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Obesity and Shift Work in the General Population

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ABSTRACT

Purpose: This narrative review examines the hypothesis that shift work contributes to the major public health problem of obesity and suggests ways in which weight gain might be prevented in those who must work at times outside of the conventional 8-hour daytime work period. **Methods:** A comprehensive literature review was performed using several relevant electronic databases and print journals. **Results:** Those who do shift work are at a greater risk for weight gain than those who work daytime hours. The exact mechanism by which this occurs is unknown, although eating and exercise habits as well as the disruption in circadian rhythm appear to contribute. **Conclusions:** It is imperative that clinicians be aware of the relationship of shift work to obesity and of interventions that can help prevent obesity in those who must work during unconventional hours.

INTRODUCTION

Obesity is a dangerous health problem and its prevalence is continually increasing.[1-4] Therefore, it is important to identify factors that contribute to this increase, discover why, and take action for prevention. Several factors are already known to contribute to obesity, including age, gender, race, diet, level of physical activity, family history of obesity, and socioeconomic status.[5,6]

Less well recognized by clinicians and less studied by researchers is the question, "Does shift work make a significant contribution to the risk of obesity?" In today's "open 24-hours" society in which many people must work at unconventional times, it is pertinent that scientists and medical practitioners explore this question thoroughly. Knowing that shift work may be a risk factor for obesity has significant implications for preventive medicine as clinicians struggle to reduce the prevalence of this deadly health problem. Therefore, this research will explore the unique contributory effect of shift work to obesity, investigate the causes of this increased risk, and address possible preventive measures to reduce weight gain in shift workers.

METHODS

Information for this literature review was primarily obtained from print journals and the following electronic databases: MEDLINE (Ovid), PubMed, EMBASE, UpToDate, Cochrane Database of Systematic Reviews and Cochrane Central Register of Controlled Clinical Trials. The latter two did not provide any pertinent sources. In addition, the reference lists of articles retrieved through the databases were searched for other pertinent publications. The search was confined to English language literature. All subjects were adults but no age limits were prespecified. Although no limitation on publication dates was set for the search, the papers identified and reviewed ranged from 1995 through 2009. Key words used for the search included shift work, obesity, overweight, body mass index (BMI), metabolic syndrome, circadian rhythm, and occupational health.

BODY OF REVIEW

Defining Obesity and its Lethality

Obesity has been defined by the Centers for Disease Control and Prevention (CDC), as well as the World Health Organization (WHO), as a body mass index (BMI) of greater than 30 kg/m^2. WHO categorizes BMI into the following six stages: Underweight (<18.5), Normal (18.5-24.9), Overweight (25.0-29.9), Obesity class I (30-34.9), Obesity class II (35.0-39.9), and Obesity class III ($\geq$ 40.0).[7] These definitions will be used throughout this review.

The detrimental effects of obesity are well-known and will only be briefly mentioned here in order to underscore the importance of identifying all of its risk factors. Composite data from six major epidemiological studies (Alameda County Health Study, Framingham Heart Study, Tecumseh Community Health Study, American Cancer Society Cancer Prevention Study I, Nurses' Health Study, and NHANES I Epidemiology Follow-up Study) reveal a significant mortality risk from obesity.[8] Calculations derived from these studies indicate that in the year 2000 over 400,000 deaths could be attributable to obesity.[9] In addition, obesity is commonly associated with several potentially lethal co-morbidities including hypertension, type II diabetes, dyslipidemia, cardiovascular disease, liver and gallbladder disease, and cancer.[3-6]

Because obesity is so dangerous, it is important that clinicians are aware of all of the factors that contribute to weight gain. Shift work is one such factor that makes a unique contribution to weight gain.[11-25]

Defining Shift Work and its Prevalence

Shift work comprises work patterns that extend beyond the conventional 8-hour daytime work day. It includes night shift work, rotating shift work (between the thirds of the 24-hour cycle) and/or irregular work hours. Shift work is prevalent throughout the world. In 2007, The US Bureau of Labor Statistics reported that more than 21 million wage and salary workers, or 17.7 percent, usually worked alternate shifts that fell at least partially outside the daytime shift range.[26] Similar results have been reported from Europe and Japan.[18,27] Shift work is considered to be disruptive of normal diurnal biological rhythms and has been associated with many health problems.[28] Obesity is among the less well known and studied health problems associated with shift work.

