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Article Title: Occupational Factors Associated with Four Year Weight Gain in Australian Adults

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Running Title: Work and Weight Gain in Australian Employees

ABSTRACT

Objective: This article examined whether occupational factors predicted 4-year change in body mass index (BMI) in a sample of full-time Australian employees.

Methods: Data from 1670 full-time Australian employees were collected through the Longitudinal Study of Australian Children. Multinomial logistic regression was used to examine whether several occupational factors at baseline predicted changes in BMI at 4-year follow up; several health and demographic covariates were controlled.

Results: Inflexible working hours (odds ratio = 1.54, 95% confidence interval [1.14 to 2.09]) and weekend work (odds ratio = 1.33, 95% confidence interval [1.04 to 1.68]) significantly predicted increased BMI.

Conclusions: This article demonstrates that certain occupational factors (ie, inflexible work hours and weekend work) significantly predicted increased BMI. Targeting these factors may play a role in combating obesity and related health problems among employees.

Learning Objectives

- * Discuss previous studies of the possible contribution of working conditions to the development of obesity.
- * Identify the two work-related factors associated with weight gain in this longitudinal study.
- * Review the possible mechanisms of these associations and the implications for preventing obesity in employees.

INTRODUCTION

Obesity is recognized as a global health epidemic that contributes to elevated morbidity and mortality. In Australia, approximately 25% of the adult population is obese; this statistic has more than doubled in the space of 30 years.¹ Recent studies have shown that certain work schedules and psychosocial working conditions could be contributing to obesity in employees. Cross-sectional data, for example, indicate that individuals working long hours, over-time, or night shifts are more likely to be obese.²⁻⁴ Factors pertaining to greater job strain, work fatigue, and inflexible working hours have also been associated with obesity.²⁻⁶ Several studies examining components of Karasek's [7](#) demand/control model have found that job strain (characterized by high demand combined with low control) is associated with an increased risk of obesity.^{8,9}

Longitudinal studies have extended these findings by demonstrating that some of these occupational factors are predictive of weight gain over time. For example, Hannerz et al.¹⁰ found that a lack of job security and greater job strain were associated with an increased risk of 5-year weight gain in 1980 obese male employees. Overgaard et al.^{11,12} found that high job demands and low control, as well as high and low "busyness" in jobs predicted 6-year weight gain. In a sample of 7965 employees in the United Kingdom, Kivimäki et al.¹³ found that greater job demands and low job control predicted weight gain in men with a higher baseline body mass index (BMI), whereas increased work stress was associated with weight gain in women regardless of initial BMI. Brunner et al.¹⁴ found that increased job strain among employees was associated with a 50% increased risk of obesity at 19-year follow up. Finally, Lallukka et al.¹⁵ found that increased work pace and longer working hours were weakly associated with weight gain over a 28 year period in a sample of 449 employees at baseline.

These studies demonstrate that certain work-related factors are associated with

weight gain in employees, suggesting that working conditions could contribute to the development of obesity. However, more longitudinal data examining these associations are needed for two major reasons. First, not all the existing studies have controlled for potential confounding variables such as health behaviors and demographic factors (eg, age, income, and marital status). Second, few studies have examined the relationship between working conditions and obesity in an Australian context. Ostry et al ⁴ found that long working hours were positively, and physical demand negatively, associated with BMI when controlling for job stress in Australian male employees. Di Milia and Mummery ² also found that long working hours was significantly associated with obesity in Australian adults. Two other Australian studies have found evidence that increased sitting time is one possible mechanism linking work patterns with an increased risk of obesity.^{16,17} These cross-sectional studies are important, but to our knowledge, there have not been any longitudinal studies conducted on an Australian sample that have examined these associations. Therefore, the purpose of this article was to extend on previous Australian studies and examine the associations between working conditions (eg, long work hours, flexibility of work hours, and weekend work) and 4-year change in BMI in a sample of full-time Australian employees.

