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The impact of stress and life style factors on short-term sickness absence in a large Danish industrial company

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Abstract

Objectives: Work-related stress and certain lifestyles have been associated with sickness absence among employees. We analysed relations between stress and lifestyles (as risk factors) and short-term sickness absence among employees of a large Danish industrial company. Moreover, we analysed the impact of risk factors on short-term sickness absence.

Methods: A self-administered questionnaire was completed by 7753 employees (67% response rate). Relations between risk factors (dyssomnia, low physical activity, alcohol, smoking, unhealthy food habits, overweight and stress) and short-term sickness absence were analysed by calculating etiologic fractions and binary logistic regression. Relations between the number of risk factors and short-term sickness absence were also analysed. Finally, the cost of short-term sickness absence from risk factors was estimated to illustrate the potential savings in avoided loss of productivity that could be gained from intervention programmes.

Results: Stress, overweight, smoking and dyssomnia are significantly related to short-term sickness absence. Etiologic fractions revealed that these factors were associated with between 29.8% and 37.8% of short-term sickness absence. The number of risk factors was also related to the risk and length of sickness absence.

Conclusion: This study identified risk factors that could be addressed by intervention programmes to reduce short-term sickness absence. Based on the results, focus on the risk factors that account for most of short-term sickness absence and reduction of the number of risk factors could potentially reduce short-term sickness absence. A 30% reduction is equivalent to an avoidance of a loss of productivity of 4.5%, corresponding to 9.4 million Euros per year.

Background

Evidence indicates that stress and lifestyles are associated with workloads, workplaces and health problems among employees [1-4]. Other studies have determined the direction of causality from workloads and work demands to stress and unhealthy lifestyles among employees [5-6]. Stress and unique lifestyles have also been associated with specific workplaces and specific workgroups [7] and furthermore, with specific cultures in work groups [8]. Other findings show that the psychosocial work environment is related to leadership and workgroup dynamics, which are important predictors of stress among employees [9]. Finally, stress and unhealthy lifestyles among employees have been associated with sickness absence [10-12]. Thus, stress and lifestyles can be interpreted as both a part of workplace and workgroup culture as well as a consequence of the work environment that can lead to increased sickness absence.

In recognition of these contexts, many organisations offer health promotion programmes that often target stress and specific lifestyles as risk factors, since the employee's health and well-being are important elements of the company's derived productivity and profitability [13-15]. Although many health programmes have shown health improvements among employees, no convincing overall evidence of increased efficiency has been demonstrated, probably due to personal differences between individuals in workplaces [16] as well as divergence between various workgroups' social compositions, cultures and work demands [17-18]. Other reasons might include differences in the prevalence of risk factors, intercorrelations between risk factors and the degree to which these factors are related to the workplace and to employees' life outside the workplace [16]. Identifying current key elements for health promotion programmes and implementation strategies for relevant target groups is therefore crucial to ensuring successful interventions against sickness absence in companies and public workplaces.

Aims

The purpose of this study was to identify risk factors associated with short-term sickness absence from work. An additional scope was to illustrate the potential for a specific organisation to reduce short-term sickness absence by implementing interventions targeting the most contributing risk factors and by reducing the number of these risk factors among employees. Finally, the cost of short-term sickness absence based on risk factors was estimated in order to illustrate the hypothetical magnitude of savings in avoided loss of productivity if effective intervention strategies were implemented.

Methods

Data were collected from a cross-sectional survey sent to all employees of a large Danish private-sector industrial company (anonymous) in 2005. Half of the employees were academic staff while the other half were production staff. The questionnaire was answered by 7753 employees (67% response rate) and consisted of 53 questions about working conditions, health, morbidity, stress and lifestyles. Descriptive results regarding stress and lifestyle factors – as risk factors – are shown in Table 1.