Obesity and Shift Work

Several researchers have reported that shift workers display a higher frequency of obesity than those who work exclusively during normal daytime hours.[11-25] In one study, 319 men, ages 35-60, were randomly selected among production process workers at a chemical industry site in Apulia, Italy.[11] Criteria for inclusion were employment duration of at least five years and no indication of diabetes or impaired glucose tolerance as determined by fasting blood glucose and a glucose tolerance test. All participants were also asked about their work, family and clinical history, and smoking habits. Shift workers (185/319) were on a counter-clockwise rotating schedule, working two nights, two afternoons, two mornings, then three days of rest; the remaining 134 worked only days. Results showed that shift workers comprised 74% of the total obese population ($p < 0.05$). Not only did the shift workers constitute the majority of the obese population, they also had a greater degree of obesity than the daytime workers. The range of BMI for the daytime workers was 19.8 – 35.4 kg/m^2, whereas the range for those working night shift was 20.2 – 40.7 ($p < 0.01$). The association between shift work and BMI was independent of age and work duration beyond five years.[11]

A more recent retrospective longitudinal study from Italy compared municipal waste management workers in Milan who were either on permanent night shift or day shift or who switched from day to night shift between 1976 and 2007.[12] Results were adjusted for study period, job, age and lifestyle variables. Socioeconomic status was controlled for by virtue of the fact that the socio-economic level of the workers was quite homogeneous, both in terms of education (mainly secondary school) and social conditions. In comparing night vs. day workers holding the same jobs, night shift workers had a higher average BMI and higher prevalence of BMI in the obese range. Moreover, among those who were day workers at the beginning of their employment and later became night workers, there was a significant increase in BMI associated with night work.[12]

A health survey of workers in the county of Vaesterbotten, Sweden, evaluated 27,485 men and women between 1992 and 1997 to determine if there is an association between shift work and metabolic syndrome (defined here as obesity, dyslipidemia with high triglycerides and low high density lipoprotein cholesterol concentrations, and hypertension).[13] Though occupations were not specifically reported, the participants were drawn from a broad population base that included both blue collar workers and professionals. Participants were questioned about working conditions, smoking habits, diet, and level of physical activity and components of the metabolic syndrome were clinically assessed. For cross-sectional analysis, the participants were divided into four groups according to their ages at the time they were studied: 30, 40, 50, and 60 years. Results showed that having two or more metabolic factors was appreciably more common among shift workers than in those who worked only during the day ($p < 0.0001$). The odds ratio for obesity risk alone was 1.4 for both men and women shift workers compared to day workers. As age

increased, the obesity gap between the two working populations became larger. Socioeconomic status did not affect the measured outcome differences between the two groups. [13] Other studies have also shown a correlation of shift work with the metabolic syndrome but did not specifically focus on weight gain or obesity.[14,15]

Geliebter et al studied 85 employees in a New York City hospital, including nurses, nurse's aides, and security personnel; these individuals were surveyed to determine whether workers on late shifts gain more weight than those on regular day shifts after starting their current shift.[16] Thus, each participant served as his/her own control. The questionnaire included four sections describing demographics, work and weight history, health and medical history, as well as sleeping and eating patterns. The workers were categorized as working in one of three time slots: day (0800 to 1600), evening (1600 to 0000), and night (0000 to 0800). Results were adjusted for gender, age, years on shift, and smoking habits. Both before and after these adjustments, results showed that late shift workers (evening and night shifts) experienced more weight gain than did day workers since beginning their respective shifts. In fact, the adjusted average weight gain for night shift workers was 4.4 kg versus 0.7 kg for those who worked during the day ($p=0.008$). Furthermore, night workers reported an increase in food intake, later last daily meal times, more and longer naps, and less exercise, all of which may have contributed to their greater weight gain.[16]

