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ACOEM Guidance Statement:

Obesity in the Workplace: Impact, Outcomes, and Recommendations

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Abstract

Objective—To conduct a comprehensive literature review to develop recommendations for managing obesity among workers to improve health outcomes and to explore the impact of obesity on health costs to determine if a case can be made for surgical interventions and insurance coverage.

Methods—We searched PubMed from 2011–2016, and CINAHL, Scopus, and Cochrane Registry of Clinical Trials for interventions addressing obesity in the workplace.

Results—A total of 1,419 articles were screened, resulting in 275 articles being included. Several areas were identified that require more research and investigation.

Conclusions—Our findings support the use of both lifestyle modification and bariatric surgery to assist appropriate patients in losing weight.

INTRODUCTION

Obesity is a disease commonly defined as a body mass index (BMI) of ≥30 kg/m^2. Recent data from the National Health and Nutrition Examination Survey (NHANES) reports that the prevalence of obesity among US adults is 37.7%, with more women than men having obesity (35.0% men v. 40.4% women).[1] Diet, lifestyle, and genetics all play a role in the increase of obesity. However, with the conversion of the American workforce from predominately manual labor to desk jobs, this has placed more focus on the workplace as a contributor to the growth of the obesity problem. This decline in manual labor has resulted in a decrease in more than 100 calories in both men and women in their daily occupation-related energy expenditure.[2] Sitting time at work is associated with higher BMI.[3]

Increasingly, the responsibility for managing obesity among the working population has fallen to employers, large and small. However, companies offer different levels of care and modalities related to weight management which may contribute to access issues for workers. A recent online survey that measured consumers' perceptions of medical services covered by their health insurance, participants reported low prevalence of coverage for a registered dietitian (28%), bariatric surgery (26%), medications designed to promote weight loss (24%), and medical weight management (23%). Of those participants who were employed, "16% indicated that their employer had a wellness program with incentives or penalties based on their weight or BMI." Participants that had access to these wellness programs reported more coverage for obesity treatment – coverage for a registered dietician (60%), medical weight management (53%), bariatric surgery (32%), and pharmacotherapy (30%).[4]

In order to have a healthy company, employers and their health plan designers need to understand how to manage obesity among their employees and develop evidence-based programs focused on obesity prevention and treatment, so they could offer the American worker benefits that can assist with improving their health.

BACKGROUND

In order to provide employers with appropriate recommendations on managing obesity among the working population, the American College of Occupational and Environmental Medicine (ACOEM) conducted a systematic review of the literature on obesity related to the workplace. In response, ACOEM convened a 14-member, multi-disciplinary panel comprised of experts in occupational medicine, internal medicine, pediatrics, emergency medicine, surgery, advanced laparoscopic and bariatric surgery, obesity medicine, public health, clinical psychology, and exercise physiology to develop this guidance document that addresses the management of obesity among workers to improve health outcomes. This document is also intended to explore the impact of obesity on health costs in order to determine if a case can be made for lifestyle, non-surgical and surgical interventions and insurance coverage of such interventions.

METHODOLOGY

A Research Team was engaged to conduct a comprehensive literature review. In compiling available evidence upon which to develop recommendations for managing obesity in the workplace, the Research Team classified the studies by level (Level 1 – randomized controlled trial; Level 2 – prospective cohort studies, prospective comparative studies, and large population-based studies; Level 2a – prospective simulation studies), and summarized them into evidence tables. The Panel then reviewed the evidence tables and developed appropriate recommendations based on the available evidence.

Using ACOEM's Methodology as a guide,[5,6] the Research Team searched PubMed from 2011 through 2016 (see supplement materials for search terms), and also CINAHL, Scopus, and Cochrane Registry of Clinical Trials using similar search criteria. Interventions addressing obesity in the workplace prior to 2011 have been previously reviewed.[7]

Inclusion criterion were Level 1 (randomized controlled trials) and Level 2 evidence (prospective cohort studies, prospective comparative studies, and large (n >25,000) population-representative sampling studies). Prospective studies incorporating simulation as opposed to empirical data were included, but qualified as Level 2a studies. Articles were required to be relevant to obesity specifically in the workplace setting to be included. Studies that measured cognitive performance and behavioral outcomes in a laboratory setting – and could be considered relevant to the workplace by extrapolation of laboratory settings to workplace settings – were also recommended by the Panel. However, these were qualified as extrapolation rather than direct testing in the workplace. Thus, we applied our standard evidence classification to these studies, but qualified them as Level 1* or Level 2* (Table 1).

The total number of articles screened was 1,419. The search resulted in 80 Level 1 articles, 187 Level 2 articles, and 8 simulation studies. The number of included articles was 275 (Table 1). See supplemental materials for evidence tables of included studies.

DEFINITIONS

For the purposes of this discussion, overweight is defined as a BMI of 25–29.9 kg/m^2 and obesity defined as a BMI ≥30 kg/m^2. This definition is broken down into standard three classes of obesity – Class I Obesity (low risk) with a BMI of 30–34.9 kg/m^2, Class II Obesity (moderate risk) with a BMI of 35–39.9 kg/m^2, and Class III Obesity (high risk) with a BMI ≥40 kg/m^2.[8]

Target Population

The definition of obesity for working, non-Asian adults, age 18–65 years old, employed in the US, is a body mass index (BMI) of ≥30 kg/m^2. For an Asian population, the definition has been defined by the World Health Organization (WHO) as a BMI ≥27.5 kg/m^2.[9] Although BMI is widely used in health and productivity population-based research, there are limitations and controversies associated with its use to determine individual employee risk for morbidity and mortality.

ASSOCIATION

Medical expenditures including pharmaceutical costs, and productivity metrics including absenteeism, short-term disability (STD), workers' compensation (WC), and productivity have all been found to be associated with BMI. The greatest impact is for a worker with a BMI ≥30 kg/m^2. There have been several employee-based studies on the association of BMI with worker absenteeism, disability, workers' compensation claims, and on-the-job productivity or performance also termed "presenteeism," which refers to working while sick and, similar to absenteeism, can result in the loss of productivity. These studies have generally shown a "J-shaped" relationship between BMI and these productivity metrics with a BMI of approximately 25 kg/m^2 at the nadir of the J-shaped curve.

