Obesity and Depression
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Chapter 3

Overweight and distress have a joint association with long-term sickness absence among Dutch employees

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ABSTRACT

Objective: To examine separate and joint associations of overweight and distress with long-term sickness absence (LTSA).

Methods: We included N=2724 Dutch employees participating in occupational health checks between 2008 and 2012. Overweight was defined as BMI ≥ 25kg/m², distress concerned a score of ≥10 on the Four-Dimensional Symptom Questionnaire. LTSA was defined as sickness absence lasting >2 consecutive weeks. Synergy was estimated from logistic regression models using the synergy index (SI).

Results: The joint association of overweight and distress with LTSA was significant in women (odds ratio, OR=2.35; 95%-confidence interval, CI: 1.31; 4.24), but not in men (OR=1.58; 95%-CI 0.74; 3.37). In women, we found an SI=1.04 (95%-CI 0.34; 3.15).

Conclusions: The joint association of overweight and distress with LTSA was not synergistic. Addressing co-morbid overweight and distress may help to reduce the burden of LTSA in women.
INTRODUCTION

Overweight and obesity are major public health problems in western societies, and their physical and functional health costs have become enormous (1). In the Netherlands, the annual costs attributable to obesity amount up to 887 million Euros (2). For the Dutch working population, Robroek et al. reported prevalences of 34% for overweight and 8% for obesity (3). Besides affecting physical and functional health, overweight has been found to be a source of distress (4,5). Overweight individuals are often subject to stigma and discrimination in their everyday lives (4). Moreover, attempts to control one’s weight can be distressing, particularly when attempts to lose weight have repeatedly failed, which ultimately may lead to clinically significant distress (6).

Distress and overweight can both contribute to sickness absence. Sickness absence has received considerable scientific and political attention in many European countries. In the Netherlands, sickness absence and particularly long-term sickness absence (LTSA) of >2 consecutive weeks costs almost 20 billion Euros annually (7). Comorbidity is associated with an increased risk of LTSA and decreased return to work (8).

Previous studies have considered overweight and distress as separate conditions in relation to LTSA (9-12). Contemporary developments in epidemiology suggest that the potential synergy between two exposures of interest is best measured by statistical interaction on the additive scale using measures such as the synergy index (SI) (13). The SI reflects whether the joint association of two exposures is larger (or smaller) than the sum of the individual associations of the two exposures (13). The main objective of the present study was to examine the separate and joint associations of overweight and distress with LTSA. The SI was used as a measure to test the hypothesis that the joint association of overweight and distress with LTSA is greater than the sum of the separate associations of overweight and distress. As overweight and distress often co-occur and may be interrelated, assessing their synergistic association may have public health implications with regard to prevention strategies.
METHODS

Study population

This cross-sectional study included N=2724 Dutch employees (46% women) aged 35.2 (standard deviation 9.1) years who participated in occupational health checks in the period between 2008 and 2012. Dutch law obliges employers to offer a health check to their personnel every four years, but for employees it is not mandatory to participate in health checks. ArboNed is a nationwide Dutch occupational health service (OHS) that offers different types of health checks to employees of contracted companies, ranging from brief check-ups to extended health checks including physical examinations and blood tests. Employers decide on the type of health check in dialogue with the works council or employee representatives. Employees were working for different employers, predominantly in the financial (75%) and healthcare (17%) sector, but they all had similar sick leave benefits (i.e., 100% compensation in the first year of sickness absence and 70% in the second year). All employees except those with temporary employment were invited for occupational health checks, irrespective of age and job tenure. Approximately 66% of employees participated in the health checks. The health checks consisted of a health check questionnaire with items on perceived health status, including a history of medical conditions and sickness absence, as well as perceived work environment characteristics. Depending on the questionnaire results, employees were invited for preventive consultations with an occupational health nurse or physician.

Ethical approval for this study was granted by the Medical Ethical Committee of the University Medical Center Groningen, the Netherlands (reference METc2012/105).