Analysis

Significance of risk factors for short-term sickness absence is analysed using binary logistic regression backward selection models (SPSS v. 27) (Table 1). Possible confounding from working conditions and interactions between the risk factors (covariates) are also tested. Impact of the included risk factors on short-term sickness absence is further analysed using Relative Risk (RR), Rate Differences (RD) and Etiologic Fraction (EF) calculations (Table 2 and Table 3). Finally, binary correlations between risk factors are tested using Spearman Rho tests (Table 4).

The significance level in the analysis is 5% ($p \leq .05$) and Odds Ratio for the significant risk factors are also calculated (Table 1). Furthermore, R^2 (log-likelihood) is calculated in the binary logistic regression models to show how much unexplained information there is after the model fitting.

RR and RD calculations are performed for each risk factor to illustrate the relationship between the risk factor and sickness absence, and to analyse the proportions of sickness absence that can be related to the risk factor (Table 2). RD and RR calculations are also performed for groups of employees with varying numbers of risk factors to illustrate the relationship between the number of risk factors and sickness absence (Table 3).

Etiologic fractions (EF) are calculated to demonstrate the potential overall impact and proportions of short-term sickness absence that can be related to the included risk factors. The etiologic fraction calculations are based on Relative Risk (RR) calculations between exposed employees and non-exposed groups of employees as references. EF is calculated by applying the following formula [19], which in the Tables 2 and 3 is referred to as ‘pure additive calculation method’. The overall “pure additive EF calculation” is the sum of RR from all the included risk factors.

$$EF = PP_{firm} (RR-1)/PP_{firm} (RR-1)+1,$$

The overall EF calculation on sickness absence based on contributions from all included risk factors is calculated by using the following formula [20], which is referred to as ‘sum-formula’:

$$EF_{tot} = 1 - (1-EFa)(1-EFb)...(1-EFn).$$

Age, gender and education adjusted RR are also calculated. The adjusted RR calculation expresses the excess of short-term sickness absence cases among the exposed groups of employees if their age, gender and educational distribution had been the same as among the non-exposed employees (Table 2 and Table 3).

EF methods assume that no significant interactions occur between the risk factors and that the risk factors are not essentially intercorrelated. These conditions are tested using logistic regression analysis and the Spearman Rho-correlation technique (Table 1 and Table 4).

Finally, Cronbach Alpha (CA) is calculated to validate the scale measuring stress symptoms.

Loss of productivity

To assess the potential expenses for the organization due to short-term sickness absence based on risk factors, we estimate loss of productivity using the human capital approach informed by the average and median gross monthly income for private-sector employees in Denmark in 2012

according to Statistics Denmark [21], given a standard 37-hour workweek.

The base salary, various additions for work time outside normal work hours, staff goods, irregular payments, and company pension shares of the salary are included in the monthly payment.

Outcome

Short-term sickness absence was included as outcome in the analysis. Short-term sickness absence was measured based on the question: ‘How many days have you stayed at home within the previous 14 days due to illness, injuries or complaints?’ The answers were dichotomised into ‘yes’ or ‘no’ if the respondents were absent due to sickness for one or more days within the previous 14 days. Further, among those who had been absent, the number of days off was used to analyse the relation between the number of days off and the number of risk factors.

Covariates

In this study, stress and lifestyle factors were included as risk factors and dichotomised into an ‘unhealthy’ and a ‘healthy’ value (see Supplemental Material). The unhealthy values were primarily based on results from other health studies and recommendations from Danish health authorities [22-28]. Other cut-points for the covariates are shown in Supplemental Material to illustrate alternative interventional potentials.

Stress

Two previously validated questions regarding ‘perceived stress’ and ‘frequent stress symptoms’ were used to investigate the psychological and physiological elements of stress among employees [22;29]. The answers were dichotomised into: ‘often perceived stress’, and: ‘less often’ or ‘no stress’.

