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This study showed that a change in psychosocial working conditions is weakly associated with major weight gain and that baseline body mass index contributes to that association. The results highlight the need to consider differences between BMI groups when aiming to health promotion among employees. Future research examining these associations among different age groups and among employers other than municipalities is needed.

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Key terms: epidemiology; job content questionnaire; obesity; overweight; psychosocial working condition; weight; weight gain; working condition

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Original article

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Changes in working conditions and major weight gain among normal- and overweight midlife employees

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Objectives We aimed to examine the association between changes in psychosocial working conditions and major weight gain among midlife women and men. Furthermore, we examined the associations separately among normal- and overweight participants.

Methods We used survey data among employees of the City of Helsinki, Finland, from 2000–2002 (phase 1, N=8960), 2007 (phase 2, N=7332), and 2012 (phase 3, N=6814), with a final study sample of 4369 participants. We examined changes in job strain, job demands, and job control from phase 1 to 2. We defined major weight gain as ≥10% weight gain between phases 1 and 3 based on self-reported weight (kg). We performed logistic regression analysis adjusting for baseline age, marital status, and occupational class, stratifying by gender and by baseline body mass index.

Results Job demands among both genders and job strain among women was associated with major weight gain. Furthermore, increased job demands [odds ratio (OR) 1.52, 95% CI 1.05–2.20] or increased job strain (OR 1.53, 95% CI 1.11–2.11) was associated with major weight gain among overweight women. Normal-weight men reporting decreased job demands (OR 4.11, 95% CI 1.48–11.40) and overweight men reporting increasing job demands (OR 2.93, 95% CI 1.26–6.82) exhibited higher odds of major weight gain.

Conclusions Associations between working conditions and weight gain appeared primarily weak. Our study suggests that overweight individuals might be at a higher risk of weight gain when facing psychosocial strain in the workplace.

Key terms epidemiology; job content questionnaire; obesity; psychosocial working condition.

In previous research, psychological strain has been associated with unhealthy behaviors, such as smoking, physical inactivity, and poor diet (1–3), which are common risk factors for obesity (4). Studies have also found that associations between job demands and job control, as well as their combined interactive effect (the job strain model) (5), with weight gain appear typically weak or non-existent (6–10). However, only a few longitudinal studies have considered this association in changing psychosocial working conditions finding either no association (11, 12) or one only among women (13).

Previous studies suggest that under- and overweight individuals appear more likely to gain weight when exposed to psychosocially strenuous working conditions at baseline (8, 14–16). A limited number of studies have examined this in changing psychosocial working conditions; thus far, only the association between changes in job strain and weight gain has been studied with opposing results (12, 13). In a Japanese follow-up study (12), body mass index (BMI), waist circumference, and job strain among 3371 industrial male and female workers were assessed at two time points at a six-year interval. No significant association was found among either gender. In the Nurses' Health Study (13) (N=52 000), by contrast, an association between persistent high job strain and greater increase in BMI was found among initially heavier women during a four-year follow up.

Previous study among this study population showed no association between baseline job strain and weight gain exceeding 5 kg during a 5–7-year follow-up (17). However, changes in working conditions were not examined in the previous study. Furthermore, the previ-

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ous study did not consider the contribution of baseline weight to the associations, that is whether the associations between work stress and weight gain differed among normal and overweight employees.

To fill in the existing gaps in the literature, this study aims to examine the association between changes in psychosocial working conditions and major weight gain among midlife employees. More specifically, we examine the associations between changes in job demands, job control, and job strain and major weight gain during a 10–12-year follow-up period at three time points among normal- and overweight participants. We also consider key confounders – age, marital status, occupational class, dietary habits, and leisure-time physical activity – in the association examined. Based on previous research, our hypothesis was that weight gain is higher when (i) job demands or job strain increase, (ii) job control decreases, or (iii) the exposure to high job demands or job strain or low job control is persistent. Higher weight gain during the follow up is expected among initially overweight (BMI ≥25 kg/m^2) compared to normal-weight (BMI <25 kg/m^2) participants.