For example, a study of 3,066 financial services employees who had completed a health risk appraisal (HRA) which was linked to the employee's medical claims (inpatient, outpatient, prescription drugs) found that for both men and women there was a J-shaped curve with the greatest medical costs for a BMI ≥30 kg/m^2.[10] The drivers of these medical claims were cancer, digestive, circulatory, mental disorders, and musculoskeletal disorders. A study of 35,932 employees and spouses in a manufacturing company who participated in a health plan and completed an HRA, found that medical and pharmaceutical costs increased $119.70 (4%) and $82.60 (7%) respectively per BMI unit adjusted for age and gender. For individuals with diabetes and heart disease, the likelihood of having a medical claim increased 11.6% and 5.2% respectively for each BMI unit.[11] Similarly, a study of 29,699 employees from several employers who had completed a HRA linked to their medical claims including pharmaceutical claims also showed a J-curve association with the greatest costs for employees with a BMI ≥30 kg/m^2.[12] Another study found that "four of the 10 modifiable health risks (class I and class III obesity, high blood pressure, high blood glucose, and high cholesterol) were significantly associated with increased medical care costs when employee demographics and other health risks were held constant. Class I obesity risk was associated with higher costs for each outcome."[13]

Workdays lost to STD and absenteeism have also been shown to have a linear or J-curve relationship with BMI. A study of more than 17,000 employees in a financial services company reported that the percentage of workers with an STD event steadily increased with BMI and the number of workdays lost per STD event was a J-curve with longer durations for a BMI ≤18.5 kg/m^2 and BMI ≥30 kg/m^2.[14] A more linear association of BMI and the percentage of workers with an STD was also noted by Burton et al,[10] although Van Nuys et al,[12] found an association for both absenteeism and STD.

A study of more than 11,000 health care and university employees reported on a strong linear association between BMI and WC injuries. The relative risk of a WC claim increased from 0.81 for a worker with a BMI ≤18.5 kg/m^2 to 1.45 for a worker with a BMI of ≥40 kg/m^2.[15] Van Nuys et al, reported on a J-curve association of BMI and WC claims in almost 30,000 from a multi-employer database with linked WC and HRA data.[12] Similarly, Hertz et al, reported a linear association between work limitation prevalence and BMI using the National Health Interview Survey 2002 data.[16]

ASSESSMENT OF OBESITY

Obesity can be defined as an amount of body fat higher than what is considered healthy for an individual's weight.[17] The Panel encountered various approaches to determine patient obesity. BMI is an anthropometric calculation of body weight (kg) divided by height squared (m^2). Current assessment and management guidelines from the US,[18] Canada,[19] and Europe[20] recommend measuring BMI as a first step in evaluating adult patients for obesity. The National Committee for Quality Assurance (NCQA) 2017 Healthcare Effectiveness Data and Information Set (HEDIS) measure for obesity also utilizes BMI as the criterion to document assessment.[21] According to the American Heart Association/American College of Cardiology/The Obesity Society (AHA/ACC/TOS) 2013 Guidelines for Managing Overweight and Obesity in Adults,[18] it is recommended to measure height and weight and calculate BMI at annual visits or more frequently depending on the patient's risk factors. Furthermore, based on the evidence of assessment and benefits of treatment, the US Preventive Services Task Force recommends screening all adults for obesity, and that patients with a BMI of ≥30 kg/m^2 receive intensive, multicomponent behavioral intervention.[22] A desirable or healthy BMI is 18.5–24.9 kg/m^2, overweight is 25–29.9 kg/m^2, and obesity is ≥30 kg/m^2. As noted above obesity is further sub-defined into Class I (30.0–34.9 kg/m^2), Class II (35.0–39.9 kg/m^2), and Class III (≥40 kg/m^2). Corresponding designations are used by ICD-10 for coding and billing purposes.

Since abdominal fat is an independent contributor to the development of comorbid diseases such as type 2 diabetes, cardiovascular disease, and metabolic syndrome, proper measurement of waist circumference (girth) also is recommended for individuals with BMI 25–34.9 kg/m^2 to provide additional information on risk. (Metabolic syndrome is a group of risk factors that raises risk for heart disease and other health problems, such as diabetes and stroke. The five metabolic risk factors are: 1) waist circumference ≥35 inches for women, ≥40 inches for men; 2) triglycerides >150 mg/dl (or on medicine to treat); 3) HDL<40 mg/dl for men and <50 mg/dl for women (or on medicine to treat); 4) blood pressure (BP) >139/89 (or on medicine to treat); and 5) fasting blood sugar 100–126 md/dl (or on medicine to treat). At least three metabolic risk factors are required for a diagnosis of metabolic syndrome.[23]) It is not necessary to measure waist circumference in patients with a BMI ≥35 kg/m^2 because waist circumference will likely be elevated and adds no additional risk information; however, it can be useful for monitoring and education. The AHA/ACC/TOS Expert Panel recommends using the cutpoints >88 cm [>35 inches] for women and >102 cm [>40 inches] for men as indicative of increased cardiometabolic risk.[18,24] Lower cutpoints have been suggested for some racial and ethnic groups since the threshold for excessive abdominal fat and incidence of co-morbid disease appears to vary from Caucasian populations.[25]

Staging of Obesity

Efforts are underway to develop more practical and useful assessments to identify patients who require more intense intervention. Analogous to other staging systems commonly used for congestive heart failure or chronic kidney disease, a cardiometabolic disease staging system (CMDS) was developed that assigns patients to one of five risk categories using quantitative parameters readily available to the clinician,[26] without regard to BMI. With advancement from stage 0 to stage 4, there are significant increments in risk and adjusted HR for diabetes, all-cause and cardiovascular disease (CVD)-related mortality. A refinement of the staging system was incorporated in the recently released Clinical Practice Guidelines for Comprehensive Care of Patients with Obesity issued by the American Society of Clinical Endocrinologists (AACE) and American College of Endocrinology (ACE).[27] Using this guideline, obesity disease stage is based on ethnic-specific BMI cutoffs along with assessment for adiposity-related complications. Stage 0 is assigned to individuals who are overweight or those who are obese by BMI classification but have no complications, whereas Stage 1 and 2 are defined as individuals who are overweight or those who are obese by BMI classification and having 1 or more mild-moderate complications (Stage 1) or at least 1 severe complication (Stage 2). The AACE guidelines explicitly recommend using a complication-centric assessment, whereby the presence of obesity comorbidities (such as cardiovascular disease), in addition to anthropometric measures (such as BMI), guides treatment indication, intensification, and goals, with the intent of targeting the most aggressive treatments to those who might derive highest benefit.

