers were converted to a scale from 0-100 at equal 25-point increments (0=never, 100=always) for the question regarding involvement in planning and at equal 20-point increments for the question regarding influence (0=never/almost never, 100=always) and dichotomized at the median value into high/low.

Job demands/control ratios

Three ratios were computed to represent the effect of qualitatively different types of job demands, relative to the degree of decision latitude available to choose how to respond to those demands. Thus the numerator varied but the denominator in each case was the job control scale above. *Psychosocial job strain* was the ratio of quantitative demands to control, dichotomised into high/low at the median value. *Physical demands and control ratio*: The ratio of physical work demands (above score from 0-100) to job control was calculated. *Emotional demands and control ratio*: The ratio of emotional demands to control was calculated with emotional demands in the nominator and control in the denominator.

Social support

Social support was measured with four questions on one answer scale (Always, often, sometimes, rarely, never/almost never, not relevant): 'How often...' '...are your colleagues willing to listen to your problems at work?', '...do you get help and support from your colleagues?', '...is your nearest supervisor willing to listen to your problems at work?', '...do you get help and support from your nearest supervisor?'. The answers were converted to a scale from 0-100 at equal 20-point increments (0=never/almost never, 100=always) and dichotomized at the median value into high/low.

Dependent variables:

Participation in workplace health promotion

Participation in WHP was calculated only among those who reported to have it available and was determined by the question 'Have you used it [the specific WHP activity asked for availability of]? (If you did, please mark)'. The following six WHP activities were requested: "Smoking cessation", "Healthy diet", "Exercise facilities", "Weekly exercise classes", "Contact with health professionals (physiotherapy, psychologist or the like)" and "Health screenings".

Covariates:

Age and gender were obtained from the Central Population Register and industry from Statistics Denmark's registers. Age was categorised into the following categories 18-29, 30-39, 40-49 and 50-59. Industry was categorised into: Manufacturing, Construction, Graphics, Transportation and Retail, Trading, Service, Agriculture, Social and health care, Teaching and research, Finance/public administration, and Business administration.

Statistical analyses

Spearman correlation coefficients were calculated for all pairs of independent variables. Variables with high collinearity were either collapsed or presented in separate models. Binomial logistic regression models

were used to estimate odds ratios for participation in WHP according to work environment factors. Job strain, the emotional demands/control ratio, social support, fatigue, physical work demands and availability timing were added into the same regression model to investigate their mutually adjusted associations with participation. The ratio of physical work demands/job control was investigated in a separate model with the same covariates, where it replaced the other two ratios.

All models were adjusted for age, gender and industry. Furthermore, the model investigating participation in smoking cessation was restricted to those with current/previous smoking status. The statistical analysis was performed using the SAS statistical software 9.2 for Windows. An alpha level of 0.05 was defined as representing statistical significance.

RESULTS:

The two social support indices (i.e. colleague support and supervisor support) were highly correlated (Table 1) and therefore collapsed. Physical work demands and lifting and carrying were highly correlated, and therefore we moved on with the measure of physical work demands only. There were 9835 (93%) employees providing data on availability and participation of WHP included in the analyses.

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TABLE 1: Correlation matrix with an overview over single measures of work environment and their correlation with each other in a representative sample of Danish workers

	Physical Work	Fatiguing work	Lifting and carrying	Job control	Quantitative demands	Work Pace	Emotional demands	Social support from colleagues	Social support from supervisor
Physical work demands									
Spearman rho	1	0.37	-0.68	-0.19	-0.25	0.01	0.02	0.00	-0.04
p=	.	<.0001	<.0001	<.0001	<.0001	0.196	0.1089	0.6939	0.0004
Fatiguing work									
Spearman rho	.	1	-0.34	-0.22	-0.01	0.17	0.06	-0.13	-0.15
p=	.	.	<.0001	<.0001	0.2515	<.0001	<.0001	<.0001	<.0001
Lifting and carrying									
Spearman rho	.	.	1	0.18	0.16	-0.04	0.06	0.06	0.07
p=	.	.	.	<.0001	<.0001	0.0005	<.0001	<.0001	<.0001
Job control									
Spearman rho	.	.	.	1	0.09	-0.07	0.09	0.20	0.30
p=	<.0001	<.0001	<.0001	<.0001	<.0001
Quantitative demands									
Spearman rho	1	0.33	0.20	-0.16	-0.17
p=	<.0001	<.0001	<.0001	<.0001
Work Pace									
Spearman rho	1	0.15	-0.11	-0.14
p=	<.0001	<.0001	<.0001
Emotional demands									
Spearman rho	1	0.01	-0.03
p=	0.4414	0.0041
Social Support from colleagues									
Spearman rho	1	0.55
p=	<.0001
Social support from supervisor									
Spearman rho	1
p=