METHODS

Participants

This article used data collected through the Longitudinal Study of Australian Children (LSAC). The LSAC is an ongoing longitudinal study of Australian parents and their children, conducted by the Australian Department of Families, Housing, Community Services and Indigenous Affairs. The LSAC collects data from parents, teachers, caregivers, and children on a wide range of topics including employment status, working conditions, health, demographics, and parenting. These data are collected through a series of questionnaires and structured interviews. Baseline data were collected in 2004/2005 (wave 1); families were randomly selected from the Medicare enrolment database and were mailed an invitation to participate in this study. At present, data are available at

the 2- (wave 2) and 4-year (wave 3) follow-ups. In this article, we used data from waves 1 and 3.

Ethics approval to use these LSAC data for the purposes of the present article was obtained from the University Human Research Ethics Committee.

The LSAC comprises two separate cohorts. Cohort B consists of infants aged 0 to 1 at baseline and their families, whereas Cohort K consists of children aged 4 to 5 years at baseline and their families. In this article, we included data from Cohort K only, because there may be considerable disruptions to work patterns and health in parents from Cohort B associated with caring for an infant, and these may have confounded the results. Furthermore, we only included adults from Cohort K who were employed in full-time work (ie, minimum of 35 hours a week) at baseline and 4-year follow-up.

Measures

The data were collected through a series of structured interviews and self-report questionnaires. BMI was calculated using self-reported height and weight; participants were subsequently categorized as lean ($\text{BMI} \geq 18.5$, < 25), overweight ($\text{BMI} \geq 25$, < 30), or obese ($\text{BMI} \geq 30$) at baseline.¹⁸

Individuals' BMIs at 4-year follow-up were subtracted from their BMI at baseline to calculate the change in BMI. Previous studies have adopted a variety of approaches to quantify the difference in BMI or body weight at different time points.^{19,20} We categorized changes in BMI, which is consistent with a number of recent studies. We coded the change in BMI into the following categories: 1) stable BMI (change in BMI $\geq -1 \text{ kg/m}^2$ and $\leq 1 \text{ kg/m}^2$); 2) decreased BMI (change in BMI $< -1 \text{ kg/m}^2$); and 3) increased BMI (change in BMI $> 1 \text{ kg/m}^2$). These categories are generally consistent with a range of other definitions of weight change. For example, a change in BMI of 1.0 kg/m^2 for an individual who is 1.75 meters tall and weighs 75 kg, is equivalent to a change in body weight of approximately 3 kg or 4% of body weight. Such changes are consistent with a number of studies that have defined weight gain in terms of an increase in body weight of 3 to 5 kg or an increase in body weight of 5% (this is considered clinically significant).²¹⁻²⁴

Data on a range of work-related factors were also obtained via the self-report questionnaires and

interviews. Work hours were assessed by the question “How many hours do you usually work each week?” Responses were categorized into short/medium work hours (ie, ≥ 35 and < 50 hr/wk) and long work hours (ie, ≥ 50 hr/wk), consistent with the definitions provided by the Australian Bureau of Statistics.²⁵ Job autonomy was determined from the question “I have a lot of freedom to decide how I do my own work.” Participants responded on a 5-point Likert scale ranging from strongly disagree to strongly agree; these were recoded as “no autonomy” (strongly disagree, disagree, unsure) and “autonomy” (agree and strongly agree). Job security was determined from the question “How secure do you feel in your own job?” Participants responded on a 5-point Likert scale from very insecure to very secure, and the data were coded as “low job security” (very insecure, insecure, not sure) and “job security” (secure and very insecure).

Participants were also asked whether they could change their work hours if needed by the following question: “If you sometimes need to change the time when you start and finish work, is it possible?” This provided an indication of flexibility in work hours, which was coded as “yes” and “no/not likely.” Participants were also asked to indicate the frequency with which they worked on weekends (either at home or at work) and responses were coded as weekly/monthly and rarely/never.

