ELSEVIER

The Impact of Obesity on Illness Absence and Productivity in an Industrial Population of Petrochemical Workers

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PURPOSE: Examine employee illness absence and the economic impact of overweight and obesity in a petrochemical industry workforce.
METHODS: A 10-year follow-up (1994–2003) of 4153 Shell Oil Company employees was conducted. Absence frequency rates and average number of workdays lost were calculated for normal weight, overweight, and obese employees with and without the presence of additional risk factors. The study also assessed the change in overweight and obesity prevalence in the study population and estimated the current and future economic impact of these conditions.
RESULTS: Overall, obese employees were 80% more likely to have absences (24.0 vs. 13.3 per 100 employees) and were absent 3.7 more days (7.7 vs. 4.0 days) per year compared with those employees with normal body weights. Among employees with no additional risk factors, overweight employees lost more than 1.5 times more days (4.2 vs. 2.6 days) per year, and obese employees more than 2.5 times more days (7.2 vs. 2.6 days) compared with their normal-weight colleagues. Similarly, absence frequency attributable to cardiovascular disease significantly increased among employees with one or two additional risk factors present, such as smoking, high blood pressure, or hypercholesterolemia. The direct cost of illness absence from overweight and obesity for this study population was $1,873,500. Furthermore, 31% of the total illness absence was attributable to overweight and obesity in 1994, and the percentage had risen to 36% by 2003.
CONCLUSIONS: The economic impact to employers is great and will continue to rise unless measures are taken, particularly to reduce the number of employees moving from overweight to obesity with time.
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KEY WORDS: Petroleum, Manpower, Occupational health, Obesity, Risk factors.

INTRODUCTION

Overweight and obesity have steadily increased throughout Europe and the United States. The World Health Organization European Region has seen the prevalence of obesity (body mass index [BMI]) $\geq$ 30.0 kg/m^2) triple in the last 20 years (1). The prevalence of obesity in the United Kingdom, approximately 13% among men and 16% among women in 1993, steadily increased to about 25% in both genders in 2004 (2). When the prevalence of both overweight and obesity is considered, a staggering 76% of men and 69% of women had BMIs $\geq$ 25 kg/m^2 in 2005 (1). In The Netherlands, the prevalence of obesity increased among men from 4% in 1981 to 10% in 2004 and doubled from 6% to 12% among women (3). In 2005 the prevalence of overweight and obesity (BMI $\geq$ 25 kg/m^2) in The Netherlands was 62% in men and 55% in women (1). The prevalence of obesity among Danish adults more than doubled between 1987 and 2001 among men from 5.6% to 12.5% and from 1.4% to 9.0% among women (4). If the prevalence of obesity in the WHO European Region continues to increase at the same rate as in the 1990s, there will be an estimated 150 million obese adults in the region by 2010 (1). In the United States, the prevalence of obesity remained about 15% in adults between 1960 and 1980 (5). However, through the late 1980s and early 1990s, obesity continued to climb and more than doubled to 31% by 2000 (6). By 2015, an estimated 87% of men and 83% of women are expected to be overweight or obese (1).

The current cost of obesity is estimated to represent 2% to 7% of all national health expenditures worldwide (7). In England, the cost to the National Health Service is about 1 billion pounds per year (or approximately 1.8 billion U.S. dollars in 2005) and an additional 2.3 to 2.6 billion pounds in estimated indirect costs to the UK economy. The currently increasing trend translates to an annual cost to the economy of approximately £3.6 billion per year by 2010 (8). Several studies have estimated the average annual obesity-related medical costs in the United States to be between 5% and 7% of annual health care expenditures (9–12) or about $70 billion in 1995 (13). The prevalence of obesity

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Selected Abbreviations and Acronyms

BMI = body mass index
HSS = Health Surveillance System

in the U.S. workforce has increased by 44% in the last 10 years, and nearly 30% of all workers are considered obese (14). Obesity-related absenteeism cost U.S. employers $2.4 billion in 1998 (15).