p = level of significance

A little more than half of the study population were male (54%) and the most prevalent age group were 40-49 year olds (32%). Further descriptive information on the gender distribution, age group, industry (30% unknown), work environment and availability of health promotion is presented in Table 2. The most prevalent available WHP was contact to health professional (33%) and the least prevalent WHP available in the population was smoking cessation (16%). Among those with WHP available, the WHP with highest participation was healthy diet (53%) and the WHP with the lowest participation was smoking cessation (10%). Further descriptive detail regarding availability and participation is given in table 3.

TABLE 2: Descriptive information regarding distribution of age, gender, industry and work environment in a representative sample of Danish workers.

N=9835	n	%
Gender (%)		
Female (%)	3925	45.9
Male (%)	4627	54.1
Age (%)		
18-29 years	1429	16.7
30-39 years	1944	22.7
40-49 years	2703	31.6
50-59 years	2476	29.0
Industry (%)		
Manufacturing (%)	910	10.6
Construction (%)	244	2.9
Graphics (%)	64	0.7
Transportation and Retail (%)	621	7.3
Trading (%)	243	2.8
Service (%)	392	4.6
Agriculture (%)	57	0.7
Social and health care (%)	1683	19.7
Teaching and research (%)	684	8.0
Finance/Public administration (%)	629	7.4
Business administration (%)	425	5.0
Unknown	2600	30.4
High emotional demands	4940	51.6
High emotional demands/control ratio	4641	49.9
Low social support	4306	45.8

High physical workdemands	4769	50.0
High jobstrain	4639	49.7
High quantitative demands	5146	53.6
High work pace	6477	67.7
High physical workdemands/control	4581	49.9
Low Control	5723	60.1
Fatigue		
No (%)	5971	62.3
Moderate (%)	2594	27.1
Very (%)	1023	10.7

TABLE 3: Availability and participation during the past year for six different categories of health promotion among a representative sample of Danish workers.

	Availability		Participation	
	n	%	n	%
Smoking cessation	1600	16.3	156	9.8
Healthy diet	1948	19.8	1027	52.7
Exercise Facilities	3263	33.2	919	28.2
Weekly exercise	1784	18.1	457	25.6
Contact to health professional	3230	32.8	1260	39.0
Health check	1676	17.0	752	44.9

The association between work environment and participation

The results of the regression models are presented in Table 4 and described below.

TABLE 4: Binary regression mutually controlled for gender, age and industry on the association between work environment and participation in workplace among a representative sample of Danish workers.