The item ‘frequent stress symptoms’ was used as a dichotomised item expressing whether the

respondent answered 'all the time' or 'most of the time' to at least 1 of 10 questions regarding

stress-related symptoms [16] (Supplemental Material). A scale reliability test (Cronbach's Alpha (CA)) of the 10 stress symptoms in this study revealed an acceptable high reliability coefficient of .80. The included 10 questions therefore comprise a reliable scale measurement regarding frequent stress symptoms in this study.

Lifestyles

The following lifestyles (and values) were included as risk factors in this study (Supplemental Material):

- Dysomnia (never or seldom sleeping enough to feel rested) [22-23];
- Being overweight (body mass index [BMI] > 25) [24];
- Unhealthy food habits (high intake of fat and low intake of fish, fruit and vegetables) [25];
- Smoking habits (smokes cigarettes at least occasionally) [26];
- Alcohol habits (regularly exceeding the Danish Health Authority's recommendations of a maximum of 21 standard drinks/week for men and 14 standard drinks/week for women). Since this investigation, these limits have been changed by the authorities to respectively 14/7 standard drinks/week) [27];
- Low physical activity (does not perform physical activity equivalent to the Danish Health Authority's recommendations of 30 min/day or 3.5 hours per week) [28].

Confounders

As indicated in the background section, studies have shown associations between working conditions and risk factors among employees [5-6]. Other studies have shown associations between risk factors and sickness absence [10-12]. Working conditions might thus be a mediator between risk factors and sickness absence among employees. "Working hours" [16] (indicated by the

answers: at 'Night' and on 'Shift') and "physical work strain" [16;22] (indicated by the answers:

‘Low Physical Strain’ and ‘Heavy Workloads with lifting’) are included as possible working conditions related confounders.

Results

Overall, 15% of employees had been short-term absent within the previous 14 days (Table 1). Low physical activity (46%), overweight (38%), frequent stress symptoms (26%), and smoking (25%) are the most prevalent risk factors among employees (Table 1). ($\pi 1$)

The backwards logistic regression analysis shows that stress (perceived and frequent symptoms), dyssomnia, overweight and smoking are significantly associated with short-term sickness absence. Moreover, none of the included confounders or interactions are significantly related to short-term sickness absence (Table 1). The R^2 calculation of the logistic regression model is 5% (5.2% when adjusted for age, gender and education distribution).

The RR and RD based calculations reveal that frequent stress symptoms and overweight are the factors which contribute most to short-term sickness absence among exposed employees compared to non-exposed employees (10.3% and 5.7% of the absence, Table 2). Perceived stress, dyssomnia and smoking also contribute significantly to sickness absence. Low physical activity also contributes to sickness absence based on RR calculations. However, this risk factor is not significant when tested as a covariate in the logistic regression analysis (Table 1). ($\pi 2$)

When EF's of single risk factors are simply added (pure additive), the total EF is 37.8%. When calculated by the sum formula, the overall EF is 32.3%. When adjusted for age, gender and education, the overall EF fractions become respectively 37.7 (additive) and 32.5 (sum formula) (Table 2). Furthermore, it is shown that all significant risk factors analysed by logistic regression models are associated with 30.3% of short-term sickness absence among employees (Table 2).

Finally, the contribution to overall sickness absence based on the number of risk factors is 34.7% using the EF pure additive method, or 29.8% when the sum formula is used (Table 3). ($\pi 3$)

The risk of being absent due to sickness increases with the number of risk factors among employees

(Table 3). RR is 1 among those with zero risk factors and 2.15 among those with five or more risk

factors. When adjusted for age, gender and education, RR is 2.58 among those with five or more risk factors (Table 3). The group with five or more risk factors comprises an over-frequency of middle-aged men (35-54 years) with a short education who have been short-term sickness absent. The number of sick days during short-term sickness absence is slightly higher among employees with a high number of risk factors compared to employees with few risk factors. The number of sick days is on average 2.9 days among those with zero risk factors and 3.2 days among those with five risk factors. Finally, the contribution from risk factors for being sickness absent is lowest (22.8%) among employees exposed to one factor, and highest (53.5%) among employees who were exposed to five risk factors (Table 3).

