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Obesity and sickness absence: results from the CHAP study

S. B. Harvey[1,2], N. Glozier[1,2,3], O. Carlton[4], A. Mykletun[5], M. Henderson[1], M. Hotopf[4] and K. Holland-Elliott[2,6]

[1]King's College London, Department of Psychological Medicine, Institute of Psychiatry, Weston Education Centre, 10 Cutcombe Road, London SE5 9RJ, UK, [2]Department of Occupational Health and Safety, King's College Hospital, Denmark Hill, London SE5 9RS, UK, [3]Disciplines of Psychiatry and Sleep Medicine, Sydney Medical School, The University of Sydney, Building F, Brain and Mind Research Institute, 94 Mallett St, Camperdown, NSW 2050, Australia, [4]London Underground, Transport for London, 55 Broadway, London SW1H 0BD, UK, [5]Norwegian Institute of Public Health, Division of Mental Health, N-0403 Oslo, Norway and University of Bergen, Faculty of Psychology, N-5020 Bergen, Norway, [6]Brunel Business School, Brunel University, Uxbridge, Middlesex UB8 3PH, UK.

Correspondence to: S. B. Harvey, King's College London, Department of Psychological Medicine, Institute of Psychiatry, Weston Education Centre, 10 Cutcombe Road, London SE5 9RJ, UK. Tel: +44 (0)20 7848 0778; fax: +44 (0)20 7848 5408; e-mail: samuel.b.harvey@kcl.ac.uk

Background Obesity is an increasing public health problem. A small number of studies have examined the relationship between obesity and sickness absence, with mixed results, particularly regarding short-term sickness absence.

Aims To determine if obesity is associated with short- and long-term sickness absence and to investigate the mechanisms that may underlie any association.

Methods Cross-sectional ($n = 1489$) and prospective ($n = 625$) analyses were conducted on staff from London Underground Ltd. All participants underwent regular clinical examinations that involved their height and weight being measured, obesity-related medical problems being diagnosed and psychiatric disorders being identified. The number of days taken for short- (<10 days in an episode) and long-term sickness absence were recorded by managers on an electronic database.

Results There was a positive linear association between employees' body mass index (BMI) and the number of days' work missed due to sickness absence on both cross-sectional and prospective analyses ($P < 0.001$). Obesity was a risk factor for both short- and long-term sickness absence. Obese individuals typically took an extra 4 days sick leave every year. The majority of the increased risk for long-term sickness absence appeared to be mediated via co-morbid chronic medical conditions. The excess short-term sickness absence was not explained by obesity-related medical problems, psychiatric disorders or workplace factors.

Conclusions Obese employees take significantly more short- and long-term sickness absence than workers of a healthy weight. There is growing evidence to support employers becoming more involved in tackling obesity.

Key words BMI; obesity; sickness absence; weight; work.

Introduction

Obesity is well known to have a negative impact on health and is creating a growing financial burden for society [1,2] Rates of work incapacity, whether long-term disability or sickness absence, have been increasing in most developed countries [3–5]. Sickness absence is a complex problem, influenced not only by an individual's health but also by numerous psychosocial and workplace factors [6–8]. This biopsychosocial model can be used to understand the contribution of obesity to sickness absence. In addition to increasing the risk of chronic medical problems [9], obesity is also related to mood and anxiety disorders [10,11], and may be associated with discrimination or social isolation in the workplace [12].

A small number of studies have attempted to look at the relationship between obesity and sickness absence [13–17]. These have tended to find that obese individuals take more days sickness absence compared with non-obese employees, although the findings related to short-term absence have been mixed. Attempts to draw conclusions

from the available research are made more complicated by the lack of any agreed definition of short-term sickness absence. Laaksonen *et al.* [15] found that obesity was associated with increased rates of both short- (defined as 1–3 days duration) and long-term sickness absence among middle-aged employees of the City of Helsinki. Ferrie *et al.* [13] found similar results among British Civil Servants, although their study defined short-term sickness absence as any episode up to 7 days. However, neither Jans *et al.* nor Moreau *et al.* found any association between obesity and short-term sickness absence using this latter definition [14,16]. The reasons for these differences are not clear. The two studies that have identified an association between short-term sickness absence and obesity both used samples of civil servants [13,15]. Compared with long-term sickness absence, short-term sickness absence behaviour is influenced to a greater extent by the psychosocial work environment and therefore may be more likely to differ between workgroups [18]. Another weakness identified in some of the previous literature has been its reliance on either self-reported weight [15] or retrospective reports of absenteeism [17].