A different functional staging system for obesity that is independent of BMI, called the Edmonton Obesity Staging System (EOSS), uses a risk-stratification construct.[28] Using this approach, individuals with obesity are classified into 5 graded categories, based on their morbidity and health-risk profile along three domains – medical, functional, and mental. The staging system was recently shown to predict increased mortality among two large population cohorts.[29,30]

IMPACT

Health & Safety

Obesity is associated with numerous health and safety risks. Health risks include pre-diabetes mellitus, diabetes mellitus, coronary heart disease, depression, hypertension, high cholesterol, sleep apnea and respiratory problems, stroke, gallbladder disease, osteoarthritis, some cancers[31] (endometrial, breast, colon, kidney, esophagus, gallbladder, pancreas, and liver), and metabolic syndrome. In addition to health risks, health care and disability costs associated with obesity are also increased. Individuals are not working as long as they could because of the premature disability associated with being obese. One study found that as BMI increases from 30 to 35, the probability of a short-term disability claim increases 25% (from 3.6% to 4.5%) for those without hypertension, hyperlipidemia, or diabetes and 37% (4.9% to 6.7%) for those with one of these comorbidities.[12]

In 2013, the American Medical Association classified obesity as a “multi-metabolic and hormonal disease state” that leads to unfavorable outcomes.” Obesity is associated with lower levels of productivity, decreased quality of life, and increased mortality.[32] People with obesity, as compared to those of a healthy weight are at increased risk for many serious diseases and health conditions affecting multiple organ systems.[33–35] “Recent data provides strong evidence for a causal role of higher BMI and risk of type 2 diabetes and hypertension, and evidence that BMI increases risk of coronary heart disease.”[36] Obesity is associated with an increase in CVD such as coronary artery disease and stroke as well as CVD risk factors such as hypertension and dyslipidemia. Obesity is also associated with prediabetes (when the blood glucose level is higher than normal) and type 2 diabetes. Both prediabetes and diabetes are also risk factors for CVD. The term “metabolic syndrome” is used to combine many of these cardiovascular risk factors under one umbrella. Obesity may be a risk factor for musculoskeletal disorders such as osteoarthritis, back pain, and increased difficulty with physical functioning,[37] and is a major cause of knee replacement surgery.[33] A recent study using 17 years of data from 38,214 university and health system employees reported a significant interaction between BMI and musculoskeletal (MSK) injury risk. The effect of BMI was strongest for ‘low’ MSK injury risk occupations, but the absolute MSK injury rates for ‘mid’/‘high’ MSK injury risk occupations remained larger.[38]

In addition, the respiratory system may be affected by obesity. Obstructive sleep apnea (OSA) and obesity hypo-ventilation syndrome (OHS) are commonly seen in persons with obesity.[39,40] There is also a bi-directional relationship between sleep disorders and obesity. A 2010 review found that 90% of patients with OHS have coexistent OSA and the remainder have sleep-related hypoventilation.[41] “Among patients with OSA, the prevalence in the U.S. of OHS is approximately 6%, 18% and 25% for those having a BMI 30–34, 35–39, and equal to or greater than 40, respectively.”[41] Obesity may be associated with gastrointestinal system conditions such as gallbladder disease, gastroesophageal reflux disease (GERD), and non- alcoholic fatty liver disease. Obesity related genitourinary system conditions include urinary incontinence due to weakened pelvic muscles and abnormal ovulation.[42]

Obesity also is associated with a significant psychosocial burden. Excess body weight is linked to decreased quality of life as well as increased depressive symptoms and higher rates of mood disorders. Individuals with obesity are often stigmatized and discriminated against in a wide range of social situations, including the work place. Persons with obesity are hired less frequently than those of average body weight, receive lower salaries and less frequent promotions, and report less satisfaction with their employment than individuals of average body weight.[43]

Studies have also found an indirect association between excess body weight and workplace safety.[40] Rates of workers' compensation claims were twice as high, medical claims costs 7 times higher, and indemnity claim costs 11 times higher among the heaviest employees vs employees of average weight.[15] Compared to normal-weight employees, those with a higher BMI requested more workers' compensation days: 2.92 vs 8.59.[12]

Economic Burden

Obesity among workers has adverse occupation-related consequences (work absence, impairment, limitation, and workplace injury) and increased health care and disability costs. Between a BMI of 25 and 45 kg/m^2, medical and drug costs increased $119.7 and $82.6 per BMI unit increase adjusted for age and gender.[11] Estimated mean annual per capita health care expenses attributable to obesity are $1160 for men and $1525 for women.[44] Workers who were obese had more than double the work limitation of those who were of normal weight.[16]

Obesity is associated with a significant increase in absenteeism among US workers, which costs the nation an estimated $8.65 billion per year, accounting for 6.5% to 12.6% of total costs of absenteeism in the workplace.[45] Obesity associated with increase in workdays absent; ie, 1.1 to 1.7 extra days missed annually compared with normal-weight employees.[45] Compared to normal weight employees, those with higher BMI showed a trend for increased health care spending. In 2011, dollars out-of-pocket spending rose from $371.32 to $632.53, and total medical costs increased from $3863.34 to $7924.53. Similarly sick days were 5.29 and 7.43, and short-term disability days were 1.94 and 4.77 in comparison.[12]