Generally, only minor correlations are seen between the risk factors (Table 4). (π_4)

However, a significant intercorrelation exists between the two included stress variables (Spearman's rho coefficient [SRC] = 0.42) and significant correlations are also seen between the two stress variables and dyssomnia (SRC = 0.17 & SRC = 0.21).

A 30% reduction in short-term sickness absence (corresponding to the fraction based on RR and RD calculated contributions in Table 1 and 2) among the 15% of employees reporting short-term sickness absence (Table 1) is equivalent to a 4.5% reduction in sickness absence in the company studied. A potential 4.5% reduction in sickness absence is equivalent to 13,607 absence cases per year in the company, which is equivalent to 43,542 days of absence per year, since each case of absence within 14 days is 3.2 days on average (Table 3).

The hourly pay for a private-sector employee is on average 33 EUR [21], with a median of 29 EUR. The official workweek in Denmark is 37 hours (7.4 hours of daily work for 5 days per week) with an average private-sector payment of 246 EUR per day, or median private-sector payment of 215 EUR. Referring to the estimates above, a potential reduction of 4.5%, or 43,542 sick days, would

amount to a potential direct savings of 10.7 million EUR per year in average salaries, or 9.4 million EUR per year when calculated using median salaries.

Discussion

Most of the descriptive findings in this study are in agreement with results from other studies.

Psychosocial factors of work environments, including stress, have been shown to be significantly related to sickness absence among employees [10]. Studies have also shown that dyssomnia is related to stress [30]. Being overweight/obese, smoking and being physically inactive are other important risk factors for sickness absence [12;31]. Heavy consumption of alcohol has also been shown to contribute to sickness absence [30]. However, this study cannot confirm essential influence of alcohol on sickness absence among the employees based on exceeding the recommended alcohol limits (RR=1).

The various methods we have used to quantify the included risk factors' impact on sickness absence indicate that between 29.8% and 37.8% of short-term sickness absence among employees from the studied company is associated with the included risk factors (Table 2-3). Furthermore, the influence of gender, age and education on the EF calculations generally seems to be minor.

Employees with one or more risk factors have a significantly higher risk of short-term sickness absence than employees with no risk factors, as shown in Table 3 [30]. Furthermore, the contribution from the risk factors for absence is higher and the length of sick leave is longer for employees with several risk factors (Table 3).

Significant intercorrelations exist between the two stress and the dyssomnia risk factors (Table 4).

Results from the logistic regressions further shows that each of these risk factors contributes significantly to short-term sickness absence (Table 1). Intercorrelation between the two stress risk factors is to be expected, since both instruments measure an aspect of stress [29]. Different measurements of stress often lack consistency and thoroughness in stress investigations because they can only measure some of the aspects of stress [32-33]. This is also reflected in differences regarding the contributions from the two stress risk factors to short-term sickness absence,

indicating that the two instruments are measuring different aspects of stress (Table 2).

Intercorrelations between the two stress risk factors and dyssomnia are also expected to some extent, as this association has been shown in other studies [34]. It is however important to be aware of the risk of overestimation when using potentially overlapping measurements. The use of the pure additive method is especially sensitive to intercorrelations, as the EF's of single risk factors in this model are simply added, which causes overestimation.

Low physical activity also contributes to short-term sickness absence based on the RR and RD calculations (Table 2). However, this risk factor does not show an independently significant association with sickness absence based on binary logistic regression calculations (Table 1). Low physical activity is significantly correlated with most of the other risk factors, although the coefficients are low (Table 4). If this factor has an effect, it may act indirectly with other risk factors.

The contribution of the risk factors studied to short-term sickness absence among employees in the surveyed company varies between 29.8% and 37.8%, depending on which methods are used. Choice of method should depend on significance and intercorrelations between risk factors.