In this study, we aimed to assess the relationship between objectively measured levels of obesity and accurate contemporaneously collected measures of short- and long-term sickness absence. We also sought to understand the biopsychosocial mechanisms underlying any relationship by considering diagnosed medical complaints, psychiatric disorders and workplace factors.

Methods

The Corporate Health and Performance Group (CHAP) study is a collection of studies within various organizations aimed at exploring the relationship between health and workplace performance. One of the member organizations is London Underground (LU) Ltd. LU is responsible for the operation of trains and the staffing of stations within London's underground rail network. LU was chosen for this study as the nature of its work and the comprehensive occupational health system in place meant regular health checks, physical examinations and accurate sickness absence records were available. The information used in this project was anonymized, routinely collected data. The use of records relating to LU staff was preceded by a detailed Memorandum of Agreement between LU and the researchers. This ensured that all records were fully anonymized by LU, including the removal of any unintentional identifying data such as dates of birth or exact age, and that all analyses and the interpretation of results remained independent. It also provided guarantees regarding the secure storage and disposal of data.

All operational staff who worked full-time between 1 April 2005 and 31 March 2007 were eligible for this study. Objective measures of obesity and health were collected between 1 April 2004 and 31 March 2007, while sickness absence was recorded between 1 April 2005 and 31 March 2007. The cross-sectional association ($n = 1489$) between obesity and sickness absence was initially examined using health and sickness absence data collected in the 2-year period between 1 April 2005 and 31 March 2007. A second, prospective analysis ($n = 625$) was then performed using obesity data collected between 1 April 2004 and 31 March 2005 and sickness absence data collected between 1 April 2005 and 31 March 2007.

As all operational staff in LU perform safety critical work, they are required to undergo detailed health assessments before commencing work and at regular intervals throughout their employment. These health assessments include a detailed history and a physical examination. Full details of each health assessment were recorded electronically. During each physical examination, the employee's height and weight were measured, allowing their body mass index (BMI) to be calculated. In addition, any specific problem or diagnosis was recorded electronically using READ coding [19]. READ codes are a comprehensive list of clinical terms that have been developed within the UK National Health Service to describe the care and treatment of patients. All electronic records were scrutinized by one of the authors (S.B.H.). Obesity-related medical problems were defined as cardiovascular disease, hypertension, metabolic disease (diabetes) and musculoskeletal disorders. Psychiatric disorders were defined as any diagnosis or complaint that mapped onto the Mental and Behavioural Disorders Categories (F00–F99) of the ICD-10 classification system [20]. The dates of each complaint plus the likely duration were recorded. This allowed us to consider both chronic medical conditions that were recorded previously and new conditions that arose during the 2-year study period.

Due to the nature of the work undertaken by LU, attendance is closely monitored and recorded. All episodes of non-attendance, even very short-term absences, are recorded by managers on an electronic database. This database was able to provide the number of days sickness absence for each employee over the 2 years in the study period (1 April 2005 to 31 March 2007) and also the number of days of both short- and long-term sickness absence incurred. LU policy defines an episode of long-term sickness absence as a period of sickness absence >10 consecutive working days, while an episode of short-term sickness absence is any absence between 1 and 10 working days in length. As a result, we were able to determine for each employee the total number of working days lost due to sickness absence, the number of days lost due to short-term absence (up to 10 working days in each episode) and the number of days lost through long-term absence (>10 working days in each episode). As we limited our study to individuals who were employed full-time (95% of LU's operational workforce), we were able to consider sickness absence as working days lost rather than a percentage of

planned work time. Information on the number of discrete episodes of sickness absence was not available.

Information from LU's human resources department was used to identify each employee's age (within 5-year age bands), gender, ethnicity and job title. LU's annual employee survey was used to measure staff attitudes towards their jobs, their employers, their managers and their workgroups. Each employee was asked to record their level of agreement with 83 separate statements about their work and workplace. A Likert scale was used to score employee's agreement with each of these statements to produce two summary measures: a measure of overall employee engagement and a measure of employee satisfaction with their line manager. The responses of each individual employee remained anonymous, with summary scores made available for each workgroup. These summary measures were used as continuous variables.