PROBLEM OF OBESITY IN THE WORKPLACE

In the US, nearly 38% of adults have obesity. Obesity is more common in women (40.4%) than men (35%), and rates have exceeded 35% prevalence in four states, 30% in 25 states, and 20% in all other states.[1,46] One forecast estimates a 33% increase in obesity and a 130% increase in severe obesity (BMI >40 kg/m^2) by 2030.[47]

Rates of obesity differ by race and ethnicity. Blacks (48.4%) and Latinos (42.6%) have higher obesity rates than Whites (36.4%) and Asian Americans (12.6%).[1] In addition, there are inequities in obesity among different education and/or income levels and among different occupations. According to the 2008–2010 Behavioral Risk Factor Surveillance Survey, 32.8% of adults who did not graduate high school had obesity vs 21.5% of those who graduated from college/technical school. Nearly 34% of adults who earn less than $15,000 per year have obesity compared to 24.6% of adults whose income is above $50,000.[48]

With an increase of US employees who are overweight or have obesity, a number of studies have measured the impact on employer health care expenditures. Additionally, researchers have demonstrated the association of BMI with absenteeism and presenteeism, as well as WC costs related to injuries and illnesses.

Andreyeva et al, utilized the National Health and Nutrition Survey (NHANES) database of the US civilian, non-institutionalized population to study obesity and absenteeism. Obesity attributed absenteeism among American workers cost the nation an estimated $8.65 billion per year in 2012.[45] The authors reported that obesity was associated with a significant increase in lost workdays, from 1.1 to 1.7 extra days missed annually when compared to normal weight employees. Interestingly, obesity was found to account for 6.5–12.6% of total costs of absenteeism in the workplace, with results almost identical to the data on obesity in health care expenditures.

Van Nuys et al, reported a J-shaped association with BMI and a variety of metrics including health care expenditures, sick days, workers' compensation, and STD absences. They studied 29,699 employees from a variety of employers who had health risk appraisal (HRA) data linked to their health claims and productivity data. Normal-weight employees cost an average of $3,830 per year in combined medical, sick days, STD, and WC claims while employees with a BMI >40 kg/m^2 cost more than double that amount ($8,067) in 2011 dollars.[12] The nadir of health care costs and lost productivity was associated with a BMI of 25 kg/m^2.

In looking at a Total Worker Health® model, (defined as policies, programs, and practices that integrate protection from work-related safety and health hazards with promotion of injury and illness prevention efforts to advance worker well-being) Dong et al, studied occupational and non-occupational factors associated with work-related injuries among 12,686 US construction and non-construction workers in the National Longitudinal Survey of Youth. Obese/overweight, smoking, and cocaine use were risk factors for work-related injuries when demographics and occupational factors were held constant.[49]

Overweight and obesity have also been associated with lost on the job productivity. A study based on the National Health Interview Survey 2002, found that the 9,636 workers with obesity had more than double the work limitation of workers who were normal weight.[16] Workers with obesity were found to have a 6.9% prevalence of work limitations vs 3.0% among normal-weight workers. Bustillo et al, reported on 56,971 respondents to the 2009–2010 Canadian Community Health Survey and found that obesity is marginally associated with absenteeism and presenteeism.[50] BMI has been found to be associated with a number of other medical conditions among workers including emotional exhaustion,[51] menopausal vasomotor symptoms,[52] and diabetes-related metabolic risk factors in workers in China.[53] With rising levels of obesity among workers, employers are evaluating the impact of increasing weight not only on health care costs, but occupational injuries, absenteeism, presenteeism and thus, prompting a focus on workplace interventions to address this public health issue.

IMPACT OF THE WORKPLACE ON OBESITY

Obesity is highly contextual—obesity may be considered a consequence of the reciprocal manner in which individuals interact with their environments.[54] The workplace environment represents an important consideration because of the reciprocal nature between obesity and employment. While many researchers studied the impact of obesity on performance and productivity, it is equally important to note the potential influence of work on obesity.

Work as a Causal Factor for Obesity

Work has previously been recognized as a source of adverse environmental exposures associated with obesity (or excess weight gain).[2,55–58] Activities to consider in conceptual frameworks include multi-level influences (ie, individual, group, organization, and community level), corporate vision (eg, leadership, cultural norms and values, and worker involvement), and environmental approaches including conditions of work (eg, physical environment, psychosocial factors, socioeconomic environment, and job tasks and demands).[58,59] Risk factors that have been associated with obesity among workers include social stressors, psychosocial work factors, working hours, sleep and night shift work, and sedentary behavior.

Social Stressors

Work-related stress includes conflicts with co-workers and supervisors, a lack of control of work functions, and a negative group climate at work. Kottwitz et al, studied the influence of social stress among women workers on BMI and change in BMI over the course of a year. Measures of social stress in the workplace – including job control and conflict with co-workers – were found to positively correlate with BMI.[60] Furthermore, the authors noted that increased social stressors at work and reductions in job control increased BMI longitudinally. Low decision latitude, defined as the lack of authority to make important decisions, was also associated with obesity in a study by Nelson et al.[61] Being harassed while at work, including being sworn at, screamed at, and receiving hostile or offensive gestures, was associated with both obesity and low levels of physical activity.[61,62] Similarly, physical threats at work were noted to be moderately associated with weight gain in a longitudinal cohort study in Finland.[56] In a study designed to test the association between lifestyle-related modifiable health risks (physical activity, cardio-respiratory fitness, and obesity), Pronk et al, observed that severe obesity (BMI $\geq$40 kg/m^2) was associated with an increased number of work loss days, but obesity (BMI $\geq$30 kg/m^2 and $\leq$40 kg/m^2) was related to an increased difficulty of getting along with coworkers.[63] In a 14-year longitudinal study of Canadian workers, decision authority was noted to be a significant work-related predictor for obesity among women, but not men.[64]