Validity

The present investigation comprises an observational cross-sectional study based on the questionnaire answers from the participating employees. However, this method imposes certain limitations on the quality of our study, as self-reporting may have resulted in e.g. misclassification. The overall response rate for this study is similar to other workplace studies, and the reliability tests revealed satisfying agreements between synonymous questions ($p < 0.001$). Bias from these factors is therefore concluded to be at the same level as comparable work place studies [32].

As a cross-sectional study cannot demonstrate causality, indications of causality from either previous studies or from other studies might be used to provide meaningful focus points for preventive interventions.

Furthermore, is it impossible to address to what degree the reported stress and lifestyle behaviours are related to the workplace, and to what degree they are related to employees' lives outside of the workplace [5]. Previously published results from this study, however, have shown that many of the employees with reported stress and specific lifestyles are employees from certain workgroups and specific work locations. Variations between work groups and between locations were significant even when sociodemographic and compositional differences and workplace confounders between the groups were taken into account. This indicates that much of the reported stress and much of the specific lifestyles in this study are most likely workplace-related [35-38].

Stress and lifestyle behaviours over time were not included in the questionnaire used. However, accumulated effects from risk factors over time have likely nonetheless contributed to short-term sickness absence among employees, as illness related to long-term stress and risk-associated lifestyles often takes several years to manifest [30; 35]. Since cumulative damage from exposure to risk factors over time can be, to some extent, irreversible [39-40], is it uncertain to what degree the risk of illness and absence from sickness can be reduced by using effective workplace interventions to remove significant risk factors. It is furthermore uncertain how long it would take after removal of a risk factor until a reduction in risk of illness subsequently a reduction in sickness absence could be expected. That depends on the person's age and how long the person has performed the risk behaviours, among other things [40-41].

Another potential bias is employees who altered their lifestyle before this study. For example, those who have quit smoking before the study and now identify as non-smokers might nonetheless suffer

from (possibly irreversible) tissue damage and consequently, increased risk for sickness absence.

This could result in an underestimation of the effect of interventions against smoking on short-term sickness absence [39;41].

Risk factors and cut-points

Generally, most of the used risk factors show higher proportions of short-term sickness absents on the higher levels of risk as shown in the Supplemental Material. Use of alternative cut points could be advantageous depending on the proportion of sickness absence and the number of employees related with the different levels of risk.

Alcohol is included in this study as a dichotomous variable with a cut-point equivalent to the authority's recommendations for alcohol consumption (21/14 standard drinks/week among men/women). The health authority has since reduced these recommended limits to 14/7 standard drinks per week [27]. By setting the cut-point to a higher consumption the potential effect of interventions might increase (see Supplement Material). However, only 5.9% of employees answered that they regularly exceed the recommended limit (21/14 drinks/week) for alcohol consumption, and only 3% stated that it is important for their health to reduce their alcohol consumption (data not shown). The overall potential for the company to reduce sickness absence by implementing general interventions against heavy alcohol consumption therefore seems low. A small group consisting 1.9% of employees, exceeds 28/21 standard drinks/week of alcohol use. This group has a very high proportion of sickness absence (see Supplemental Material). Since the company has a no-alcohol policy, however, one can speculate about social desirability bias and the validity of the alcohol answers from employees. Due to this strict alcohol policy in the company, employees may be hesitant to answer truthfully on the questionnaire, and additional heavy alcohol users might also exist among the non-responders in this study. The potential for targeted interventions against heavy alcohol consumption in the group of heavy users therefore also seems

low due to both the strict alcohol policy and the difficulty of detecting heavy alcohol users.