Information on the type of job participants were employed in was also collected; these were then classified according to the Australian Standard Classification of Occupations.²⁶ This defines nine major occupation groups, which are distinguished on the basis of skill level and skill specialization.²⁶ For the purposes of this article, we combined the top three groups into one category (ie, managers, professionals, paraprofessionals) and the remaining groups into a second category (eg, tradespersons, productions workers, laborers).

Data on a range of covariates were also collected. The Kessler 6 scale was used to assess levels of psychological distress; scores were coded as low psychological distress (score ≤ 12) and high psychological distress (> 12).²⁷ Information on age, sex, marital status, weekly income, country of birth, alcohol consumption, and smoking status was also collected.

Statistical Analysis

We examined whether work hours, flexibility of work hours, job type, job autonomy, job security, and weekend work as measured at baseline predicted 4-year change in BMI (ie, “decreased BMI,” “stable BMI,” “increased BMI”) using multinomial logistic regression (“Stable BMI” was the reference category). The following covariates were included in the model: age, sex, country of birth, marital status, income, alcohol consumption, smoking, and psychological distress. The results are reported in terms of odds ratios (OR) and 95% confidence intervals. Because two comparisons were performed (“Stable BMI” vs “Decreased BMI” and “Stable BMI” vs “Increased BMI”), statistical significance was determined by a P-value of <0.025 (ie, $[\alpha]/2$).

RESULTS

The demographic characteristics of the sample at baseline are shown in Table 1. The sample consisted of 1670 adults aged 23 to 56 years (mean = 37.37; SD = 5.14), the majority of whom were men ($n = 1437$). A total of 18.1% of participants were obese, 46.1% overweight, and 35.8% lean at baseline. The mean working hours was 40.85 hours (SD = 3.24) for the short/medium workgroup and 57.65 hours (SD = 9.90) for the long work category. At 4-year follow up, approximately 14.6% of participants had lost weight, 34.5% had gained weight and the remaining 50.9% had remained stable (ie, $\pm 1.0 \text{ kg/m}^2$). The regression model (Table 2) indicated that inflexible work hours (OR = 1.54 [1.14 to 2.09]) and weekend work (OR = 1.33 [1.04 to 1.68]) significantly predicted increased BMI at 4-year follow-up. None of the other work-related factors were associated with increased BMI, but several demographic and behavior factors did predict increased BMI. In particular, low income (OR = 1.31 [1.04 to 1.66]), smoking (OR = 1.52 [1.15 to 2.02]), and overweight/obesity at baseline (OR = 1.50 [1.19 to 1.89]) predicted increased BMI. Men were significantly less likely than women to have gained weight (OR = 0.52 [0.38 to 0.73]).

None of the work-related factors included in this article were associated with decreased BMI. However, individuals who were overweight/obese at baseline (OR = 3.56 [2.48 to 5.12]) were

more likely to have lost weight compared with lean individuals. Men (OR = 0.48 [0.29 to 0.70]) and married individuals (OR = 0.46 [0.24 to 0.87]) were less likely to have lost weight.

Table 1. Baseline Characteristics of the sample (n = 1,670)

Variable	Total Sample (n = 1,670)
Age (years), M (SD)	37.59 (5.18)
Sex, n (%)	
<i>Male</i>	1,437 (86.0)
<i>Female</i>	233 (14.0)
Country of Birth, n (%)	
<i>Australia</i>	1,290 (77.2)
<i>Other</i>	380 (22.8)
Marital Status, n (%)	
<i>Single</i>	129 (7.7)
<i>Partnered</i>	1,541 (92.3)
BMI category, n (%)	
<i>Lean</i>	598 (35.8)
<i>Overweight/Obese</i>	1072 (64.2)
Income, n (%)	
< AUS \$1,000	810 (48.5)
≥ AUS \$1,000	860 (51.5)
Work Hours, n (%)	
≥ 35, <50 hours	973 (58.3)
≥ 50 hours	697 (41.7)
Flexible Work Hours, n (%)	
<i>No</i>	271 (16.2)
<i>Yes</i>	1399 (83.8)
Job Autonomy, n (%)	
<i>Low Autonomy</i>	1203 (72.0)
<i>High Autonomy</i>	467 (28.0)
Job Type, n (%)	
<i>Managers/professionals</i>	996 (59.6)
<i>Tradespersons/labourers</i>	674 (40.4)
Job Security, n (%)	
<i>No</i>	304 (18.2)
<i>Yes</i>	1366 (81.8)
Weekend Work, n (%)	
<i>Rarely/never</i>	712 (42.6)
<i>Weekly/monthly</i>	958 (57.4)
Psychological Distress (K6), n (%)	
<i>Low</i>	1446 (86.6)
<i>High</i>	224 (13.4)
Smoking status, n (%)	
<i>Current smoker</i>	306 (18.3)
<i>Non-smoker</i>	1,364 (81.7)
Alcohol Consumption, n (%)	
<i>Light/moderate</i>	1,297 (77.7)
<i>Harmful consumption</i>	373 (22.3)