Statistical analysis was performed using STATA computer software [21]. Because of the timing of regular health checks, measures of obesity within the timeframe of this study were only available on a sub-sample of the entire operational workforce. Chi-squared and Mann–Whitney rank-sum tests were used to examine for differences between employees included in this study and the remainder of the eligible workforce. As expected, the distribution of sickness absence was skewed. Therefore, medians were used when a summary measure of sickness absence was required. The association between BMI and sickness absence was initially explored using quantile (median) regression models with BMI-defined World Health Organization obesity grouping [22] as the independent variable and days of sickness absence as the dependent variable. Interaction by gender was tested using a dummy variable containing the interaction product of gender and BMI-defined obesity groups. This analysis was conducted separately for both the cross-sectional and prospective data sets.

The potential confounding or mediating effects of various medical, socio-demographic and work-related factors were examined using multivariate logistic regression. In order to maximize the number of participants included in the multivariate models, this analysis was conducted on the cross-sectional data. To allow the use of logistic regression, participants were divided into groups of low (bottom 75%) and high (top 25%) rates of sickness absence. This was done separately for short- and long-term sickness absence. For short-term sickness absence, this divide equated to up to 10 days of short-term sickness absence per year (low) versus >10 days (high), while for long-term sickness absence, it equated to any versus no long-term sickness absence (24% of participants had an episode of long-term sickness absence). Robust standard errors taking account of clustering were used in logistic regression models involving variables measured at the level of groups (employee satisfaction and satisfaction with line management). Missing data were accounted for by utilizing list-wise deletions within each individual regression analysis.

Results

Of the 9096 operational staff who were employed full-time throughout the study period, 1491(16%) had BMI results calculated and stored. Individual employees only had weight and height recorded if one of their routine medical examinations fell within the time period of the study. As older employees are legally required to have routine medical examinations more frequently, workers with an available BMI measurement tended to be older ($P < 0.001$). Males ($P < 0.01$) and employees from a White ethnic group ($P < 0.01$) were also more likely to have a weight recorded.

The details of the sample used in the cross-sectional analysis are described in Table 1. The average BMI was 29.5 kg/m^2, with 39% ($n = 577$) of staff being either obese or very obese. This is higher than the mean BMI for the UK population, which was recently estimated to be 27 kg/m^2 [2]. Two participants with a very low BMI ($<$18.5 kg/m^2) were excluded from further analysis.

Sickness absence data were available for all 1489 participants. The median number of days sickness absence for all participants between 1 April 2005 and 31 March 2007 was 15, equating to a sickness absence rate of 7.5 days per year. As demonstrated in Figure 1, there is a clear cross-sectional association between the BMI and the amount of overall sickness absence. There is a positive linear trend ($P < 0.001$) with an increasing number of sickness absence days taken as BMI increases. Individuals with a 'healthy' BMI tended to take only 6 days sickness absence each year, while obese and very obese individuals tended to take 9.5 and 11 days, respectively. Figure 1 also displays the similar association between BMI and sickness absence stratified by gender. There was no evidence of any interaction by gender.

In order to evaluate the temporal nature of any relationship between obesity and sickness absence, we also conducted a separate prospective analysis showing the association between anthropometric measurements collected between 1 April 2004 and 31 March 2005 and levels of sickness absence in the period 1 April 2005 to 31 March 2007. A total of 632 individuals had their height and weight measured between 1 April 2004 and 31 March 2005. Sickness absence records for the 2 years following this period were available for all of these employees. Figure 2 demonstrates the prospective association between BMI and sickness absence. A positive linear association between BMI and sickness absence is demonstrated ($P < 0.01$). Workers of a healthy weight tended to incur 5 days sickness absence per annum over the 2 years following their weight measurement, while obese workers took 9 days per annum.