Two recent longitudinal studies in Japanese blue collar workers also found that shift work is a risk factor for obesity.[17,18] In one study, 1529 male sash and zipper factory workers, ages 19-49, were analyzed according to their work pattern over a 10-year period. Those who had done shift work for the entire period showed a significantly larger increase in BMI than did those who had remained on day-shift after adjusting for baseline age, BMI, smoking, alcohol intake, and leisure-time physical activity. [17] In the other study, over 7000 male steel workers were studied over a 14-year period. Alternating shift work was found to be an independent risk factor for all three of the weight gain endpoints of 5, 7.5 and 10%.[18]

Some studies have focused on the duration of shift work exposure as a determinant of weight gain. Parkes et al examined the interaction between age and shift work duration as predictors of BMI in over 1500 British male offshore oil and gas industry workers ranging in age from 29.9 to 55 years.[19] Participants held a wide range of job types from managerial to maintenance, and their educational levels ranged from secondary school to university level. Half worked 12-hour day-night shift rotations (0700h to 1900h and 1900h to 0700h) with 7 night shifts, 7 day shifts followed by 14 days off. The other half worked 14-day shifts followed by 14 days off. Mean duration of shift work exposure was 12.9 years (range 2 months to 46 years) and did not differ between the two groups. Day workers showed a normative increase in BMI with age without an independent effect of duration of day-shift exposure on this outcome. In contrast, the BMI increase over time seen in day-night shift workers was predominantly determined by duration of shift exposure, with age contributing relatively little. Multivariate analysis controlling for job type, education and smoking status did not alter the results.[19]

The results of the Parkes study are consistent with three other studies that showed a correlation between duration of shift work and weight gain. Niedhammer et al[20] reported that weight gain among French nurses working night-shift was greater than that of day-shift nurses during the second, but not the first, five-year interval of their 10-year longitudinal study. However, unlike the Parkes study, adjustment was not made for the confounding impact of advancing age.[20] Van Amelsvoort et al from the Netherlands observed an annual excess gain in BMI and waist-to-hip ratio in shift workers over a five-year period as compared to day-workers from the same companies. The excess BMI gain averaged 0.12 kg/m^2/year. A wide range of occupations was represented among the 377 participants. Results were adjusted for age, gender, educational level, smoking status, and current physical activity level at work and during sport.[21] A recent study of over 1500 male mostly blue-collar employees from several large Belgian companies reported that the risk for the development of metabolic syndrome, including obesity, increases with accumulated years of rotating shift work after adjustment for potential lifestyle, and work-related confounders.[22] Collectively, these studies suggest a dose-response relationship between duration of shift work and obesity.

Three studies, primarily focused on the association of shift work with coronary heart disease risk, also reported a correlation of shift work with obesity.[23-25] A trend of increasing BMI with increasing duration of night shift work (spanning 1 to 15+ years) was observed in the Nurses' Health Study which comprised over 79,000 US female nurses.[23] In a Japanese study, male blue-collar industrial workers on a rotating three-shift schedule were compared with day-shift workers. The shift workers had a significantly higher prevalence of central obesity as measured by abdominal to hip ratio ($p<0.05$).[24] In the prospective Copenhagen male study comprising over 5000 workers ages 40-59, shift workers weighed more than day workers ($p<0.01$), though the frequency of obesity was not specified. The correlation remained significant after multivariate analysis.[25] Because obesity or weight gain were not the primary outcome measures in these three studies, the contributing factors to weight gain in these workers cannot be assessed. Nonetheless, the correlation between shift work and weight gain seen in these studies supports the results of studies focused on obesity.