	Decreased BMI	Increased BMI	Likelihood
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Table 2. Adjusted odds ratios examining the associations between occupational factors and BMI change at 4-year follow up.

					Ratio p value
Flexible Work Hours					.016
<i>No</i>	1.41	0.93, 2.13	1.54*	1.14, 2.09	
<i>Yes</i>	ref		ref		
Job Autonomy					.870
<i>Low Autonomy</i>	0.91	0.65, 1.29	0.97	0.75, 1.25	
<i>High Autonomy</i>	ref		ref		
Job Type					.334
<i>Managers/professionals</i>	1.24	0.89, 1.73	0.97	0.76, 1.23	
<i>Tradespersons/labourers</i>	ref		ref		
Job Security					.827
<i>No</i>	1.10	0.75, 1.60	0.97	0.73, 1.29	
<i>Yes</i>	ref		ref		
Weekend Work					.066
<i>Rarely/never</i>	ref		ref		
<i>Weekly/monthly</i>	1.09	0.79, 1.50	1.33*	1.04, 1.68	
Work hours					.765
<i>≥ 35, <50 hours</i>	1.03	0.75, 1.43	Ref		
<i>≥ 50 hours</i>			0.93	0.73, 1.18	
Initial BMI					< .001
<i>Lean</i>	ref		ref		
<i>Overweight/Obese</i>	3.56*	2.48, 5.12	1.50*	1.19, 1.89	
Age	1.01	0.97, 1.03	0.97*	0.95, 1.00	.043
Sex					< .001
<i>Males</i>	0.48*	0.29, 0.70	0.52*	0.38, 0.73	
<i>Females</i>	ref		ref		
Country of Birth					.615
<i>Australia</i>	0.88	0.61, 1.27	1.07	0.82, 1.39	
<i>Other</i>	ref		ref		
Marital Status					.024
<i>Single</i>	0.46*	0.24, 0.87	0.69	0.46, 1.04	
<i>Partnered</i>	ref		ref		
Income					.048
<i>< AUS \$1,000</i>	1.30	0.95, 1.78	1.31*	1.04, 1.66	
<i>≥ AUS \$1,000</i>	ref		ref		
Psychological Distress (K6)					.143
<i>Low</i>	1.08	0.69, 1.70	1.38	1.00, 1.90	
<i>High</i>	ref		ref		
Smoking status					.015
<i>Current smoker</i>	1.24	0.83, 1.84	1.52*	1.15, 2.02	
<i>Non-smoker</i>	ref		ref		
Alcohol Consumption					.435
<i>Light/moderate</i>	ref		ref		
<i>Harmful consumption</i>	0.85	0.60, 1.22	0.85	0.66, 1.12	

*p < .025

DISCUSSION

This article examined the associations between selected work-related factors and 4-year change in BMI in a sample of full-time Australian employees. During the 4-year period, more than one third of the sample gained weight (ie, $>1.0 \text{ kg/m}^2$) and two work-related factors included in this article were found to predict increased BMI. First, participants who worked weekends were 33% more likely to have gained weight. Second, participants who were unable to work flexible hours if needed were 54% more likely to have gained weight. These findings were independent of potential confounding variables such as income, sex, and baseline obesity. This article extends on previous studies conducted on Australian adults, demonstrating cross-sectional associations between work-related factors (eg, long working hours, physical job demands, and occupational sitting time) and obesity in employees.^{2,4,17} In particular, the use of longitudinal data allowed us to examine which work-related factors were associated with weight gain and might contribute to obesity.