Psychosocial Work Factors

Psychosocial work factors, such as job demands, job content, job control, social interactions, and job future and career issues,[65] may affect health and well-being. Health behaviors may be intermediate factors between the psychosocial work environment and health-related outcomes, such as obesity or excessive weight gain. Quist et al, followed Danish health care workers (3,982 men/152 women) as part of a cohort study with 3 years of follow-up and studied psychosocial work environmental factors and weight change.[66] Specifically, they looked at work pace, workload, quality of leadership, influence at work, meaning of work, predictability, commitment, role clarity, and role conflict. High-quality leadership predicted weight loss among men. Among women, high role conflict and living alone predicted weight gain whereas high role clarity predicted both weight gain and weight loss. Another longitudinal cohort study conducted in Finland by Roos et al, noted that during the 5- to 7-year follow-up (during which time 26% of women and 24% of men gained 5 kg or more), physical threats at work were modestly associated with weight gain.[56]

Social interactions may be a strong influence in the workplace where individuals spend a large share of their waking hours.[32,67,68] Obesity proves to have myriad causes and associations. Diet, calorie expenditure, diabetes, stress, and quality and quantity of sleep all appear clustered around obesity.[68–70] Workers with obesity are over-represented vs the general population in certain occupations.[32,70,71] For example, one study found that non-Hispanic white males who worked in health care support (36.3%), protective service (34.3%), and transportation and material moving (33.7%) had the highest prevalence of obesity while among non-Hispanic white female workers, the highest prevalence of obesity was in farming/fishing/forestry (35.9%), transportation and material moving (31.5%), and production (30.4%).[32]

A factor that is certain to cut across all jobs is the social network that underpins the employment milieu. Obesity in a first degree friend carries a 45% higher rate of obesity for the individual.[67] Same sex contacts with obesity increases the individual's chances for obesity by 71%.[67] There is likely a large component of altered social norms contributed to the obesity “contagion.”[32,67] If an individual deems someone with obesity a friend (one sided), there appears to be a 57% increase in obesity risk. If the regard is mutual then the number rises to 171%.[67] Clearly, social distance and strength of the social bond contribute greatly to the spread of obesity in the social context.

Although there are positive impacts to measures such as voluntarily increasing activity at the workplace,[32] further research on the social factors within the workplace may provide further insights and mitigation strategies to the growth of the obesity problem. By understanding some of the organizational and psychosocial factors of these jobs, more targeted and perhaps more effective interventions can be brought to bear.

Working Hours

Based on data from the 2010 National Health Interview Survey, employment involving work of more than 40 hours per week and exposure to a hostile work environment were associated with obesity.[66] Similar results were noted for older workers based on panel data from the Health and Retirement Study.[72] Here, older employees who worked more than 59 hours per week were 23% more likely to gain weight as compared to those who worked less than 59 hours per week. Hauck and Hollingsworth reported that employment itself is associated with more weight gain and less weight loss among middle-aged women.[73] Furthermore, they noted that among employed women, increasingly long working hours were associated with more weight gain, especially higher levels of weight gain.

Sleep and Night Shift Work

Sleep problems and obesity appear to cluster among working men and women in the same work unit, as reported by Oksanen et al, in a large study of 39,873 workers from 3,040 workplaces in Finland.[40] Given the co-occurrence of sleep problems and obesity among workers in the same work unit, interventions to reduce sleep and obesity problems may benefit from identification of "risky" workplaces. Night work has previously been associated with negative health effects. Buchvold et al, found a significant positive correlation between the number of night shifts worked in the last year and BMI.[74] In contrast, Bekkers et al, did not report a positive association of night and shift work with weight change over 1 year, although they did note a larger weight increase among normal weight workers who went from day to shift work.[75] Night shift workers often have lack of choices to healthy meals due to poor access to healthy foods at night and this may be one reason for a correlation between poorer sleep patterns and eating behaviors.[76] In general, despite some inconsistencies, a recent review of the literature concludes that there seems to be convincing evidence that shift work increases the risk of obesity.[77]

Sedentary Behavior

Increased sedentary behavior is associated with obesity. Fixed night work has been associated with lower likelihood of becoming physically active.[78] Based on a 2-year follow-up study with a cohort of 2,062 recently graduated female health care assistants, the researchers reported no significant relationships between fixed night work with weight gain or obesity. Church et al, studied occupational physical activity and energy expenditure trends over the past 5 decades for US workers and the relationships to obesity noting that during the 50 years between 1960 and 2010, daily occupation-related energy expenditure has decreased by more than 100 calories.[2] This reduction expressed in energy expenditure accounts for a significant portion (≥80%) of the increase in mean US body weight for both men and women during the same timeframe. Based on a review of the literature, Shrestha et al, concluded that no significant association is yet shown between sedentary work and obesity, noting that simply replacing sitting at work by standing at work is unlikely to prevent or manage obesity.[77]

BENEFITS OF ADDRESSING OBESITY IN THE WORKPLACE

The US Centers for Disease Control and Prevention (CDC) recommends four main evaluation measures for determining the benefits of interventions addressing obesity in the workplace: 1) worker productivity, 2) health care cost, 3) health outcomes (obesity and related conditions like hypertension and type 2 diabetes), and 4) organizational change (health behaviors).[79]

Worker productivity is most easily measured as absenteeism. Van Wormer et al, assessed 2-year absenteeism among 1,228 employees completing a worksite-randomized trial that evaluated an environmental weight gain prevention intervention.[80] They found weight change and baseline weight interacted to influence absenteeism – employees who were obese and gained weight averaged 6.6 sick days over 2 years vs. normal-weight employees who maintained weight who averaged less than half this number. These results suggest that addressing obesity in the workplace, particularly through the prevention of weight gain, can benefit productivity by reducing absenteeism.

However, CDC notes that while worker productivity can be measured by number of sick days, a more precise indication can be gained by the use of a questionnaire such as, the Health and Work Performance Questionnaire (HPQ), a 10-point instrument assessing absenteeism and presenteeism. Harden et al, administered the HPQ before and after a 12-month Internet-delivered weight-loss intervention among 1,030 workers with a BMI of >25 kg/m^2.[81] Although 22% of the participants achieved clinically meaningful weight loss (>5% initial weight), no statistically significant changes in HPQ presenteeism or absenteeism were observed.