Further multivariate analysis was conducted on the cross-sectional sample. As described earlier, participants were divided into low and high (top 25%) ranges of both short- and long-term sickness absence (Table 2). The unadjusted odds ratios (Model 1) demonstrate the positive linear

Table 1. Description of LU staff used in the cross-sectional analysis (n = 1489)

Variables	n (%)
Gender	
Male	1314 (88)
Female	175 (12)
Age (years)	
16–25	110 (7)
26–35	365 (25)
36–45	622 (42)
46–55	342 (23)
≥56 years	50 (3)
Ethnicity	
White British	739 (50)
White Other	139 (9)
Asian	192 (13)
Black Caribbean	88 (6)
Black African	112 (8)
Other	58 (4)
Missing	161 (11)
Job category	
Train operator	601 (40)
Customer services	344 (23)
Manager/supervisor	403 (27)
Other	141 (10)
BMI	
Healthy (18.5–24.9)	266 (18)
Overweight (25.0–29.9)	646 (43)
Obese (30.0–34.9)	372 (25)
Very obese (≥35)	205 (14)
Diagnosed medical problems (from health checks)	
Cardiovascular and HT	361 (24)
Endocrine (diabetes)	147 (10)
Musculoskeletal	231 (16)
Psychiatric disorder	155 (10)

HT = hypertension.

relationship between BMI and both short- ($P < 0.001$) and long-term ($P < 0.01$) sickness absence. The addition of indicators for obesity-related medical conditions into the multivariate model (Model 3) significantly reduces the strength of the association between BMI and long-term sickness, but has a much smaller effect on the association with short-term sickness absence. Both psychiatric disorder and workplace factors were associated with sickness absence ($P < 0.05$, data not shown). However, including psychiatric disorder in the model (Model 4) had very little effect on the relationship between obesity and either short- or long-term sickness absence and the inclusion of workplace factors (Model 5) had very little impact on the relationship between obesity and short-term sickness absence. Workplace factors did appear to have a negative confounding effect on the relationship between obesity and long-term sickness absence, with the effect of obesity on long-term sickness absence becoming even greater once the impact of workplace factors was considered. In the final model, there remains a significant positive association ($P < 0.01$) between body mass and short-term sickness absence

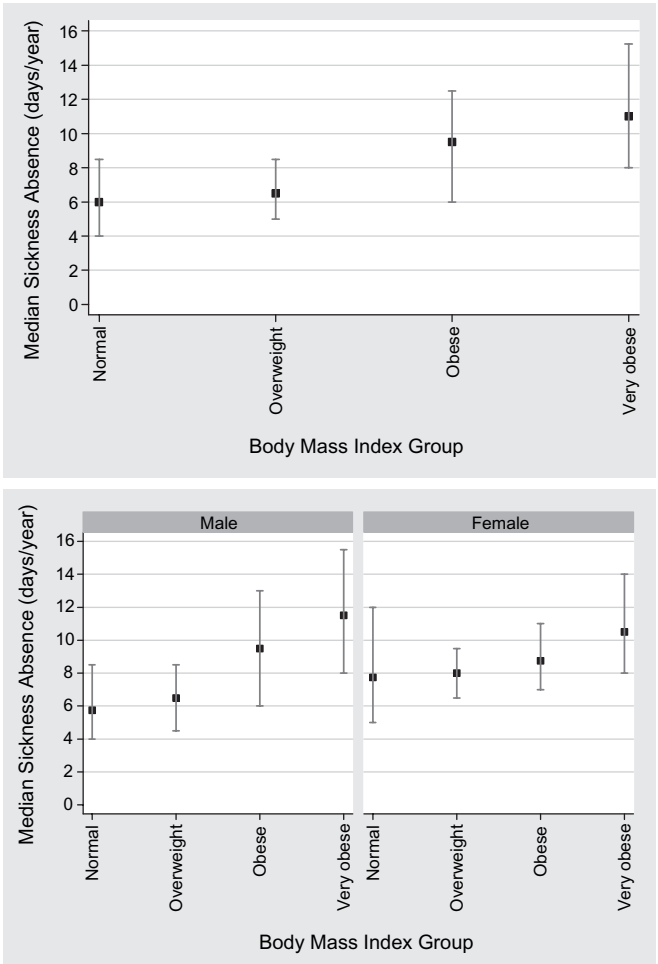

Figure 1. Median sickness absence (days per year) among full-time employees in different weight groups. Results are shown for the entire sample (n = 1489) and then separately for male (n = 1314) and female (n = 175) staff. The 40th to 60th centile range for each weight group is also displayed.