Measurements

Overweight

The Body Mass Index (BMI) was calculated from the body weight (kilograms, kg) and height (meters, m) employees reported on the health check questionnaire. Health check participants were classified into three categories according to the standard international classification (WHO 2013): normal weight (BMI <25.0 kg/m²), overweight (BMI 25.0–29.99 kg/m²), and obese (BMI ≥30.0 kg/m²). We combined overweight and obesity together as overweight (BMI ≥25.0 kg/m²) to increase the power of the study during regression analyses.
Distress

Distress was assessed by the Four-Dimensional Symptom Questionnaire (4DSQ) (14). The distress scale consists of 16 items (e.g., during the past week, did you suffer from worry? During the past week, did you feel tense?), which were scored on a 5-point response scale (‘no’= 0, ‘sometimes’=1, ‘regularly’ =2, ‘often’ =2, and ‘very often or constantly’=2). The item scores were summed up to a scale score ranging between 0 and 32. A score >10 was defined as distress (14).

Socio-demographic and work-environment characteristics

Age, gender, level of education, job demands, job resources and lifestyle factors (i.e. leisure-time physical activity) were included as confounders, because these factors have been reported to be associated with either overweight or distress, and LTSA without being on the causal pathway (15). Age (in years) was categorized into <35, 35-44, 45-54, and ≥ 55 years and educational level into low (primary and lower secondary education), middle (higher secondary education) and high (tertiary or higher education). The frequency of physical activity was assessed by two items about performing daily activities (e.g., walking stairs, vacuum cleaning) for at least 30 consecutive minutes (moderate exercise), and practicing sports for at least 20 consecutive minutes (vigorous exercise). Both items were dichotomized according to Dutch national recommendations: For insufficient moderate exercise, a cut-off point of less than 5 times a week for 30 minutes, and for insufficient vigorous exercise, a cut-off point of less than 3 times a week for 20 minutes were used (3). Data on smoking habits and alcohol intake were also available from the health check questionnaires, but were missing in more than 90% of the health check participants.

Work environment characteristics were measured by using the job demand-resources (JD-R) model as a framework. The JD-R model integrates aspects of both the job demand–control and effort–reward imbalance models, and is commonly used to characterize the work environment (16). Principal component analysis revealed two components, corresponding to job demands and job resources. The job demands component (Eigen value=2.4 and Cronbach’s alpha = 0.72) included physical demands, work pressure and work-family interference. The sum score of job demands component
was calculated by multiplying scale scores by component loadings (17), and higher scores indicated higher job demands. The job resources component (Eigen value=4.7) included nine scales on participation in decision-making, feedback, supervisor support, co-worker support, communication, independence at work, role clarity, job skills, and work variation, with an internal consistency (Cronbach’s alpha = 0.86). The sum score of job resources component was calculated by multiplying the scale score by component loadings (17). A higher score indicated more job resources.

**Long-term sickness absence**

Sickness absence was defined as paid absence from work because of any (work-related and non-work-related) illness. Absences from work for longer than two consecutive weeks were defined as long-term sickness absence (LTSA). LTSA was assessed by the health check questionnaire with the item: ‘In the past 12 months, did you have one or more sickness absence episodes lasting more than 2 consecutive weeks?’ with response categories ‘no’ (=0) and ‘yes’ (=1). Voss et al. reported that 70% of men and 71% of women with 15 or more recorded sickness absence days also reported 15 or more sickness absence days in a year (18).

**Statistical analysis**

We first described socio-demographic, lifestyle factors and work environment characteristics for four categories i.e., no overweight and no distress, overweight only, distress only and both overweight and distress. Differences in proportions were tested by χ²-tests and differences in means were tested by analyses of variance (ANOVA). Binary logistic regression analyses were used to examine the cross-sectional associations of overweight, distress, and their combination with LTSA. All analyses were adjusted for age, gender, educational level, job demands and job resources. The analyses were conducted separately for men and women, after checking the significance of interaction terms overweight, distress and their combination by gender with LTSA.