In summary, the collective data strongly suggest that shift work is a risk factor for obesity. This conclusion is strengthened by the fact that the evidence supporting it is drawn from several populations around the globe with widely diverse ethnicities, dietary and lifestyle patterns, and socioeconomic, educational, and occupational backgrounds. However, the studies performed thus far are observational in design. Despite adjustments for several confounding variables, they can only be hypothesis-generating and cannot firmly establish a causal relationship between shift work and obesity. Also, because the available studies included numerous variations of shift work schedules, we cannot determine whether any particular rotating shift schedule is better or worse than a steady night shift schedule in inducing obesity. This is another question to be determined by future research. Despite these shortcomings, it is worth looking at possible pathways through which shift work might bring about weight gain.

Possible Causes for Shift Work-Related Weight Gain

The reasons for the increased risk of obesity seen with shift work in the previously cited studies are still being unraveled. It is likely that there is more than one cause, including lifestyle alterations in eating and exercise and the disruption of circadian rhythm that contribute to shift work-related weight gain. Each of these possible causes should be considered when health care professionals are educating patients on preventative measures.

One of the simpler reasons suggested as the cause for weight gain in those working night shift is merely a change in lifestyle, including eating habits. Kivim Äki et al examined the association between shift work and health habits.[29] They studied a population of 689 nurses (age 22-62 years) working night or daytime shifts. Smoking, alcohol consumption, sedentary lifestyle, and being overweight were the considered habits. Results did not show an increased incidence of alcohol consumption or sedentary lifestyle in those who worked night shift. However, there was an increased incidence of smoking and being overweight in those who worked during the night compared to those who worked only daytime hours. Kivim Äki et al[29] extrapolated from their data and postulated that the adoption of unhealthy habits, such as smoking, leads to unhealthy eating habits as well. Unfortunately, the study did not evaluate the diet of the shift workers who showed increased weight gain. Thus, Kivim Äki et al[29] have no basis on which to conclude that the weight gain seen in the night shift workers is actually due to poor eating habits.

Persson et al conducted qualitative interviews with 27 nurses (2 men and 25 women) between the ages of 25 and 63 to determine the impact of night shift work on diet and exercise habits.[30] Many of the nurses reported eating foods high in sugar in order to override the feeling of tiredness. Sweet foods and junk food were readily consumed due to ease of access compared to an alternatively healthy snack. In addition, nurses reported that it was difficult to select healthy foods the day after working night shift. Although limited by population size, this study showed that shift workers frequently make unhealthy food choices. Since weight was not measured, it only suggests, but does not demonstrate, a possible link between working night shift and obesity mediated through unhealthy eating habits.[30]

In contrast, the previously described study by Geliebter et al did look at both eating habits and weight gain in late shift hospital workers.[16] These researchers showed that on average, shift workers reported eating their last “daytime” meal at 10:27pm, whereas daytime workers reported their last meal at 5:52pm. These authors suggest that eating later may reduce the thermic effect of the meal, thus promoting weight gain. However, it is also recognized that weight gain specifically due to late eating has not yet been confirmed. Thus, this can be considered a possible contributor to increased weight gain while working night shift, but is not likely the only factor promoting it.[16]

Other small studies have also reported altered distribution of food intake and eating habits in shift workers, including a preference for cold and fast food vs. hot food, a tendency to nibble rather than have a meal, and to eat fewer meals per day.[31,32] However, most studies have not shown an increase in total calorie or macronutrient intake in shift workers.[33,34] In contrast, a recent large study of over 2200 male manual workers, ages 20-59, in a Japanese metal products factory did show a higher total energy intake among workers with midnight shifts, but only in those over age 30.[35]

An obvious reason for weight gain in those working night shift is merely a change in physical fitness and exercise. It is said that those who work night shift often deal with insomnia and are more likely to get inadequate sleep.[36] Lack of energy to engage in physical activity would, therefore, be a major contributor to weight gain in those who work during the night.[36] Unfortunately, this can be a vicious cycle difficult to break if not addressed quickly. Exercise energizes the body.[37] Clearly, individuals who do not exercise do not benefit from the energy provided, and therefore continue in their feeling of lassitude.