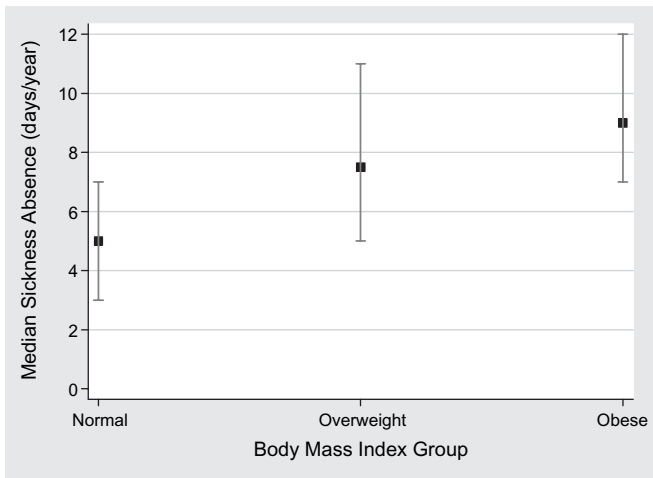

Figure 2. Prospective analysis of median sickness absence (days per year) in different weight groups (n = 632). Weight and height measured between 1 April 2004 and 31 March 2005. Sickness absence recorded between 1 April 2005 and 31 March 2007. The 40th to 60th centile range for each weight group is also displayed.

Table 2. Unadjusted and adjusted odds ratios for higher rates of short (up to 10 working days) and long-term (>10 working days) sickness absence (cross-sectional analysis)

Weight category	High levels of short-term sickness absence[a]		Any episode of long-term sickness absence[a]	
	Odds ratio (95% CI)	*P* value (trend)	Odds ratio (95% CI)	*P* value (trend)
Model 1 (unadjusted[b)]		<0.001		<0.01
Healthy weight	1.0		1.0	
Overweight	1.1 (0.8–1.6)		1.0 (0.7–1.4)	
Obese	1.5 (1.1–2.2)		1.6 (1.1–2.3)	
Very obese	2.1 (1.4–3.2)		1.6 (1.1–2.5)	
Model 2 (Model 1 + sex, age and ethnicity)[b]		<0.001		<0.01
Healthy weight	1.0		1.0	
Overweight	1.2 (0.8–1.7)		0.9 (0.6–1.3)	
Obese	1.9 (1.3–2.8)		1.4 (1.0–2.1)	
Very obese	2.3 (1.4–3.6)		1.5 (1.0–2.3)	
Model 3 (Model 2 + obesity-related medical problems)[b]		<0.01		NS
Healthy weight	1.0		1.0	
Overweight	1.1 (0.8–1.7)		0.8 (0.6–1.2)	
Obese	1.7 (1.1–2.5)		1.2 (0.8–1.7)	
Very obese	1.9 (1.2–3.0)		1.1 (0.7–1.8)	
Model 4 (Model 2 + psychiatric disorders)[b]		<0.001		<0.05
Healthy weight	1.0		1.0	
Overweight	1.2 (0.8–1.7)		0.9 (0.6–1.3)	
Obese	1.8 (1.2–2.8)		1.4 (0.9–2.0)	
Very obese	2.2 (1.4–3.5)		1.4 (0.9–2.2)	
Model 5 (Model 2 + workplace factors)[b]		<0.001		<0.01
Healthy weight	1.0		1.0	
Overweight	1.2 (0.8–1.6)		1.0 (0.7–1.6)	
Obese	1.8 (1.2–2.8)		1.6 (1.1–2.3)	
Very obese	2.2 (1.4–3.7)		1.7 (1.1–2.8)	
Final adjusted model[b]		<0.01		NS
Healthy weight	1.0		1.0	
Overweight	1.1 (0.8–1.6)		0.9 (0.6–1.4)	
Obese	1.6 (1.0–2.5)		1.3 (0.9–1.8)	
Very obese	1.9 (1.1–3.2)		1.2 (0.8–2.0)	

NS = not significant.

[a]High levels defined as an individual with a short-term sickness rate >75th centile. In total, 354 (24%) of participants had any episodes of long-term sickness absence.

[b]Model 1 is unadjusted for any potential confounders; Model 2 adjusts for age, gender and ethnicity; Model 3 adjusts for variables in Model 2 plus the number of potentially obesity-related medical problems [cardiovascular, hypertension, metabolic (diabetes) and musculoskeletal disorders]; Model 4 adjusts for variables in Model 2 plus psychiatric disorders; Model 5 adjusts for variables in Model 2 plus job type and workgroup-level scores for employee satisfaction and satisfaction with line management and final fully adjusted model includes gender, age, ethnicity, obesity-related medical problems, psychiatric disorders, job type and workgroup-level scores for employee satisfaction and satisfaction with line management.

that cannot be explained by any of the other factors measured. In contrast, the association between body mass and long-term sickness absence is no longer statistically significant, mainly due to the controlled effect of obesity-related medical conditions.