To examine the hypothesis that the joint association of overweight and distress was greater than the sum of associations of overweight and distress, we used the algorithms to compute odds ratios (OR) as suggested by Andersson et al. (19). If overweight is present, then \( i = 1 \) otherwise \( i = 0 \). If distress is present, then \( j = 1 \) otherwise
j=0. OR_{ij} represents the OR in the exposure category i, j; three odds ratios (i.e., OR_{11}, OR_{10}, OR_{01}) are estimated by logistic regression analyses (19). Synergy in the joint association of overweight and distress with LTSA was assessed by the SI. The SI was calculated with the formula: SI = (OR_{11} - 1) / [(OR_{10} + OR_{01}) - 2] and confidence intervals (CIs) for the SI were calculated using Andersson et al’s algorithm (19). SI = 1 indicates that there is additivity, but no synergy in the association of overweight and distress with LTSA (19). A positive synergistic association of overweight and distress with LTSA is reflected by SI > 1, while SI < 1 represents a negative synergistic (antagonistic) association of overweight and distress. Crude ORs and adjusted ORs (aORs) were calculated with 95% CIs for all analyses. Statistical analyses were performed in the Statistical Package for Social Sciences (SPSS) version 20.0 (SPSS Inc., Chicago, IL, US), and statistical significance was concluded for $p<0.05$. 
RESULTS

Sample characteristics

A total of $N = 1754$ (64%) employees had normal body weight, $N=811$ (30%) overweight and $N = 159$ (6%) obesity. Distress was reported by $N= 868$ (32%) employees; $N = 258$ (10%) employees had joint overweight and distress; $N=53$ (2%) employees had joint obesity and distress (Table 1). Hereafter, overweight and obesity are combined together as ‘overweight’ for the rest of the analyses. LTSA was reported by 224 employees of whom 49% was aged <35 years, 34% 35-44 years, 9% 45-54 years and 8% ≥55 years. Of the employees reporting LTSA, 41 (13%) had joint overweight and distress, 57 (10%) distress only, 47 (7%) overweight only, and 79 (7%) neither had distress nor overweight ($\chi^2, p<0.001$). Most employees had LTSA due to mental disorders (38%); 30% had LTSA due to musculoskeletal disorders and 32% due to other somatic disorders. Of employees with mental LTSA, 35% was aged <35 years, 42% 35-44, 16% 45-54 years and 7% ≥55 years. Of employees with musculoskeletal LTSA, 23% was aged <35 years, 43% 35-44 years, 30% 45-54 years and 4% ≥ 55 years, and for other somatic LTSA 48%, 33%, 15% and 4%, respectively.
Table 1: Socio-demographic, lifestyle and work environment characteristics of the employees by bodyweight and distress status

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Non-overweight and non-distressed n=1197</th>
<th>Overweight only a n= 659</th>
<th>Distress only n=557</th>
<th>Overweight and distressed n=311</th>
<th>Total sample N=2724</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, n (%)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>&lt;35</td>
<td>713 (59.6)</td>
<td>285 (43.2)</td>
<td>389 (69.8)</td>
<td>164 (52.7)</td>
<td>1551 (60.0)</td>
</tr>
<tr>
<td>35-44</td>
<td>306 (25.5)</td>
<td>191 (29.0)</td>
<td>105 (18.9)</td>
<td>88 (28.4)</td>
<td>690 (25.3)</td>
</tr>
<tr>
<td>45-54</td>
<td>115 (9.6)</td>
<td>125 (19.0)</td>
<td>43 (7.7)</td>
<td>39 (12.5)</td>
<td>322 (11.8)</td>
</tr>
<tr>
<td>≥ 55</td>
<td>63 (5.3)</td>
<td>58 (8.8)</td>
<td>20 (3.6)</td>
<td>20 (6.4)</td>
<td>161 (5.9)</td>
</tr>
<tr>
<td>Gender, Female n (%)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Low</td>
<td>569 (47.5)</td>
<td>219 (33.2)</td>
<td>333 (59.8)</td>
<td>138 (44.4)</td>
<td>1259 (46.2)</td>
</tr>
<tr>
<td>Middle</td>
<td>267 (22.8)</td>
<td>153 (24.2)</td>
<td>128 (23.5)</td>
<td>105 (34.5)</td>
<td>653 (24.6)</td>
</tr>
<tr>
<td>High</td>
<td>895 (76.6)</td>
<td>473 (74.7)</td>
<td>411 (75.4)</td>
<td>195 (64.2)</td>
<td>1974 (74.5)</td>
</tr>
<tr>
<td>Frequency of physical activity (PA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;5times/week moderate PA</td>
<td>510 (42.6)</td>
<td>336 (51.0)</td>
<td>275 (49.4)</td>
<td>178 (57.2)</td>
<td>1299 (47.7)</td>
</tr>
<tr>
<td>&lt;3times/week vigorous PA</td>
<td>589 (49.2)</td>
<td>353 (53.6)</td>
<td>302 (54.2)</td>
<td>209 (67.2)</td>
<td>1453 (53.3)</td>
</tr>
<tr>
<td>LTSA, n (%)</td>
<td>79 (6.6)</td>
<td>47 (7.1)</td>
<td>57 (10.2)</td>
<td>41 (13.2)</td>
<td>224 (8.2)</td>
</tr>
<tr>
<td>Job demands, mean (SD)</td>
<td>6.56 (1.3)</td>
<td>6.59 (1.3)</td>
<td>7.09 (1.5)</td>
<td>7.12 (1.4)</td>
<td>6.74 (1.4)</td>
</tr>
<tr>
<td>Job resources, mean (SD)</td>
<td>22.03 (3.2)</td>
<td>22.04 (3.4)</td>
<td>20.35 (3.3)</td>
<td>20.44 (3.5)</td>
<td>21.50 (3.4)</td>
</tr>
</tbody>
</table>