Despite the logic that reduced physical exercise may contribute to the higher prevalence of obesity seen in shift workers, direct evidence in support of this contention is lacking. Persson et al observed that many of the night shift nurses they interviewed stated that they frequently felt too tired to exercise so they opted to rest instead. They felt as if neither the time before work or after work was appropriate for exercise because they needed more rest.[30] However, as previously stated, this study did not

examine weight gain. Geliebter et al noted that hospital employees who worked nights reported taking more frequent and longer naps and exercising less.[16] However, they could only speculate on this being a possible contributor to the weight gain they observed in this group. Finally, in several studies, the link between shift work and obesity remained statistically significant even after controlling for physical activity at work and/or during leisure.[13,18,21,22,35] Clearly, more work needs to be done to define the role of physical activity in shift work-related obesity.

One of the more complex explanations for weight gain while working night or rotating shifts involves the disruption of normal circadian rhythm, which leads to lack of sleep. Circadian rhythm is synchronized around a 24-hour period and is cued by the daily occurrences of light and darkness. Thus, it can be argued that the sleep-wake cycle is the primary source of output for other functions that depend on circadian rhythm.[38,39] The master circadian pacemakers in the brain are the suprachiasmatic nuclei (SCN). They are responsible for much of the body's behavioral and physiological rhythms, such as the sleep-wake cycle and feeding behavior. Circadian clock genes have been discovered to exist in the brain, heart, liver, adipose tissue, and pancreas which supports the idea that the body clock has an important role in all of these organs.[39]

Laposky et al explored the hypothesis that "sleep and circadian rhythms have a direct impact on energy metabolism," which may very well be the mechanism by which night shift workers are more likely to become overweight and obese.[39] Spiegel et al note that many people who work during the night get an average of five hours of sleep per work day and Laposky et al suggest that less daily sleep time may be the cause of adverse health effects, including obesity.[39,40]

In support of this hypothesis, Spiegel et al evaluated 11 men, ages 18-27 for sixteen consecutive nights at a clinical research center.[40] They regulated the amount of time subjects spent in bed, comparing carbohydrate metabolism and hormone levels during sleep-debt (4 hours of sleep for 6 nights) and in sleep-recovery (12 hours of sleep for 7 nights). In the average participant, an impairment of carbohydrate tolerance was noted in the sleep-debt subjects, with glucose and insulin responses returning to normal range after sleep-recovery. After an injection of glucose, the rate of glucose clearance was 40% slower when the participants were in sleep-debt than after sleep-recovery ($p < 0.02$). Carbohydrate metabolism was also assessed by measuring glucose effectiveness, "the ability of glucose to mediate its own disposal independently of insulin".[40] Results showed that glucose effectiveness in the sleep-debt participants was 30% lower than after sleep-recovery ($p < 0.0005$). Spiegel et al noted that the level of glucose effectiveness during sleep deprivation is comparable to the glucose effectiveness seen in non-insulin-dependent diabetics.[40] In addition to carbohydrate metabolism, thyroid stimulating hormone (TSH) and cortisol levels were evaluated. During the sleep-debt period, average TSH levels were markedly decreased by roughly 35% ($p < 0.01$) compared to levels during the sleep-recovery period. Furthermore, cortisol levels were elevated in the sleep-debt condition. Measurements of free cortisol in the saliva suggested increased levels in the afternoon and early evening of the sleep-debt participants ($p = 0.0001$). These results are important because both impaired carbohydrate metabolism and hormone balance can lead to obesity.[40]