Discussion

Our study found that obese individuals take significantly more short- and long-term sickness absence compared to employees with a healthy weight. On prospective analysis, obese individuals (BMI of >30 kg/m^2) typically took an extra 4 days sick leave every year. Given the high and rising prevalence of obesity, this represents significant levels of individual disability and a major economic burden on employers and society.

This study makes three main contributions to the literature. First, it provides confirmatory evidence for the previously disputed association between obesity and short-term sickness absence [13,15]. Second, it quantifies

the amount of increased sickness absence incurred by obese employees in terms of days per year. Finally, the availability of detailed individual, health and workplace information provided an opportunity to explore possible pathways linking obesity with sickness absence behaviour. While the increased risk for long-term sickness absence appears to be mediated primarily via co-morbid chronic medical conditions, medical problems appear to explain much less of the increase in short-term sickness absence.

The main strength of this study is the use of objective measures of both BMI and sickness absence. It is also strengthened by its use of clinical examinations, rather than self-report, to collect information on participants' health. There are however some limitations that must be considered. LU staff have their health closely monitored, which may make this sample unrepresentative of other workforces. Individual employees could only be included in the study if one of their routine medical examinations fell within the time period of the study. As older employees are legally required to have routine medical examinations more frequently, it is not surprising that workers with an available BMI measurement tended to be older. In the prospective study, the increased chance of BMI measurement among males appeared to be due to older workers being more likely to be male ($P < 0.001$). Reassuringly, there was no difference between those with and without a valid BMI measurement with regard to the median total number of days sick leave taken within the study period (not significant). The small numbers of females in our sample also limit the extent to which our findings can be generalized and will have reduced the power to detect interactions by gender. Only two participants had a BMI in the underweight range (<18.5 kg/m^2). Because of the small size of this group, these individuals were excluded from further analysis; thus, we cannot comment on the occupational impact of low body weight. However, *post hoc* analysis confirms that the cross-sectional ($P < 0.001$) and prospective ($P < 0.01$) relationships between BMI and total sickness absence remain if these individuals were included. Within the cross-sectional analysis, there remains the possibility of reverse causation, with sickness absence leading to increased obesity. However, the findings of the prospective analysis suggest that this is unlikely to be a major problem. The lack of information on other potential confounders, such as smoking, alcohol use and exercise, is also a limitation.

Previously, results relating to short-term sickness absence have been mixed. Two studies involving civil servants found obese individuals take more short-term sickness absence [13,15], while two other studies involving mixed groups of employees found no association [14,16]. The results presented in this paper suggest obesity is a risk factor for both short- and long-term sickness absence. Our results also suggest that the mechanisms involved in linking obesity to short-term absence may be different to those seen with long-term absences. The increased risk for long-term sickness absence among obese employees appeared to be mediated primarily via co-morbid chronic medical conditions. This was not the case with short-term sickness absence. While we were able to explain some of the increased levels of short-term absence among obese employers, the question as to what underlies the majority of this increased risk remains unanswered. A number of very tentative hypotheses can be generated. One possibility is that obese individuals may be more susceptible to minor non-chronic medical problems or may take longer than those of healthy weight to recover from such illnesses. Alternatively, obese individuals may have more negative emotional perceptions and coping styles [23], which may lower their threshold for taking sickness absence.

The results presented in this paper demonstrate that obesity is related to increased levels of both short- and long-term sickness absence. They also demonstrate that the disabling and economic effects of obesity cannot be captured by considering obesity-related medical problems alone. This study adds to a growing evidence base for employers, who are in a unique and powerful position to promote healthy lifestyles, to become more involved in tackling obesity.

Key points

- Obesity is associated with increased levels of short- and long-term sickness absence.
- Within this sample, obese individuals (body mass index of >30 kg/m^2) typically took an extra 4 days sick leave every year.
- While the increased risk for long-term sickness absence appears to be mediated via co-morbid chronic medical conditions, obesity-related chronic medical problems seem to explain much less of the increase in short-term sickness absence.

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Conflicts of interest

None declared.

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