Methods

Sample

The baseline data (phase 1) were derived from the ongoing Helsinki Health Study and collected using a mail survey among 40-, 45-, 50-, 55-, and 60-year-old employees of the City of Helsinki, Finland, in 2000–2002 (response rate 67%, N=8960) (18). Phase 2 was collected in 2007 (response rate 83%, N=7332) and phase 3 was collected in 2012 (response rate 78%, N=6814) among all baseline respondents despite their current employment status. For this study, we excluded participants based on the following criteria: BMI <18.5 kg/m^2 in phase 1 (N=63, <1%), retiring (N=1921, 21%) or unemployed (N=49, <1%) before phase 2, and drop out before phase 3 (N=1921, 21%). Thus, the study sample consisted of 4369 participants (83% women) who were employed and provided information on psychosocial working conditions in phases 1 and 2, covariates in phase 1, and information on body weight during all three phases. Table 1 presents the characteristics of the study population during phase 1.

The Ethics Committees of the Department of Public Health at the University of Helsinki and the health authorities of the City of Helsinki, Finland, approved the Helsinki Health study protocol.

Measurement of psychosocial working conditions

A change in job demands, job control, and job strain was defined as a change from baseline during 2000–2002 to the first follow-up in 2007. Job demands and control were assessed using Karasek's job content questionnaire (JCQ) (job demands–control model) (5) during phases 1 and 2. In this study, we used a shortened version of the questionnaire consisting of nine items on job demands and nine items on job control, similar to the questionnaire used in previous studies as well. Each answer regarding job demands and control received a score on a scale of 1 ("strongly disagree") to 5 ("strongly agree"). We summed the scores for job demands and control separately. Following previous studies, we dichotomized the summed scores using the median, classifying them as high and low job demands and control (19, 20). We then classified the dichotomized job demands and control into high job strain (high demands–low control), active work (high demands–high control), low job strain (low demands–high control), and passive work (low demands–low control). Since our primary interest was to compare those in the high job strain category to those in other categories, we combined active work, low strain, and passive work into one group labelled "no job strain/other". We divided changes in job demands and control into four categories: (i) low, no change, (ii) increased (from low to high), (iii) decreased (from high to low), and (iv) high, no change. In addition, changes in job strain were divided into four categories: (i) low, no change (no job strain/other at both time points), (ii) increased (from no job strain/other to high job strain), (iii) decreased (from high to no job strain/other), and (iv) high, no change (high job strain at both time points). What was considered an adverse change varied between these components of psychosocial working conditions. For job demands and strain, increased or persistently high exposure was considered an adverse change. For job control, by contrast, decreased or persistently low exposure was considered an adverse change in psychosocial working conditions.

Measurement of body weight and weight change

Body weight was self-reported at each phase within a 1-kg accuracy. Since weight gain was relatively common among the study population, we focused on weight gain that exceeds the World Health Organization's (WHO) recommendation for adult population (4). Weight change was described as percentage change in body weight between phases 1 and 3, and major weight gain was defined as ≥10% weight gain during that time period of 10–12 years.

To examine the contribution of initial body weight to the association between psychosocial working conditions and body weight change, we stratified the study population using BMI at phase 1. BMI was calculated using self-reported weight and height. We divided the

Table 1. Employees of the City of Helsinki, Finland (N=4369) by baseline body mass index (BMI).

	Women						Men					
	All		Normal weight (BMI <25 kg/m^2)		Overweight (BMI ≥25 kg/m^2)		All		Normal weight (BMI <25 kg/m^2)		Overweight (BMI ≥25 kg/m^2)	
	N	%	N	%	N	%	N	%	N	%	N	%
Participants	3622	82.9	2101	58.0	1521	42.0	747	17.1	322	43.1	425	56.9
Age (years)												
40–45	1800	49.7	1134	54.0	666	43.8	319	42.7	147	45.7	172	40.5
50–60	1822	50.3	967	46.0	855	56.2	428	57.3	175	54.3	253	59.5
Marital status												
Single/divorced/widowed	1154	31.9	677	32.2	477	31.4	156	20.9	66	20.5	90	21.2
Married/cohabiting	2468	68.1	1424	67.8	1044	68.6	591	79.1	256	79.5	335	78.8
Occupational class												
Managers and professionals	1008	27.8	666	31.7	342	22.5	365	48.9	169	52.5	196	46.1
Semi-professionals	739	20.4	466	22.2	273	17.9	149	19.9	62	19.3	87	20.5
Routine non-manual workers	1452	40.1	752	35.8	700	46.0	67	9.0	22	6.8	45	10.6
Manual workers	423	11.7	217	10.3	206	13.5	166	22.2	69	21.4	97	22.8
Job demands												
Low	1917	52.9	1135	54.0	782	51.4	399	53.4	173	53.7	226	53.2
High	1705	47.1	966	46.0	739	48.6	348	46.6	149	46.3	199	46.8
Job control												
Low	1841	50.8	1040	49.5	801	52.7	398	53.3	167	51.9	231	54.4
High	1781	49.2	1061	50.5	720	47.3	349	46.7	155	48.1	194	45.6
Job strain												
Low/other	2901	80.1	1707	81.2	1194	78.5	610	81.7	266	82.6	344	80.9
High	721	19.9	394	18.8	327	21.5	137	18.3	56	17.4	81	19.1