The association between less flexibility in working hours and weight gain could be the result of a number of factors. First, a lack of flexibility in work hours could adversely impact on the balance between work and nonwork life, which is particularly relevant for the present sample of working parents. For example, it is possible that inflexible work hours interfere with the ability of parents to manage their work and family responsibilities, leading to greater work-family conflict that could promote stress²⁸ and subsequent weight gain.²⁹ A lack of flexibility in work hours may also reduce the opportunities of working parents to engage in health enhancing behaviors that prevent weight gain such as a healthy diet, adequate sleep, and sufficient levels of physical activity. Finally, reduced flexibility in work hours could reflect low job control, which is a component of job strain according to Karasek's⁷ demand/control model that has been associated with weight gain.^{13,30}

The observed association between weekend work and weight gain is interesting, given that for some individuals being able to work on the weekend offers greater work flexibility that may enhance work life balance. However, for other employees weekend work has adverse effects on family life,³¹ leading to increased stress and emotional exhaustion,³² which can promote the development of obesity. Furthermore, weekend work often reflects overtime and longer overall work hours,³³ which

have been associated with weight gain and obesity in previous studies. It is possible that weekend work and longer work hours contribute to obesity by reducing the amount of time the individual has to get adequate amounts of physical activity and sleep, and eat a healthy diet. Weekend work may also interfere with the normal recovery from the stresses and strains of work,³³ which may also contribute to weight gain over time.

The present article, to our knowledge, provides the first examination of the associations between occupational factors and weight change in Australian adults. The present findings are consistent with longitudinal studies that have been conducted in other countries.^{10,12-15} Such studies have demonstrated that a variety of work characteristics including long work hours, job strain, overtime, and work fatigue are associated with weight gain. In aggregate, these studies along with the present article, support the notion that certain types of work patterns and working conditions could be contributing to obesity among employee populations.

This study was limited by several issues relating to the use of self-report data. For example, the use of self-reported height and weight to calculate BMI is not always an accurate and reliable approach. Furthermore, the sample size ($n = 1670$) included in this article was adequate for the purposes of this article, but there were not sufficient numbers to perform additional analyses that would have provided more insight into these relationships. In particular, there were too few women in the sample to allow for a meaningful examination of sex differences. Also, some previous studies have found that the association between certain work factors and weight change depends on the individual's initial body weight status, with the association between work demands and weight gain being more pronounced in obese individuals.^{10,34} We did not have sufficient numbers to conduct the appropriate analyses. Furthermore, it is not clear how generalizable the present findings are to all full-time employees in Australia. An additional limitation of this article is that single items were used to assess constructs such as job autonomy and job flexibility. These single-item measures may not adequately reflect the multidimensional nature of these constructs. Therefore, we recommend that future research builds on the present results by using more detailed measures of variables such as job

autonomy, targeting a more representative sample, and including more time points so that detailed information regarding the trajectories of change in BMI resulting from work characteristics can be determined.

Despite these limitations, the present findings add to the growing number of studies demonstrating that certain-work related factors are associated with weight gain, which has important implications in light of the current obesity epidemic. Some work-related factors may contribute to obesity by increasing stress, impacting on work life balance, and reducing the amount of time employees have to live a healthy lifestyle. The present results suggest that limiting weekend work and allowing for flexible work hours could be an effective way of preventing obesity in Australian employees. This could improve the health and well-being of employees, which may in turn have positive benefits on workplace productivity (eg, reducing absenteeism and improving efficiency). Future longitudinal research in this area would benefit from the use of more objective measures of body weight status, additional work measures (particularly in relation to Karasek's demand/control model) and larger sample sizes.

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