In addition, Taheri et al conducted a study of 1,024 volunteers from the Wisconsin Sleep Cohort Study.[41] Data were collected from three sources: mailed sleep surveys, overnight studies, and six day sleep diaries. In this study, participants were able to select their own sleep and wake time so that hormone levels could be evaluated under real-life circumstances. Results showed a U-shaped curvilinear association between amount of sleep and BMI in participants with a BMI already over 30. Increased BMI was proportional to decreased sleep in those with less than 8 hours of sleep. The lowest measured BMI was found in those who slept an average of 7.7 hours. A less striking increase in BMI was seen with sleep duration longer than 8 hours. Shorter sleep duration was associated with lower levels of leptin, which suppresses appetite, and increased levels of ghrelin, which increases appetite. A decrease in sleep duration from 8 hours to 5 hours was associated with a 15.5% decrease in leptin and a 14.9% increase in ghrelin. With 4.5 hours of sleep, ghrelin levels increased approximately 30%.[41] Quantitatively similar changes in leptin and ghrelin, as well as significant increases in hunger and appetite for calorie-dense foods with high carbohydrate content, were reported by Spiegel et al [42] in a short-term study of 12 healthy men who were sleep-deprived under conditions that controlled for calorie intake and physical activity.[42] If calorie intake and energy expenditure had not been controlled, it is estimated that this increase in appetite would result in an increased intake of 350–500 k/cal per day, sufficient to produce weight gain and obesity over time.[39]

Although the foregoing data on the negative biologic effects of disruption of normal sleep patterns provide a theoretical basis for the weight gain associated with shift work, it is important to point out that such disruption of sleep has not been proven in shift workers. Only two of the studies cited in this review measured sleep duration in shift vs. day workers. Suwazono et al[18] found it to be essentially the same (6.6 h vs. 6.7h, respectively), whereas Boggild et al[25] reported that a significantly lower percentage of shift workers got at least 6-9 hours of sleep per night.[18,25] Neither study assessed possible qualitative differences in sleep pattern that may exist between these two groups of workers. Thus, alterations in duration or pattern of sleep remain a hypothetical, but unproven, explanation for shift work-related obesity.

Preventative Measures

Although detrimental effects of shift work are apparent, statistics show that there is a demand for people to work around the clock.[18,26,27] Thus, it is important for those who must do shift work to be aware of what they can do to prevent these effects. Likewise, practitioners, especially those in primary care, must possess this knowledge so that they can play an important role in counseling these individuals. Although unproven, the potential causes for weight gain during shift work should form the basis of this counseling. This should include discussion of the patient's work schedule, the best ways to manage time for activities outside of work, including sleep and exercise, and advice on healthy food choices and timing of meals during waking hours.[43,44]

Physicians at the Cleveland Clinic point out that shift work produces a "recurrent pattern of sleep interruption that results in insomnia or excessive sleepiness".[43] They recommend limiting the number of shifts worked in a row and not working more than four consecutive 12-hour shifts.[44] Night shift workers who work no more than four 12-hour shifts in a row should have at least 48 consecutive hours off in order to facilitate better recovery. It is best to avoid working prolonged shifts or overtime since this contributes to sleep deprivation.[44] Unfortunately, these recommendations, posted on the Cleveland Clinic web site, are not accompanied by any supporting evidence-based documentation showing that limiting the number of shifts is linked to less sleep deprivation or to less weight gain. On the other hand, since prior studies have shown that decrements in performance and alterations in mood occur with shift work, it is important to recognize that suggestions like these have merit independent of any impact on obesity.[45]

There are specific recommendations on meal times and on which foods are good when considering a snack or meal. Eating nutritious foods (fruits and vegetables) during the night while working is recommended to help keep blood glucose levels from fluctuating so greatly. A heavy meal and alcohol just before sleep are discouraged. In addition, caffeine should be avoided for five hours before bedtime.[37] In fact, reliance on stimulants should be avoided because the body is only temporarily "fooled into functioning properly" and these drugs can contribute to complications with sleep.[44]

In addition to eating healthy foods and eating less, it is obvious that weight can be controlled by burning calories. It might be difficult for night shift workers to think of exercising if they are experiencing sleep deprivation. It is important to know that exercise energizes the body and might even be the key to a good day's rest.[37,44] However, because of its energizing effect, exercise is not recommended just before sleep.[37]