study population into two groups according to the WHO guidelines (4): (i) normal weight (BMI <25 kg/m^2) and (ii) overweight (BMI ≥25 kg/mg^2).

Covariates

We assessed all covariates at phase 1. The baseline background variables consisted of age, gender, marital status, occupational class, and BMI. Information on occupational class was derived either from the questionnaire or from the employer's personnel register if the participant consented to the linkage to the personnel register (78%).

We performed additional analyses to examine and address the contribution of dietary habits and leisure-time physical activity to the associations between working conditions and weight gain. We assessed dietary habits using a 20-item food frequency questionnaire from the previous four weeks, from which we created a healthy eating index based on current national dietary recommendations (21). Following a previous study (22), we composed the healthy eating index using the sum score of whether the participant reached the recommendation in question. In our statistical analyses, we used the mean score for the healthy eating index during follow-up as a continuous variable. Leisure-time physical activity was measured as an approximate metabolic equivalent (MET) by multiplying the time used by the MET values for each intensity grade, and then summing these four values (23). We used the mean MET score from all three phases as a continuous variable in the analyses.

Statistical analysis

We stratified the study population by gender and further by baseline BMI. Statistical analyses were carried out using SPSS, version 23 (IBM Corp, Armonk, NY, USA). We used logistic regression analysis to examine the associations between changes in psychosocial working conditions and major weight gain. Two different models were applied: model 1 was adjusted for age in phase 1 and model 2 was further adjusted for marital status, occupational class, and baseline BMI. Following a previous procedure (20), the reference groups of job demands, job control, and job strain varied in the analysis, such that each change group was compared to the group to which participants belonged during phase 1. For example, those experiencing increased job demands were compared to the group with recurring low job demands, while those experiencing decreased job demands were compared to the group with recurring high job demands. In addition, those with recurring high job demands were compared to the group experiencing recurring low job demands. This enabled us to examine the effect of an increase and decrease in working conditions on major weight gain.

Results

Adverse changes in psychosocial working conditions were similarly reported among women and men as well

as among normal- and overweight participants (table 2). Mean weight change between phase 1 and 3 reached +5.6% (+3.7kg) among women and +2.6% (+3.1kg) among men. Major weight gain appeared more common among women compared with men. In relation to psychosocial working conditions, major weight gain among women varied 27–33% among normal-weight and 23–37% among overweight participants across working condition categories. Among men, the corresponding figures were 8–25% among normal-weight and 9–27% among overweight participants.

There was a significant difference in mean dietary habits among those with major weight gain compared to those without (P<0.01). In both genders, dietary habits were less healthy among those with major weight gain (the mean healthy eating index 5.5 among women, and 4.5 among men). In addition, there was a significant difference in leisure-time physical activity between those with major weight gain and those maintaining their weight (P<0.01). In both genders, major weight gainers were physically less active (the mean MET score 26.6 among women and 28.4 among men).

Tables 3 and 4 show the results of logistic regression analysis among women and men. Changes in job demands and strain were weakly associated with major weight gain among both genders. In the age-adjusted model, increased job strain among women and decreased job demands among men were associated with major weight gain. These associations remained after full adjustments. In addition, among women, persistently high job demands was associated with major weight gain in the fully adjusted model.

Stratifying by baseline BMI revealed differences between normal- and overweight participants in both genders. In the age-adjusted model, persistently high job strain among normal-weight women and decreased job demands among normal weight men were associated with major weight gain. Among overweight participants, women reporting increased job demands or increased job strain and men reporting increased job demands had higher odds of major weight gain. These associations remained after full adjustments, except among normal-weight women.