Low physical activity is included as a part of a dichotomous statement of whether the employee fulfils recommendations for physical activity equivalent to 30 min/day [28;42]. Results indicate that greater health potential exists in convincing employees who perform no physical activity to perform 1 hour of physical activity per week (reduction in OR from 1 to 0.53 for having been absent due to sickness within 14 days) compared to the effect of increasing physical activity from 3 to 4 hours per week (reduction in OR from 1 to 0.91). It is therefore important to motivate employees who perform no or very little physical activity to perform at least some physical activity, as the potential gain in health/reduction in sickness absence is greater among such employees than when increasing the amount of physical activity among employees who almost meet physical activity recommendations (Supplemental Material). This confirms results from other studies [43]. However, using a cut-point for low physical activity that includes only employees who answered they perform no activity or only 30 minutes of physical activity per week in their spare time includes less than 3% of the surveyed employees. Therefore, it seems more effective for this company to focus on the larger proportion of employees who do not exercise the recommended 3.5 hours per week (45%), and motivate them to increase their physical activity.

It is thus important to be aware of the possible benefits of alternative cut-points on various risk factors and on the number of employees included before choosing the focus for interventions. It is also important to be aware of possible barriers to detecting employees with a high level of risk behaviour – e.g. due to a policy that makes it difficult to find and engage the people in question.

Perspectives

When aiming to reduce sickness absence, conduct of a thorough survey could be beneficial to identify the risk factors with the greatest impact on local sickness absence which can improve precision on interventions. . The former results from the present data reveal that risk factors vary

significantly between workgroups and between workplace locations [37-38]. Consequently, the

potential for successful intervention programmes might vary between groups of employees. In such cases, it would be beneficial to focus on intervention strategies against the risk factors with greater impact on specific workgroups and locations rather than using mass strategies or individual actions [7;9;37-38].

The use of more extreme cut-points for the included risk factor might improve the individual health potential for successful interventions. However, for most risk factors, the overall potential for reducing sickness absence among employees would be lower for the company, because fewer employees would be included. In such a context, effective intervention strategy might shift from mass strategies and specific group interventions towards individual actions. It is therefore important not only to be aware of the possible benefits of alternative cut-points on risk factors, but also to consider the right focus before choosing strategies for interventions and health promotion programmes.

It is furthermore important to be aware of possible 'healthy worker effects' over time, as policies and interventions against at least some of the risk factors could accelerate exhaustion from the workplace [36]. Companies keen on promoting the reduction of smoking among employees, for example, may also risk that some employees would prefer to maintain their current habits and instead look for another workplace.

We have used a proportion of 30% to quantify our calculations of the potential loss of productivity based on risk factors in the investigated company. This proportion corresponds to the fraction based on RR and RD calculated contributions to short-term sickness absence from significant risk factors shown by the logistic regression (Table 1-2). Furthermore, this proportion reflects the fact that there are intercorrelations between some of the risk factors and that many employees possess more than one risk factor (Table 3). A 30% reduction in short-term sickness absence corresponds to an overall

improvement in work capacity of 4.5% in the investigated company. An improved work capacity of that magnitude corresponds to direct savings of between 9 and 11 million EUR per year, depending

on the applied mean of the salary distribution. Due to high variations in private-sector salaries compared to public-sector salaries, we recommend using median salaries, which could result in the lower total of about 9 million EUR in potential savings each year – not accounting for the cost of interventions. This is, however, probably only a fraction of the total savings that could be observed if a more comprehensive societal cost study were applied. Using the human capital approach presents a limitation, since the friction cost would likely be applied in the organisation studied here, as short-term replacement staff would be needed on the production line. In all, our estimation of losses due to short-term sickness based on the risk factors used is very conservative, and it would likely be higher if all perspectives were assessed.

Conclusions

This study shows that companies – based on cross-sectional studies – can identify suspected causes of absence and estimate their potential impact for subsequent intervention programmes to reduce short-term sickness absence among employees. It is also important to reduce the number of risk factors to reduce short-term sickness absence. The analysis further indicates that the overall potential for the reduction of short-term sickness absence in this company lies between 29.8% and 37.8%, depending on intercorrelations, local prevalence and significance of risk factors.

This study further reveals the potential overall influence of the included risk factors on short-term sickness absence. For the investigated company this represents a potential loss of productivity of 4.5%, equivalent to 9-11 million EUR per year.