Patients who must work night shift should be counseled on making sleep a priority, especially since they are at risk for developing sleep disorders.[44] Physicians should advise their patients on ways to optimize conditions conducive to daytime sleep such as having a room with dark shades and a comfortably reduced temperature. Family members should be advised to keep noise down and to unplug the telephone. Ear plugs and eyeshades are also recommended to decrease the amount of sound and light.[37]

In recent years, there has been a growing recognition among employers that they need to do more to prevent obesity in their employees than to simply contribute to their health insurance costs.[46] The motivating factor is the excess medical claims costs associated with obesity.[47,48] A number of studies have shown that employer-based wellness programs directed at obesity can be beneficial to employees and can be cost-effective for the employer.[46,49-53] These programs vary widely in structure, making it difficult to compare their reported outcomes. However, a recent systematic review of 47 studies performed by the Task Force on Community Preventive Services found that "worksite nutrition and physical activity programs achieve modest improvements in employee weight status at the 6–12-month follow-up."[54] Based upon this review, the group published an accompanying recommendation to employers, insurance companies, policymakers and other interested parties to improve employee weight status through worksite health promotion programs targeting nutrition, physical activity or both.[55] The National Institutes of Health is currently sponsoring seven randomized trials that are testing innovative environmental interventions for weight control and obesity prevention in approximately 48,000 employees at 114 worksites; results should become available within the next year.[56] Another study, entitled Step Ahead, is now in its formative phase. It is a site-randomized controlled trial of a multilevel intervention that promotes physical activity and healthy eating in six hospitals in central Massachusetts.[57] Hopefully, these clinical trials will provide stronger evidence than currently exists in support of worksite intervention programs for obesity.

Two important points need to be made with respect to the employer-based programs discussed above. First is the fact that currently these programs are mostly being implemented in large companies with well over 500 employees. Only 21% of a nationally representative sample of employers offers weight-management programs.[46] Thus, most obese workers in the United States cannot take advantage of these collective group efforts to prevent and combat obesity. Even more pertinent to the focus of this review is the fact that none of the studies, past or ongoing, directly address the issue of shift-work-associated obesity. Due

to the unique pathogenetic factors that promote obesity in shift workers, the interventions that have shown some success in the general working population may not be completely transferable to this subgroup of workers. There is a need for worksite-based health promotion and disease management programs designed specifically for shift workers, and for research that investigates the efficacy and cost of those programs.

LIMITATIONS

This is a narrative review, not a systematic review or meta-analysis. As such, it does not follow the prespecified search rules described in the QUOROM or PRISMA statement guidelines for those more rigorous types of reviews.[58] Consequently, as with all narrative reviews, there is the possibility of selection bias in that some relevant literature may have been missed. However, we do believe that our search was extensive enough to provide a useful overview of this subject for the practicing clinician.

CONCLUSIONS

Based on the published literature comparing weight gain in rotating or night shift workers versus those who work during the day, it is likely that there is a greater predisposition to weight gain in those who work at night or on rotating shifts.[11-25] Shift work appears to be an independent risk factor for obesity in addition to the more widely recognized factors of age, gender, race, diet, level of physical activity, family history of obesity, and socioeconomic status. However, the available literature linking shift work to obesity is relatively sparse in comparison to other risk factors for obesity. Moreover, the studies are observational in design and, as such, are only hypothesis-generating; their conclusions cannot be considered definitive. Despite attempts to control for a number of confounding factors, others may exist that were not measured. Prospective randomized controlled trials are needed to better define the etiologic relationship between shift work and obesity. There are likely several underlying reasons for the weight gain seen in shift workers which are still being studied. More research is needed in this area in order to identify specific preventive measures. Additional research is also needed in the development and assessment of work-based health promotion programs designed specifically for shift workers. At the present time, however, physicians and mid-level practitioners have the power to help those who work during the night by giving proper counseling. Ideally, this should be done before the patient begins working these unconventional shifts.

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