Future research is required to better define whether addressing obesity in the workplace can improve worker productivity and contain health care costs, and whether such efforts should target weight gain prevention as opposed to weight loss. Studies must also incorporate measures of presenteeism which has been studied less extensively than absenteeism. A prior systematic review identified 14 studies addressing the influence of workplace health promotion programs on presenteeism, finding approximately half of them yielded improved presenteeism but substantial discrepancies regarding the best intervention strategies to promote presenteeism as well as methods to assess presenteeism.[82]

MANAGEMENT OF OBESITY: NON-SURGICAL INTERVENTIONS

Lifestyle Modification Interventions

A program of diet, physical activity, and behavior therapy (ie, lifestyle modification) has long been the cornerstone of treatment for most individuals with obesity. A 5% weight loss is considered clinically significant.[18](18) In trials conducted in academic medical centers, persons counseled to eat a diet of 1200–1500 kcal/d, combined with regular exercise and a comprehensive program of lifestyle modification, lost approximately 7–10% of their initial weight in approximately 6 months.[83,84]

These interventions have been modified for use in primary care practice,[85,86] as well as specialty medical practices, such as infertility programs.[87] Weight losses and improvements in weight-related comorbidities seen in these studies have been clinically significant for the majority of treated patients, but often not as robust as seen in well-controlled efficacy studies. In recent years, investigators have modified these interventions for administration using telephone-based counseling, internet sites, and smart phone applications.[88] Similar to studies conducted in medical settings, weight losses with these approaches are typically more modest than those seen in studies that involve direct patient-provider contact.

This literature has served as the foundation of lifestyle modification interventions delivered in the workplace. A large number of studies have investigated lifestyle modification for weight loss — caloric restriction, increased activity and/or behavioral counseling or support — offered to employees. Some of these studies have involved the use of commercial providers brought into the workplace; others have used a self-help or peer-support model. Other programs have focused on specific aspects of lifestyle modification — changing the food available in cafeterias through a number of strategies, promoting physical activity with increased walking, or organizing employees to work together as teams and compete with one another. The wide creative range of approaches likely has helped foster levels of employee engagement, but also makes cross-study comparisons difficult. In general, lifestyle modification interventions delivered in the workplace produce modest, but often clinically significant weight losses and improvements in weight-related health problems for many individuals (see evidence tables). However, and is often seen in the high-quality clinical trials from academic medical centers, sustained engagement in the behaviors that promote weight loss is difficult and successful weight maintenance in the years after treatment is atypical. In contrast, the CDC-recognized lifestyle change programs for prediabetes, which is commonly associated with obesity, showed that those with prediabetes who take part in a structured lifestyle change program can reduce their risk of developing Type 2 diabetes by 58% (71% for people >60 years old), and the impact of this program can last for years to come.[89]

Pharmacotherapy

According to the US Food and Drug Administration (FDA), adjuvant pharmacological treatments are approved for patients with a BMI ≥30 kg/m^2 or with a BMI ≥27 kg/m^2 who also have concomitant obesity-related risk factors or diseases and for whom dietary and physical activity therapy has not been successful. When prescribing an anti-obesity medication, patients should be actively engaged in a lifestyle modification program that provides the strategies and skills needed to effectively use the medication. As with all medical interventions, the benefits of treatment must out way the risks in terms of side effects and cost.

The Endocrine Society recently published guidelines on the *Pharmacological Management of Obesity*.[90] Core recommendations include the following:

- Prescribe pharmacotherapy for obesity as an adjunct to diet, exercise and behavior modification for individuals with BMI ≥30 kg/m^2 or >27 kg/m^2 with at least one comorbidity; who are unable to lose and successfully maintain weight; and who meet label indications.
- Continue pharmacotherapy if the patient has lost at least 5% of initial body weight within 3 months of use; if not, discontinue and seek alternative approaches.
- In patients with uncontrolled hypertension and/or history of cardiovascular disease, do not use sympathomimetic agents.
- Use a shared decision making process in selecting medications, providing patients with estimates of weight effects of medications.

Since 2012, four new anti-obesity medications were approved by the FDA for weight loss and maintenance of weight loss: lorcaserin, phentermine/topiramate (PHEN/TPM) extended release, naltrexone sustained release (SR)/bupropion SR, and liraglutide. Although none of these medications have been selectively studied in the workplace, reduction of weight and associated co-morbid conditions might lead to reduced absenteeism, presenteeism, and health care expenditures.

All of the 4 new medications have undergone randomized, placebo-controlled, double-blind trials of efficacy and safety. For FDA approval, medications are required to meet at least one of the following two criteria: 1) the difference in mean weight loss between the active-product and placebo-treated groups is ≥5% and the difference is statistically significant; and/or 2) the proportion of subjects who lose ≥5% of baseline body weight in the active-product group is at least 35%, is approximately double the proportion in the placebo-treated group, and the difference between groups is statistically significant.[91] Although weight loss outcomes vary among the medications, 1-year categorical 5% weight loss ranges from 47.2–66.7% among those randomized to medication compared to 17.1–27.1% for those taking placebo. Clinical and statistical dose-dependent improvements were also seen in selected cardiovascular and metabolic outcome measurements that were related to the weight loss.

MANAGEMENT OF OBESITY: SURGICAL INTERVENTIONS

Bariatric surgery is one option for the treatment of obesity. The indications for surgery are based on a National Institutes of Health (NIH) consensus statement published in 1991 – well before important advances in bariatric surgery (namely accreditation), widespread use of laparoscopy, and increased understanding of obesity. These indications include a BMI of ≥40 kg/m^2 or ≥35 kg/m^2 with comorbidity, as well as documentation of previous weight loss efforts and absence of psychiatric or medical contra-indication. The most commonly performed procedures in the US include gastric bypass and sleeve gastrectomy followed distantly by lap band and duodenal switch. Each procedure has its own advantages and potential risks. On average, patients tend to lose two-thirds of their excess body weight 1 year after surgery and maintain substantial weight loss long term.[92–94]