LTSA: Long-term sickness absence; aBMI ≥ 25 kg/m²; b3% of individuals had no information available on the educational status; SD: Standard deviation

Overweight and LTSA

As presented in Table 2, overweight was associated with LTSA in women (OR =1.70; 95%-CI 1.17; 2.45), but not in men (OR = 0.93; 95%-CI 0.59; 1.45). After adjustment for age, education, physical exercise, job demands and job resources, the association of overweight with LTSA attenuated and became non-significant in women with aOR=1.48 (95%-CI 0.98; 2.22).

Distress and LTSA

Distress was associated with LTSA in both women (OR = 1.59; 95%-CI 1.11; 2.75) and men (OR=1.70; 95%-CI 1.09; 2.67), but after adjustment for potential confounders remained significant only in women (aOR = 1.71; 95%-CI 1.14; 2.35) as is shown in Table 2.
Joint association of overweight and distress with LTSA

Joint overweight and distress was associated with LTSA in women (OR=2.64; 95%-CI 1.55; 4.49), but not in men (OR=1.73; 95%-CI 0.93; 3.20). After adjustment for age, education, physical exercise, job demands and job resources, the association was attenuated but remained significant in women (aOR=2.35; 95%-CI 1.54; 4.47) (Figure). However, the synergistic association of overweight and distress with LTSA was non-significant in women SI=1.04 (95%-CI 0.34; 3.15). We calculated no SI for men because the joint association of overweight and distress with LTSA was not significant in men (Table 2).
Table 2: Association of overweight, distress and their combination with long-term sickness absence stratified by gender