	Contact with health			Health check			Exercise facilities			Weekly exercise			Healthy diet			Smoking cessation*		
	Estimate	95% CI		Estimate	95% CI		Estimate	95% CI		Estimate	95% CI		Estimate	95% CI		Estimate	95% CI	
		Lower	Higher		Lower	Higher		Lower	Higher		Lower	Higher		Lower	Higher		Lower	Higher
Emotional demands (high)	1,25	1,00	1,58	1,04	0,76	1,41	0,99	0,77	1,26	0,91	0,64	1,30	1,20	0,90	1,61	0,51	0,25	1,04
Physical Work demands (high)	0,98	0,83	1,16	1,23	0,97	1,54	0,96	0,81	1,15	0,91	0,70	1,17	0,81	0,66	1,01	1,00	0,62	1,62
Quantitative demands (high)	1,03	0,88	1,21	0,99	0,79	1,24	0,97	0,82	1,16	0,83	0,65	1,07	1,13	0,92	1,39	0,87	0,55	1,37
Work pace (high)	1,01	0,85	1,20	0,88	0,70	1,12	0,92	0,76	1,11	0,96	0,73	1,25	1,02	0,83	1,26	0,91	0,56	1,49
Social Support (Low)	1,12	0,95	1,31	0,99	0,79	1,24	0,81	0,68	0,96	0,86	0,67	1,11	0,86	0,70	1,06	1,07	0,67	1,70
Emotional demands/control ((High)	0,72	0,57	0,91	0,86	0,62	1,17	0,96	0,75	1,24	0,90	0,63	1,29	0,65	0,48	0,87	1,10	0,54	2,21
Physical workdemands/control (high) ^a	0,96	0,82	1,12	1,15	0,93	1,41	0,95	0,80	1,11	0,95	0,75	1,20	0,80	0,66	0,97	0,97	0,64	1,47
Jobstrain (ratio (high/low)) (high)	0,95	0,81	1,11	0,99	0,79	1,25	1,03	0,87	1,22	0,83	0,65	1,07	1,10	0,90	1,36	0,93	0,58	1,51
Availability setting (leisure time) ^b	0,70	0,60	0,82	0,34	0,26	0,43	0,75	0,62	0,90	0,56	0,43	0,73	0,27	0,20	0,36	0,54	0,34	0,85
Moderately fatigued	1,25	1,03	1,51	0,93	0,72	1,21	1,06	0,87	1,29	0,93	0,70	1,24	1,00	0,78	1,28	1,74	1,06	2,87
Very fatigued	1,20	0,90	1,60	0,86	0,54	1,38	0,79	0,57	1,11	0,54	0,31	0,94	1,16	0,78	1,73	1,53	0,70	3,34

Significant (p>0.05) associations are highlighted (bold), borderline significant associations are highlighted (italics), a=separate model controlled for gender, age, control and industry, b=ref=working hours, *=only among smokers and previous smokers

Availability timing

Availability timing of WHP during working hours vs. leisure time was highly associated with participation in WHP. WHP offered during leisure time was associated with lower participation in all measured WHP activities compared to when offered during working hours (Odds ratio (OR) (Confidence interval (CI)) = 0.70 (0.60-0.82) for contact with health professional, 0.34 (0.26-0.43) for health screening, 0.75 (0.62-0.90) for exercise facilities, 0.56 (0.43-0.73) for weekly exercise, 0.27 (0.20-0.36) for healthy diet, and 0.54 (0.34-0.85) for smoking cessation.

Physical work demands

Having high physical work demands was not associated with WHP participation with ORs ranging from 0.91-1.00 for most WHP activities. There were only weak, non-significant associations with higher participation in healthy diet (OR=1.23(95%CI=0.97-1.54) and lower participation in health check (OR=0.81(95%CI=0.66-1.01).

Physical Fatigue after work

Being moderately fatigued after work (compared to no fatigue) was associated with higher participation in contact with health professional (OR=1.25(95%CI=1.03-1.51)) and smoking cessation (OR=1.74(95%CI=1.06-2.87), but not with participation in other WHP activities. Being very fatigued after work was associated with lower participation in weekly exercise sessions (OR= 0.54(95%CI=0.31-0.94) referencing those not being fatigued.

Quantitative demands

Reporting high quantitative demands at work was not significantly associated with participation in WHP activities, with ORs ranging from 0.83-1.13.

Work pace

Reporting high work pace was not significantly associated with participation in WHP activities with ORs ranging from 0.88-1.02.

Emotional demands

Reporting of emotional demands at work was associated with higher participation in contact with health professional (OR=1.25 (95%CI=1.0-1.58)). For the other WHP activities, the ORs were non-significant between 0.99-1.20. There was a stronger, but also non-significant association between high emotional demands and lower participation in smoking cessation (OR=0.51 (95%CI=0.25-1.04)), indicating lower participation.

Demands/control ratios

Demands and control ratios: High job strain was not associated with participation in any WHP activities, with ORs ranging from 0.83-1.10. A high ratio of physical demands to job control was associated with lower participation in healthy diet (OR= 0.80 (95%CI=0.66-0.97)). The physical demands/job control ratio was not associated with the other WHP-activities, with ORs ranging from 0.95-1.15.