Recent data, as well as improved outcomes, have led many experts and medical societies to suggest modifying the indications for bariatric or metabolic surgery. An international consensus of diabetes experts recently published guidelines using multiple randomized controlled trials with data now extending to 5 years. The data that found surgical therapy for type 2 diabetes results in superior outcomes to maximal medical therapy. Forty-five medical societies now recommend bariatric surgery for any individual with a BMI >35 kg/m^2 and type 2 diabetes. Furthermore, these guidelines recommend that surgery be considered for type 2 diabetics with a BMI of 30–35 kg/m^2 who are not optimally controlled by medical therapy.[95]

Bariatric surgery has been shown in appropriate patients to be the most effective method for weight loss and prevention of recidivism. There are multiple procedures offered and weight loss for procedures, such as gastric bypass and vertical sleeve gastrectomy, generally result in excess weight loss of greater than 60%.With higher BMIs, lower percentages are seen on average. Perhaps, more importantly, obesity-related comorbid conditions can improve or even go into remission. In addition to diabetes, sleep apnea, hypertension, hyperlipidemia, degenerative joint disease, polycystic ovary syndrome, pseudotumor cerebri, chronic venous insufficiency, and gastroesophageal reflux disease have been shown to improve or resolve following bariatric/metabolic surgery.[96] However, surgery is invasive and complications can occur. Long-term effects reported in the literature have included rise in alcohol misuse, suicide, overdose and accidental death, preferential loss of lean mass, loss of bone and muscle, etc., among others including those related to surgery such as wound infections, etc.[97] Laparoscopic gastric band surgery has been associated with significant complications and is no longer recommended.[98] However, in certified centers, the risks of primary bariatric procedures has been reported to be identical to gallbladder surgery and joint replacement.[99]

Gastric Bypass

Severe obesity is associated with some degree of cognitive impairment which appears to improve for the majority of patients after the substantial weight loss seen with surgery. A number of small non-randomized or controlled studies that addressed the association between gastric bypass and cognitive function found that bariatric surgery has been associated with improved cognition and possibly reduced the risk of cognitive decline or led to improvements in cognition.[100–104] Several reports that looked at various aspects of cognitive function are from the Longitudinal Assessment of Bariatric Surgery (LABS) project,[105] a NIH-funded consortium of 6 clinical centers and a data coordinating center that addressed clinical, epidemiological, and behavioral research in 4,776 patients undergoing bariatric surgery.

Studies of small subsets of LABS patients have addressed mild cognitive impairment (MCI) and changes 12 months post gastric bypass,[106] and the effect of a family history of Alzheimer's disease (AD) on cognitive function of attention, executive function, memory, and language 12 weeks after bariatric surgery.[107] These studies found an improvement in cognitive function following bariatric surgery; however, patients with a reported family history of AD exhibited a higher prevalence of cognitive impairment and did not show post-operative gains in memory abilities."[107]

LABS data was also used to evaluate a group of 68 patients with a history of binge eating disorder (BED) with 20 patients with no history of BED to see if the disorder was associated with less improvement in neurocognitive functioning test scores 12 months following bariatric surgery. As hypothesized, participants as a whole displayed significant improvements in test performance from pre-surgery baseline to post-surgery follow-up across three of four cognitive domains: attention, executive function, and memory; improvements were not seen in the domain of language. However, in contrast to expectations, BED and non-BED groups did not significantly differ in their respective degree of improvements over time.[108] In a recent study of patients with severe obesity, the surgery group (Roux-en-Y gastric bypass) "had higher remission rates and lower incidence rates of hypertension and dyslipidemia than did nonsurgery group 1 ($P<0.05$ for all comparisons)."[109] In addition, "among the patients in the surgery group who had type 2 diabetes at baseline, type 2 diabetes remitted in 66 of 88 patients (75%) at 2 years, in 54 of 87 patients (62%) at 6 years, and in 43 of 84 patients (51%) at 12 years."[109]

Costs

Bariatric surgery has also been evaluated to assess its impact on health care expenditures. Mullen et al. evaluated a prospective cohort of patients undergoing gastric bypass (n = 224) in a specified health plan over an 85-month period to analyze whether there were cost savings in terms of less-used health care. The authors utilized a closed, experience network of surgeons and performed a comparison between actual cost of surgical patients and projected health plan costs for those who were overweight and obese. In Year 1 post-surgery, costs for patients were lower than cost the year prior to surgery. By Year 2, surgical patients had incurred fewer costs than the health plan population with obesity. By Year 3, surgical patients had incurred fewer costs than the overweight population. By 3.5 years, patients broke even on surgical costs. The authors concluded that although gastric bypass is a costly surgical procedure, longitudinal costs savings and overall health improvement for those undergoing the procedure are cost-effective within a closed, experienced network. Weight-loss surgery decreased annual costs per patient in the years after surgery.[110]

Gastric banding has declined over the past 5 years due to the rise in sleeve gastrectomy, realization of the heterogeneity of weight loss for gastric banding, and a significant incidence of surgical complications. Finkelstein initially presented a cost-benefit study of gastric banding that demonstrated a 5 year cost savings of $10,960, and a return of investment by the 9th quarter following the procedure. By utilizing indirect costs, net savings by Year 5 was $34,160. Indirect cost savings were generated by quantifying medical expenditures, absenteeism and presenteeism rates.[111]

Other Bariatric Surgery Studies

Seven studies related to multiple bariatric procedures were reviewed.[104,112–117] A population-based study of the impact of bariatric surgery on a region of Texas looked at the burden of obesity on this area and then calculated the benefit of bariatric surgery. Burden of disease was quantified by loses in business output, employment, income, indirect business taxes, and days of work. Following surgery, the median and mean of 33 (+/−10) days of work lost decreased to a median of 0 and mean of 1 (+/−4) days of work lost at 1 year. These data were derived from patient surveys before and after surgery and extrapolated to the population. Net benefit of surgery at 3%, 5%, 10% discount rates was $9.9 billion, $5 billion, and $1.3 billion, respectively, to the region, demonstrating that bariatric surgery was associated with a decrease in lost work days.[112] As in numerous other studies, bariatric surgery is associated with substantial improvements in quality of life, improvements in mobility, and reductions in self-reported pain.[115–118]

Emerging Invasive Therapies

Based on the success of bariatric surgery, new modalities have been in development to provide weight loss through endoscopy. Within the last two years, several intra-gastric balloons have been approved for commercial usage in the US. Balloons – inserted through the mouth and inflated in the stomach – are left in place for 6 months and then removed via another endoscopic procedure. As compared to placebo, balloons have been shown to result in significant weight loss at 6 and 12 months. However, a recent study reported on the deaths of five patients who underwent intragastric balloon surgery, although the root cause of death is at this time unknown.[119] Following balloon extraction, there may be a tendency for weight regain. To date, there are no evidence-based research studies that show an impact on worker health or productivity. Newer balloon models that can be swallowed and degrade – thus not requiring extraction – will soon be coming to market.