<table>
<thead>
<tr>
<th>Bodyweight and distress</th>
<th>Long-term sickness absence</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Women (N=1259)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Men (N=1465)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prev.</td>
<td>Model-1</td>
<td>OR (95%CI)</td>
<td>Model-2</td>
<td>OR (95%CI)</td>
<td>Model-3</td>
<td>OR (95%CI)</td>
</tr>
<tr>
<td>Normal weight</td>
<td>84/902</td>
<td>1.00 (reference)</td>
<td>1.00 (reference)</td>
<td>1.00 (reference)</td>
<td>52/852</td>
<td>1.00 (reference)</td>
<td>1.00 (reference)</td>
</tr>
<tr>
<td>Overweight</td>
<td>53/357</td>
<td><strong>1.70 (1.17; 2.45)</strong></td>
<td><strong>1.68 (1.15; 2.44)</strong></td>
<td>1.48 (0.98; 2.22)</td>
<td>35/613</td>
<td>0.93 (0.59; 1.45)</td>
<td>0.86 (0.55; 1.35)</td>
</tr>
<tr>
<td>Distress</td>
<td>72/788</td>
<td>1.00 (reference)</td>
<td>1.00 (reference)</td>
<td>1.00 (reference)</td>
<td>54/1068</td>
<td>1.00 (reference)</td>
<td>1.00 (reference)</td>
</tr>
<tr>
<td>Non-distressed</td>
<td>65/471</td>
<td><strong>1.59 (1.11; 2.75)</strong></td>
<td><strong>1.64 (1.14; 2.35)</strong></td>
<td><strong>1.71 (1.14; 2.56)</strong></td>
<td>33/397</td>
<td><strong>1.70 (1.09; 2.67)</strong></td>
<td><strong>1.79 (1.14; 2.81)</strong></td>
</tr>
<tr>
<td>Overweight and distressed</td>
<td>44/569</td>
<td>1.00 (reference)</td>
<td>1.00 (reference)</td>
<td>1.00 (reference)</td>
<td>35/628</td>
<td>1.00 (reference)</td>
<td>1.00 (reference)</td>
</tr>
<tr>
<td>Overweight only</td>
<td>28/219</td>
<td><strong>1.75 (1.06; 2.89)</strong></td>
<td><strong>1.70 (1.02; 2.83)</strong></td>
<td>1.54 (0.88; 2.68)</td>
<td>19/440</td>
<td>0.76 (0.43; 1.36)</td>
<td>0.69 (0.39; 1.24)</td>
</tr>
<tr>
<td>Distressed only</td>
<td>40/333</td>
<td><strong>1.63 (1.04; 2.56)</strong></td>
<td><strong>1.65 (1.05; 2.60)</strong></td>
<td><strong>1.76 (1.08; 2.88)</strong></td>
<td>17/224</td>
<td>1.39 (0.76; 2.54)</td>
<td>1.46 (0.80; 2.66)</td>
</tr>
<tr>
<td>Overweight and distressed</td>
<td>25/138</td>
<td><strong>2.64 (1.55; 4.49)</strong></td>
<td><strong>2.62 (1.54; 4.47)</strong></td>
<td><strong>2.35(1.31; 4.24)</strong></td>
<td>16/173</td>
<td>1.73 (0.93; 3.20)</td>
<td>1.68 (0.90; 3.12)</td>
</tr>
</tbody>
</table>

Prev.: Prevalence of LTSA; OR: crude odds ratio; Model-1: crude model; Model-2: age adjusted model; Model-3: adjusted for age, educational status, moderate and vigorous physical exercise, job demands and job resources. **Bold figures** reflect statistically significant estimates (p<0.05).
Figure: The association of overweight, distress and their combination with long-term sickness absence (LTSA) measured by odds ratios (ORs) in women and men.
DISCUSSION

To our knowledge, this is the first study investigating synergy in the association of overweight and distress with long-term sickness absence (LTSA). In women, but not in men, the combination of overweight and distress was significantly associated with LTSA. Although the SI was in the expected direction (i.e., indicative of a synergistic effect), the hypothesis of synergy in the joint association of overweight and distress with LTSA was not confirmed as the SI was non-significant.

Our finding that distress was associated with LTSA in women only is in line with Foss et al (20), whereas Virtanen et al (9) and Bültmann et al (22) found that distress was associated with higher incidence of LTSA in both genders (9). The association between distress and LTSA might be confounded by work environment characteristics in those studies. In men, it has been shown that longer duration of work and high job strain are associated with absenteeism (14). Another explanation for the different findings could be the use of different instruments to assess distress. Virtanen et al (21) and Bültmann et al (9) used the General Health Questionnaire-12 to assess distress, while the present study used the 4DSQ. The main advantage of the 4DSQ is that it is designed to distinguish distress from other types of mental problems, such as depression and anxiety (14). In line with Harvey et al (11) and Van Duijvende et al (22), we found no associations between overweight and LTSA. Janssens et al (24), however, reported that overweight was associated with an increased risk of high sickness absence (23). These different findings may be due to the differences in study population, setting, and definition of sickness absence. Janssens et al (24) included older adults (mean age 43 years) in their study and defined high sickness absence as having more than ten sick leave days (23).

The joint association of overweight and distress with LTSA may be explained by the fact that being thin is considered an ideal beauty in western societies. Overweight might impact on an individual’s body image and self-esteem, which may lead to dissatisfaction and distress, particularly in women (4). Furthermore, women with overweight may face more stigma and prejudice in social activities including work relative to men (5). As indicated in the present study, overweight and distressed individuals report higher job demands and lower job resources. As a consequence, they might experience higher job strain and lower motivation for work (16). High job strain might lead to ill-health and, eventually, absenteeism (25). In addition, lower motivation as a result of low
job resources (e.g., lower job support, role clarity, skills might decrease work engagement, which may also lead to absenteeism (16,25).