We also considered the contributions of dietary habits and leisure-time physical activity to these associations. Odds ratios (OR) for major weight gain remained unchanged compared to the OR in the fully adjusted model in tables 3 and 4 (further data not shown). However, these lifestyle factors played a minor effect on the risk of major weight gain. Healthier dietary habits were associated with lower odds of major weight gain among normal-weight women and overweight men. In addition, higher level of leisure-time physical activity was associated with lower odds of major weight gain among women in both BMI groups and among overweight men.

As a sensitivity analysis, we repeated the analysis using outcome variable of either ≥5% or ≥10% weight gain between phases 2 and 3. Using ≥5% as the cut-off point attenuated the observed associations; however, increase in job demands was associated with weight gain among overweight women (OR 1.45, 95% CI 1.01–2.08), while increase in job control was associated with weight gain among normal-weight men (OR 3.45, 95% CI 1.34–8.87). In addition, a ≥10% cut-off point strengthened the association between increase in job control and major weight gain among normal-weight women (OR 0.45, 95% CI 0.22–0.93).

Discussion

Our main finding suggests that a change in job demands and job strain is weakly associated with major weight gain among both women and men. Baseline BMI contributed to the association such that, among women, the relationship existed only among overweight participants, whereas changes in working conditions was associated with major weight gain among both normal- and overweight men.

Interpretation

A previous study among the same study population found no association between baseline job strain and weight gain among either gender (17). However, the study differed from the present one in several noteworthy ways. First, changes in working conditions were considered. In other words, the previous study focused on the association between baseline working conditions and subsequent weight gain only using a single measurement of working conditions. Second, the study did not consider the contribution of baseline weight, ie, whether the associations differed between normal- and overweight employees. Third, weight changes were assessed in kilograms, not percentages, the latter of which better take into account the baseline weight (5 kg is a different change for a 50 kg person as compared to a 100 kg person). Fourth, the follow-up period was shorter than in this study, with two measurement points and a follow-up of 5–7 years. We had three measurement points and a follow-up of 10–12 years, enabling us to better examine changes in working conditions and major weight during working life span. In our study, increase in job strain was associated with major weight gain among overweight women, reflecting the results from the study among US women (13). In the Japanese study (12), by contrast, no statistically significant findings were found among either gender. We found no association among men either. However, methodological differences limit comparison

Table 2. Changes in psychosocial working conditions (from 2000–2002 to 2007) and the occurrence (%) of major weight gain (≥10%) (2000–2012) among women and men by baseline body mass index (BMI).

	Women						Men					
	All		Normal weight (BMI <25 kg/m²)		Overweight (BMI ≥25 kg/m²)		All		Normal weight (BMI <25 kg/m²)		Overweight (BMI ≥25 kg/m²)	
	N	%	N	%	N	%	N	%	N	%	N	%
Job demands												
Low, no change	1431	26.1	819	26.6	612	25.5	325	12.6	140	13.6	185	11.9
Increased (from low to high)	486	30.7	316	27.2	170	37.1	74	20.3	33	12.1	41	26.8
Decreased (from high to low)	635	26.0	356	28.1	279	23.3	144	18.8	70	25.7	74	12.2
High, no change	1070	29.3	610	29.7	460	28.7	204	12.3	79	7.6	125	15.2
Job control												
Low, no change	1382	27.9	823	28.7	659	27.0	310	16.1	138	16.7	172	15.7
Increased (from low to high)	359	26.7	217	28.6	142	23.9	88	18.2	29	17.2	59	18.6
Decreased (from high to low)	648	27.8	370	27.6	278	28.1	98	11.2	42	14.3	56	8.9
High, no change	1133	27.4	691	26.8	442	28.5	251	12.4	113	11.5	138	13.0
Job strain												
Low, no change (no job strain/other at both time points)	2378	26.7	1397	26.8	981	26.5	538	13.9	235	14.0	303	13.9
Increased (from no job strain/other to high)	523	32.5	310	29.7	213	36.6	72	13.9	31	9.7	41	17.1
Decreased (from high to no job strain/other)	404	25.7	228	27.6	176	23.3	78	21.8	32	25.0	46	19.6
High, no change (high job strain at both time points)	317	29.0	166	33.1	151	24.5	59	10.2	24	12.5	35	8.6

Table 3. The association between changes in psychosocial working conditions (from 2000–2002 to 2007) and major weight gain (≥10%) (2000–2012) among women by baseline body mass index (BMI). [OR=Odds ratios; 95% CI=95% confidence interval].