Another approach uses a pacemaker type device to provide current to the vagus nerve, blocking certain aspects of vagus nerve propagation. Approved by the FDA for use in 2015, weight loss is far less than stapling procedures and adjustable bands. Presently, there are no data documenting an impact on workers afflicted with obesity.

Body Contouring Surgery

As a consequence of surgery, body contouring procedures to remove excess skin loss associated with massive surgical or non-surgical weight loss is often necessary. The American Society of Plastic Surgeons, reports that more than 50,000 individuals underwent this procedure to remove excess skin associated with increased body image issues and decreased physical function and quality of life, which likely motivates pursuit of these surgical treatments.[120,121] The majority of patients who undergo these procedures report satisfaction with the results and improvements in physical and psychosocial health. Additional research is required to determine indications for body contouring surgery and coverage by health insurance.

DISCUSSION

Recommendations for Addressing Obesity in the Workplace

Based on this systematic review of the literature regarding worker obesity, it was the consensus of the Panel that employers should adhere to the following basic recommendations in an effort to prevent and treat obesity in their workplace.

Prevention—

- Offer appealing, healthy choices in cafeteria and/or vending machines
- Provide healthier food at meetings and other employee events
- Ensure access to safe walking areas for employees/encourage employees to use the stairways
- Offer wellness classes on nutrition, exercise, and weight management
- Offer memberships or discounts to health/fitness clubs
- Offer regular health screenings/Health Risk Appraisals for employees

Treatment—

- Implement a workplace wellness program that provides opportunities to aid employees in adopting healthy lifestyles
- Offer behavioral counseling to employees

- Offer coverage/access to bariatric surgery to individuals with a BMI ≥40 kg/m^2, for those with BMI >35 kg/m^2 with significant comorbid conditions associated with obesity such as type 2 diabetes, hypertension, sleep apnea, infertility, pseudotumor cerebrei, and those with disabling joint disease requiring surgical replacement, and individuals with a BMI of 30–35 kg/m^2 with type 2 diabetes who are not optimally controlled by medical therapy[27,95]

Research Gaps

Panel members identified several areas that require more evidence-based research and investigation. These include:

- The impact of medications on performance and functional outcomes. Use of medications on a longer-term basis should be investigated, but there are no studies addressing pharmacological treatment of obesity in the workplace. In pharmaco-economics, there is an increasing emphasis on including the impact on productivity in the analysis of a drug's benefit and in many cases, even included in the pricing. The lack of pharmacology studies in the workplace is notable and needs to be addressed.
- Criteria that includes a supervised diet for 6 months prior to bariatric surgery, as there is inconclusive evidence regarding the relationship between insurance-mandated medical-weight management prior to bariatric surgery and post-operative outcomes.[118]
- Identifying post-operative therapies that can be utilized to prevent recidivism.
- The impact of bariatric surgery on cognitive functioning. As high-level cognition is a necessary element for safety and productivity, it is important to further evaluate the association of bariatric surgery and cognitive function. Small non randomized or controlled studies have shown an association of cognitive function improvement after surgery; however, further research is needed.

CONCLUSION

Helping prevent employees from developing obesity should be an important focus of workplace-based programs. Insurance companies may need to evaluate their approaches to coverage accordingly. Prevention is key as noted from two long-term cohort studies which found that "weight gain from early to middle adulthood was associated with increased risk of morbidity and mortality, and decreased odds of achieving the composite healthy aging outcome among women and men…weight gain as little as 5 kg was associated with significantly elevated incidence of a composite measure of major chronic diseases, consisting of type 2 diabetes, cardiovascular disease, cancer, and nontraumatic death."[122]

The costs of obesity among workers is immense and the responsibility for managing it is increasingly falling to employers. Employers and their health plan designers need to understand how to manage and treat obesity among employees in addition to developing programs that focus on prevention. Employers need to understand that the workplace environment and employment conditions may contribute to the obesity within a workforce and that all efforts to encourage physical activity and eating healthy should be exhausted to prevent obesity and slow weight gain for all employees. Of the studies that met our inclusion criteria, many of the findings support both the use of lifestyle modification leveraging the workplace social context and the use of bariatric surgery in appropriate patients and in certified centers to assist patients in losing weight. As these interventions may prove cost effective in the long term, a case can be made that they be covered by insurance. The intent of this document is to help guide future research in the realm of obesity among workers.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Topical Matrix by Evidence Level for Included Studies

Topic	Evidence Level	Total Studies
Benefits of Addressing Obesity in Workplace	Level 2 – 53 Level 2a – 5 Level 2* – 2	60
Impact of Workplace on Obesity	Level 1 – 1 Level 1* – 8 Level 2 – 17 Level 2* – 8	34
Lifestyle Modification – Behavioral Health	Level 1 – 42 Level 2 – 58 Level 2a – 1	101
Lifestyle Modification – Diet/Nutrition	Level 1 – 4 Level 2 – 1	5
Lifestyle Modification – Exercise/Increased Physical Activity	Level 1 – 12 Level 2 – 15	27
Lifestyle Modification – Multiple Modalities	Level 1 – 13 Level 2 – 14	27
Problem of Obesity in Workplace	Level 2 – 2	2
Bariatric Surgery	Level 2 – 5 Level 2* – 12 Level 2a – 2	19

Level 1 – Randomized Controlled Trial, Level 2 – prospective cohort studies, prospective comparative studies, and large population-based studies, Level 2a – prospective simulation studies.

*Occurred in laboratory rather than real workplace setting.