A high ratio of emotional demands to job control was associated with a lower participation in contact with health professional (OR=0.72 (95%CI=0.57-0.91)) and healthy diet (OR=0.65 (95%CI=0.48-0.87)). This ratio was not significantly associated with any of the other WHP activities with OR's ranging from 0.86-1.10.

Social support

Low social support was significantly associated with lower participation in exercise facilities (OR= 0.81 (95%CI=0.68-0.96)). Low social support was not associated with participation in the other WHP activities, with ORs ranging from 0.86-1.12.

>>Table 4<<

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For peer review only

DISCUSSION:

In this study of a large representative sample of Danish employees, several characteristics of the work environment were associated with employee participation in WHP. In particular, WHP activities available only during leisure time had markedly lower odds of participation. Adverse work environment factors (i.e. low social support and fatiguing work) were also associated with low participation. High demands at work (i.e. physical, emotional and quantitative demands) did not seem to be independent a barrier for participation. However, in combination with low control did high physical and emotional work demands seem to limit participation in WHP. In the following, the results are discussed and compared with previous studies on participation in WHP.

The most dominating factor associated with participation proved to be timing and/or setting of the availability of the WHP activity (i.e. during working hours or during leisure time). For all types of health promotion initiatives, being available only in leisure time meant a much lower probability for participation than for availability during working hours. A previous qualitative study suggested that accessibility of WHP was important for WHP participation and suggested that this may be due to WHP during paid work hours signals stronger management commitment[12]. Also having variable working hours has been shown to impact participation positively [10, 20]. Another explanation is that it is simply more feasible for the workers to fit the participation into everyday life (e.g. obligations to children or a second job may hamper participation outside working hours). The latter explanation is in line with previous explanations for participation in WHP. For example, the socio-ecological framework suggests that higher order structural factors are overarching determinants for workplace health promotion participation[11]. In the settings approach suggested by the Ottawa Charter for health promotion strategy, location and provider of health promotion were mentioned as important prerequisites for implementation[5]. However, these additional features were not measured in the current study. Furthermore, state of the art implementation techniques

also take timing into consideration when mapping barriers and facilitators for implementation of a health education initiative[21]. Thus, timing seems to be a highly important structural factor to consider when planning implementing WHP.

The actual production demands at work (emotional, quantitative and physical) were not independently associated with lower participation in WHP. This is in contradiction to previous studies suggesting that high physical work demands limit smoking cessation and weight loss[14, 15]. However, when combined with a concurrent low level of control, high physical work demands was associated with lower participation in WHP, which is in line with one previous study, indicating lower success in efforts for smoking cessation with high physical job strain[22]. Specifically, high physical demands combined with low control lowered the odds of participation in healthy diet, and the combination of high emotional demands and low control lowered the odds of contact with health professional and healthy diet.

The demand-control model is known to be associated with health and well-being and built originally on the concept that high demands and low control could increase the risk of reduced participation in the society[4]. The current study expands that understanding of participation in a way that is logical and plausible but not previously documented. Furthermore, this study established a physical demand-control ratio as previously suggested by Sanderson et al. 20015 and Schoenfisch & Libscomb 2009 [22, 23]. In addition, an emotional demand-control ratio was established. Similarly to the other demand-control ratios, the ratio of emotional demands to control was calculated with emotional demands in the nominator and control in the denominator. The authors are not aware of previous studies that have done this. The association between high emotional demands/control ratio and low participation in contact with health professional is particularly interesting because emotional demands independently increased the odds of participating in contact with health professional. One explanation is that high emotional demands at work generate a need to seek help from health professionals [16] and thus elevates participation propensity, but that low control in the job limits the opportunities for participation and thus lowers participation. However,