It is unlikely that it is possible to remove the influence of all risk factors. Some work functions will always be associated with stress, and some of the stress is likely related to the employees' lives outside of the workplace. Additionally, it is important to be aware that lifestyles may be connected to other norms outside of the workplace or to individual addictions. Moreover, a lack of knowledge regarding causality – between risk factors and the workplace – might influence the direction of subsequent intervention strategies, thus reducing the potential effects of interventions on sickness absence. There are nevertheless potential benefits to be gained from using cross-sectional studies to identify the risk factors with the greatest impact on sickness absence, since the success of subsequent interventions depends on choosing the contributing factors with the most influence and consequently designing targeted and effective intervention strategies.

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Table 1. Descriptive results and significance of unhealthy levels of risk factors on short-term sickness absence among employees from a large Danish industrial company (N=7,753)

	Prevalence	p-values	Odds Ratio
<u>Covariates</u>	PP _{firm} ** (in %)		Exp B (95% CI)
<u>Stress</u>			
Perceived stress – often feel stressed	13	<.05	1.21 (1.00-1.49)
Frequent stress symptoms – most of the time	26	<.01	1.40 (1.18-1.63)
<u>Lifestyles</u>			
Overweight — BMI > 25	38	<.05	1.16 (1.01-1.33)
Dyssomnia – never get enough sleep to feel rested	8	<.01	1.36 (1.09-1.70)
Low physical activity – <30 min/day	46	ns	
Smoking habits – occasional or daily smoker	25	<.01	1.24 (1.06-1.44)
Unhealthy food habits – unhealthy food consumption	10	ns	
Unhealthy alcohol habits – exceeding weekly limit	6	ns	
<u>Potential confounders: (Working conditions)</u>			
Typical working hours: (night/on shift)	17/1	ns	
Physical strain at work: (low work strain/heavy work strain with lifts)	44/3	ns	
<u>Potential interactions</u>			
Between covariates		ns	
<u>Outcome variable and R² from logistic regression on risk factors</u>			
	Prevalence	R ²	Adjusted R ²
Proportion of employees who have been short-term sickness absent within the previous 14 days	15%		
R ² from risk factors on short-term sickness absence (including potential confounders) from logistic regression.		5.0	5.2

Notes: OR = Odds Ratio (Exp B) of significant covariates CI = confidence interval.

PP_{firm} = The proportion of exposed (to the risk factor) among employees in the entire firm/company

Table 2. Distribution of short-term sickness absence related to risk factors among employees from a large Danish industrial company (N = 7,753)

	Prevalence (in %) of employees which have been absent~ among exposed for risk factor (R _{exp})	Rate Difference (RD in %). Difference of absence~ between exposed compared to unexposed for risk factor (R _{exp} -R _{unexp})	Proportion of extra absence~ among exposed compared to unexposed for risk factor (RD/R _{unexp})	Relative Risk (RR). Risk of being absent~ among exposed compared risk of absence among unexposed (R _{exp} /R _{unexp})	Age, gender & education standardised Relative Risk (RR) of being absent~	Proportion of absence~ which theoretically can be avoided by removing exposure to the risk factor (PP-avoid): (PP _{firm} *RD)*100 /(PP _{firm} *RD)+(1- PP _{firm} *R _{unexp})
<u>Stress</u>						
Perceived stress – often feel stressed	19.8	6.0	30.3	1.43	1.45	5.3
Frequent stress symptoms – most of the time/ale the time	18.7	5.7	30.5	1.44	1.43	10.3
<u>Lifestyle</u>						
Overweight – BMI>25	15.9	2.2	13.8	1.16	1.19	5.7
Dyssomnia – never get enough sleep to feel rested	21.5	7.6	35.3	1.55	1.52	4.2
Low physical activity – <30 min/day	15.5	1.8	11.6	1.13	1.12	5.6
Smoking habits – occasional or daily smoker	16.6	2.8	16.9	1.20	1.18	4.8
Unhealthy food habits	17.0	2.8	16.5	1.20	1.18	1.9
Unhealthy alcohol habits – exceeding weekly limit	14.2	0	0	1.00	1.08	0
Contribution from sum of significant risk factors:						30.3%
Etiologic Fractions						
					Age, gender and education standardised EF calculations	
Etiologic Fraction Methods^				EF calculations		
Sum formula				32.3%	32.5%	
Pure additive				37.8%	37.7%	