Whereas research has long established the association between health risk factors and various health end points, only more recently has the relationship between health risks and business outcomes been explored. One business outcome of interest is productivity, or more specifically the loss of productivity as a result of illness-related absences.

Illness absence in a working population is a complex phenomenon, influenced by many factors such as age, gender, education, personal health risk factors, and work-related factors. Numerous studies have examined the relationship between modifiable health risks and employee absenteeism (16). Studies have shown that overweight and obese employees have significantly higher absence rates (17–20). A few studies have also explored the relationship between the number of health risk factors and absenteeism, and some have demonstrated increased absenteeism with the accumulation of health risk factors (18, 20–22).

While several studies have examined the relationship between health risk factors and absenteeism, most are based on a cross-sectional study design and/or survey data. Very few studies have used a prospective study design and objective (i.e., not self-reported) health risk and absence data. In the current study, prospectively collected employee physical examination and illness absence data was used to examine the influence of obesity prior to the reported illness absence. The purposes of this study were to (1) assess and quantify absence frequency rates and the average number of workdays lost attributable to overweight and obesity with and without the presence of additional risk factors and (2) to assess the economic impact of overweight and obesity in a petrochemical industry workforce.

METHODS

The study population included 4153 Shell Oil Company employees from three refineries, one each in Texas, Louisiana, California, actively employed at any time between January 1, 1994 and December 31, 2003. Baseline biometric and risk factor data from employee preemployment and periodic physical examinations were derived from the Shell Health Surveillance System (HSS), the data system used in the company's ongoing monitoring of employee health (23). For study subjects actively employed in 1994, the most current examination data before 1994 were used. For employees hired after 1994, data were derived from the preemployment exams. Normal weight was defined as BMI between 18.5 and 24.9 kg/m^2, overweight as BMI between 25 and 29.9 kg/m^2, and obesity as BMI of 30 kg/m^2 or greater (1).

Morbidity data for all illness absences lasting 6 or more days was extracted from the morbidity section of the HSS. Absences lasting less than 6 days were excluded to minimize the inclusion of family-related or other nonillness-related absences. Absences related to pregnancy were also excluded. Absence records originated from company payroll and personnel systems and were thus virtually complete. More than 85% of the morbidity reports included a physician-identified reason for the absence. The causes of morbidity were coded according to the *International Classification of Diseases, Ninth Revision, Clinical Modification* (24).

Person-years at risk were calculated for each employee beginning January 1, 1994 or the date of hire (whichever was later) and ending at the closing date of the study (December 31, 2003), date of retirement, date of death, or date of termination/transfer (whichever was earlier). The absence frequency rate was calculated as the number of absences divided by person-years at risk multiplied by 1000. Similarly, the average duration of absence per employee each year was calculated as the number of total workdays lost divided by person-years at risk. Comparisons of frequency rates among normal, overweight, and obese employees were conducted using the z-test to determine the statistical significance of the difference between binomial proportions at the 95% significance level ($p < 0.05$) (25). The study also examined the proportion of normal weight, overweight, and obese employees manifesting specific risk factors. The risk factors considered included current smoking, high cholesterol (defined as ⩾240 mg/dL) (26), hypertension (defined as a diastolic reading ⩾90 mm Hg or systolic reading ⩾140 mm Hg) (27), elevated glucose (defined as an impaired fasting glucose ⩾110 mg/dL) (28), and elevated triglycerides (⩾150 mg/dL) (27). The study also assessed the change in overweight and obesity prevalence in the workforce and used this information to estimate the current and future economic impact of these conditions. Prevalence was calculated using data from the first physical exam available for each employee before 1994 or the initial exam for employees hired after 1993 and the last exam available as of 2003. Employees who only had data from one exam were excluded in this analysis. All statistical analyses were done using SAS System Software version 8.2 (29).

RESULTS

There were 3612 males and 541 females with a median age of 47 years and an average duration of employment of 18.6