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4 previously, negative affections have been shown to be highly associated with the self-reporting of
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6 psychological job demands, so the results should be interpreted with caution and the finding tested in
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8 future studies.
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11 Social support was positively associated with participation in WHP. This is in line with previous studies
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13 reporting that social support is a motivator for participation in health promotion[12, 24]. Also, social
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15 support is a well-known important factor for well-being at work[25]. Furthermore, the socio-ecological
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17 framework supports the contribution of social support as an interpersonal factor determining participation
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19 [11]. In the current study, low social support was associated with low participation in exercise facilities.
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21 Exercise facilities do not necessarily include any personal contact with colleagues or other social obligation.
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23 Therefore, colleague and supervisor support may become particularly important for the participation in
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25 such initiatives. Thus, this finding indicates that when offering exercise facilities at the work place, inclusion
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27 of some component of social support should be considered.
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35 One single adverse factor - being moderately fatigued after work - was associated with higher participation
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37 in contact with health professional and smoking cessation. Being fatigued is not *per se* a feature of the
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39 work environment, but rather a short-term indicator of its effect on the person[26]. The simple fact of
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41 acknowledging that one is fatigued may distinguish those who are more willing to seek assistance. Thus,
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43 fatigue after work may motivate for individual counseling due to an individually perceived need. Previous
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45 analyses of data from the same cohort, indicated that some groups of unhealthy employees (i.e. individuals
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47 with elevated BMI) do choose to participate in workplace health promotion presumably based on their
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49 individual motivation to promote their health[16]. Thus, even though this study indicates that higher order
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51 factors in the work environment and organization are important for participation in workplace health
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53 promotion, individual motivation may still be an important mediator [13]. However, reporting of being very
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fatigued after work was associated with lower participation in weekly exercise. An interpretation of this finding is that high fatigue after work is an important barrier for exercising.

STRENGTHS AND WEAKNESSES

This study has strengths since it involves a large number of employees from several different occupations and industries in a representative sample of Danish employees. However, the study also includes limitations. First, the self-reported information regarding work environment represents the perceived environment of the participants, which is known to impose risks of bias. For example, negative affect is shown to impact the reporting of psychological work demands[27]. Likewise, negative affect may be associated with participation in WHP. Such reporting biases would render the analyses vulnerable to confounding and reporting bias, which would increase the risk of finding false associations between adverse work environment and low participation. Therefore, the results should be interpreted in the light of this limitation. Second, the self-reported information regarding availability of health promotion represents the perceived availability of health promotion at the workplace. Therefore, it is possible that some workers have health promotion available without being aware of it, and that those aware of health promotion offers may be a selected group of workers. Third, the reporting of participation reflects any level of participation within the last year and thus there may be some misclassification since those participating only once may not be distinguishable from those not participating. In addition, the impact of work environment features on the frequency or intensity of the individual's participation cannot be determined in this study. Finally, all data were collected concurrently and analyses performed in a cross-sectional design. This hampers interpretation of causality. For example, it is possible that participation in workplace health promotion can positively impact the perception of the work environment.

Conclusion and implications for clinicians and policymakers

Adverse work environment factors such as low social support and very fatiguing work were associated with lower employee participation in WHP. High physical, quantitative and emotional demands were not

associated with low participation, but high demands in combination with low control lowered the odds for participation in WHP. These findings suggest that to obtain proper implementation and effects of WHP, initiatives for ensuring a good work environment is essential. Furthermore, the probability for participation in WHP seems to be elevated when the activities are offered during paid working hours. Therefore, a supportive work environment seems to be an important foundation for employees' participation in WHP.

Data sharing statement: The raw data from the survey is publicly available in Danish at the website of the National Research Centre for the Working Environment, Denmark. No additional data available.

Contributors: MBJ initiated the study and planned the analyses, interpretation and drafting of the paper. LP contributed to the planning of the analyses, EV conducted the analyses, AH and HB contributed to the interpretation of the results and drafting of the paper. All authors approved the final version.

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Ethics: According to Danish law, research involving questionnaire surveys only should not be reported to the local ethics committee.

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Competing interests

We have read and understood BMJ policy on declaration of interests and declare that we have no competing interests.

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	1
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-10
Bias	9	Describe any efforts to address potential sources of bias	6,11
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10-11
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	11
		(b) Describe any methods used to examine subgroups and interactions	11
		(c) Explain how missing data were addressed	11
		(d) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(e) Describe any sensitivity analyses	n/a
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6
		(b) Give reasons for non-participation at each stage	6
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	14-15
		(b) Indicate number of participants with missing data for each variable of interest	14-15
Outcome data	15*	Report numbers of outcome events or summary measures	15
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	16
		(b) Report category boundaries when continuous variables were categorized	n/a
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	19
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	22
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	20-21
Generalisability	21	Discuss the generalisability (external validity) of the study results	22
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	23

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.