Another possible explanation for the joint association of overweight and distress with LTSA is that overweight and mental disorders share neuroendocrine processes and pathways. Distress might increase the risk of overweight by activating the production of stress-induced hormones that increase appetite and blunt the satiety (i.e. feeling of having had enough) system, increasing fat retention and food intake (24). For example, Bornstein et al (26) found a dysregulation of the hypothalamic–pituitary–adrenocortical system in individuals with overweight and individuals with depressive complaints. In addition, it is well known that overweight and distress are independent risk factors for chronic somatic conditions, such as cardiovascular disease, diabetes, and musculoskeletal disorders (27,28). These co-morbidities could also explain the joint association of overweight and distress with LTSA.

Our present results showed that the joint association of overweight and distress with LTSA was only significant in women, which might be due to the stronger relationship between overweight and distress in women than in men (29,30). This joint association was close to additivity, i.e., equivalent to the sum of the separate associations of overweight and distress, as indicated by SI = 1.04. The fact that SI was >1 implies that the joint association was slightly greater than could be expected based on the sum of the estimated separate associations of overweight and distress. For the joint exposures overweight and distress, the additional risk of LTSA was 135%, while the risk attributable to overweight and distress was 130% (54% to overweight and 76% to distress). These additional risks are not statistically different. The possible reasons for the absence of supra-additive (synergistic) association of overweight and distress with LTSA could be: 1) the cross-sectional design of the study and potential common method bias, 2) distress might have been caused by factors other than overweight, 3) overweight might not bother employees as much as, for example, obesity, 4) overweight might be less of a risk factor for disorders (e.g., cardiovascular disease, diabetes, musculoskeletal disorders) with a need for sick leave. The SI may be significant when investigating the joint association of obesity and distress. The prevalences of obesity (6%) and joint obesity and distress (2%) were low in the present study. As a consequence, our study lacked the statistical power to analyze the joint association of obesity and distress with LTSA.
**Strengths and limitations**

The strength of our study was that we used data of a large sample of employees who participated in occupational health checks. In the present study, we used the 4DSQ to measure distress. The main advantage of the 4DSQ is that it is designed to distinguish distress from other types of mental problems. We assessed joint associations of overweight and distress with LTSA by calculating the synergy index, which has not been used previously in working populations to study additive interactions of two exposures. The main limitation of our study is its cross-sectional design. Thus, conclusions about causality and directions of associations between overweight, distress, and LTSA are not possible. Furthermore, our sample predominantly included employees from financial and public healthcare sectors, probably due to the type of health check (so-called ‘vitality scan’) that was performed. We did not also adjust our findings for some lifestyle factors (e.g. alcohol and smoking) due to non-random missing data on these variables. Our findings thus should be confirmed for other sectors by including lifestyle variables as potential confounders. Finally, LTSA, weight and length were all self-reported and particularly self-reported weight might have been affected by social desirability bias. As a consequence the prevalence of overweight or obesity may have been underestimated in our study population. Furthermore, it is well known that the number of self-reported sickness absence days is generally lower than the number of recorded sickness absence days (18,31). Underreporting of sickness absence may have weakened (joint) associations of overweight and distress with LTSA. We dealt with this problem by asking for episodes of sickness absence >2 consecutive weeks instead of the number of sickness absence days. Voss et al. (18) concluded that such self-reported sickness absence data can be used in epidemiological studies. Joint associations of overweight with LTSA may also have been attenuated if healthy employees were over-represented in the occupational health checks, a phenomenon known as ‘healthy volunteer effect’ (32).

**Practical implications and directions for future research**

We found that distress and the combination of overweight and distress are associated with LTSA in women, but not in men. Addressing distress might reduce the public health burden of LTSA among women with overweight. The joint effect of overweight and distress may have implications for prevention and sickness absence intervention if it is
confirmed in prospective studies. Furthermore, we expect that the burden of overweight and distress on LTSA could be significant in extreme conditions, such as obesity and depression. Therefore, the joint effect of obesity and depression on LTSA deserves further prospective investigation.

Conclusions
Distress and the combination of overweight and distress were associated with LTSA in women, but the joint association of overweight and distress with LTSA was not synergistic. As the joint association of overweight and distress with LTSA was stronger than separate associations, addressing co-morbid overweight and distress may help to reduce the burden of LTSA in women.
REFERENCES