PP_{firm} = The proportion of exposed employees (to the risk factor) among employees in the entire firm/company from Table 1;

Run_{exp} = Proportion of short-term sickness absence cases among unexposed (employees who are not exposed to the risk factor)

^See Method Chapter for used EF formula

Absence = 'Short-term sickness absence': equivalent with employees which have been sickness absent within 14 days

Table 3. Distribution of short-term sickness absence related to the number of risk factors among employees from a large Danish industrial company (N=7,753)

	Proportion (in %) of employees, distributed in groups with the number of risk factors (Risk no. groups)	Proportion within Risk no. groups which have been sickness absent within 14 days	Rate Difference (RD in %) between Risk no. groups and the No risk factor group (Risk no. groups - Runexp)	Proportion of more absence in Risk no. groups related to absence in Group with no risk factors (RD/Runexp)	Proportions of sickness absence which potentially can be avoided by removing exposures: $(PP_{firm} * RD) * 100 / (PP_{firm} * RD) + (1 - PP_{firm} * Runexp)$	Relative Risk (RR) of being absent in Risk no. groups compared to Group with no risk factors (R_{exp} / R_{unexp})	Age, gender & education standardised Relative Risk	Mean number of days off when absent in Risk no. groups
No risk factors	17.5	10.5						2.87
One risk factor	29.7	13.6	3.1	22.8%	8.2%	1.30	1.35	2.69
Two risk factors	24.9	14.3	3.8	26.6%	8.2%	1.36	1.48	3.26
Three risk factors	15.5	17.9	7.4	41.3%	9.8%	1.70	1.82	3.49
Four risk factors	7.5	15.0	4.5	30.0%	3.1%	1.43	1.62	4.36
Five risk factors	4.9	22.6	12.1	53.5%	5.4%	2.15	2.58	3.24
All employees	100.0%	15.0%						3.18
One or more risk factors	82.5	15.5	4.9	31.8%	27.9%	1.47	1.57	3.22
EF-methods	Etiologic Fraction calculations							
Sum-formula						29.8%		
Pure additive						34.7%		

R_{exp} =Proportion within Risk number groups which have been short-term sickness absent within 14 days

R_{unexp} = Proportion of short-term sickness absence among unexposed (employees with no risk factors)

Risk no. groups=Groups of employees exposed from a number of risk factors.

No risk factors=Group of employees which is not exposed from on of the included risk factors

PP_{firm} = The proportion of exposed employees (to the risk factor) among employees in the entire firm/company from Table 1;

Table 4. Bivariate correlations (Spearman Rho) between risk factors among employees of a large Danish industrial company (N = 7,753)

	Perceived stress	Frequent stress symptoms	BMI > 25	Dyssomnia	Low physical activity	Smoking habits	Unhealthy food habits	Unhealthy alcohol habits
Perceived stress	--	0.42***	-0.25*	0.17***	0.06***	0.02	0.01	0.03*
Frequent stress symptoms		--	0.04	0.21***	0.07***	0.04***	0.04**	0.02
BMI > 25			--	0.00	0.07***	0.00	0.04**	0.01
Dyssomnia				--	0.04**	0.05***	0.05***	0.00
Low physical activity					--	0.05***	0.07***	0.00
Smoking habits						--	0.09***	0.09***
Unhealthy food habits							--	0.04***
Unhealthy alcohol habits								--

* = significant with a two-tailed *p*-value: .01–.05

** = significant with a two-tailed *p*-value: .001–.01

*** = significant with a two-tailed *p*-value: <.001