Changes in working conditions from 2000–2002 to 2007	All				Normal weight (BMI <25kg/m²)				Overweight (BMI ≥25kg/m²)			
	Model 1 [a]		Model 2 [b]		Model 1 [a]		Model 2 [b]		Model 1 [a]		Model 2 [b]	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Job demands												
Low, no changed	0.86	0.72–1.03	0.80	0.67–0.96	0.86	0.68–1.09	0.79	0.62–1.01	0.86	0.65–1.13	0.83	0.62–1.10
Increased (from low to high) [c]	1.17	0.93–1.47	1.20	0.95–1.51	1.00	0.74–1.34	1.03	0.77–1.39	1.52	1.05–2.20	1.52	1.05–2.20
Decreased (from high to low) [d]	0.87	0.70–1.08	0.84	0.67–1.05	0.94	0.70–1.26	0.91	0.68–1.22	0.77	0.55–1.10	0.76	0.54–1.08
High, no change [c]	1.17	0.98–1.40	1.25	1.04–1.50	1.16	0.92–1.47	1.26	0.99–1.61	1.17	0.88–1.54	1.21	0.91–1.61
Job control												
Low, no changed	1.11	0.93–1.32	0.99	0.82–1.20	1.18	0.94–1.48	1.02	0.79–1.32	0.99	0.76–1.31	0.96	0.71–1.29
Increased (from low to high) [c]	0.89	0.69–1.16	0.95	0.73–1.24	0.95	0.68–1.32	1.01	0.72–1.43	0.82	0.53–1.26	0.83	0.54–1.28
Decreased (from high to low) [d]	1.05	0.84–1.30	0.99	0.79–1.24	1.07	0.80–1.43	0.99	0.74–1.32	0.99	0.71–1.40	0.98	0.69–1.39
High, no change [c]	0.91	0.76–1.08	1.01	0.83–1.22	0.85	0.68–1.07	0.98	0.76–1.26	1.01	0.77–1.32	1.05	0.78–1.41
Job strain												
Low, no change (no job strain/other at both time points) [d]	0.84	0.64–1.09	0.88	0.67–1.15	0.70	0.49–0.99	0.75	0.53–1.07	1.05	0.70–1.58	1.06	0.71–1.60
Increased (from no job strain/other to high) [c]	1.31	1.07–1.61	1.30	1.05–1.59	1.16	0.88–1.52	1.13	0.86–1.49	1.54	1.12–2.12	1.53	1.11–2.11
Decreased (from high to no job strain/other) [d]	0.82	0.59–1.14	0.84	0.60–1.17	0.74	0.47–1.14	0.75	0.48–1.17	0.93	0.55–1.56	0.94	0.56–1.58
High, no change (high job strain at both time points) [c]	1.20	0.92–1.55	1.14	0.87–1.48	1.43	1.01–2.02	1.33	0.93–1.89	0.95	0.63–1.43	0.94	0.63–1.41

[a] Adjusted for age in phase 1.
[b] Adjusted for age in phase 1, baseline BMI, marital status, and occupational status.
[c] Reference group "low, no change".
[d] Reference group "high, no change".

between the Japanese and US results and those observed in this study: weight change was assessed in BMI and waist circumference during a 4–6-year follow-up. In addition, change in job strain and weight was assessed during the same time period.

Our study provided novel evidence by examining changes in different components of psychosocial working conditions, job demands, and job control, and their association with weight change among participants in different BMI groups. In our data, overweight women and men had higher odds of major weight gain when exposed to increased job demands, as was expected. In other prospective studies, baseline high job demands have been associated with higher weight gain among participants with a higher baseline BMI (14, 16). However, normal-weight men had higher odds of major weight gain when exposed to decreased job demands, a change presumed as beneficial. Baseline low job demands among men have been associated with higher weight gain but only among participants with a higher baseline BMI

Table 4. The association between changes in psychosocial working conditions (2000–2007) and major weight gain (≥10%) (2000–2012) among men by baseline body mass index (BMI). [OR=odds ratios; 95% CI=95% confidence interval].

Changes in working conditions from 2000 to 2007	All				Normal weight (BMI <25 kg/m²)				Overweight (BMI ≥25 kg/m²)			
	Model 1 [a]		Model 2 [b]		Model 1 [a]		Model 2 [b]		Model 1 [a]		Model 2 [b]	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Job demands												
Low, no changed	1.10	0.64–1.85	0.88	0.51–1.54	2.08	0.79–5.50	1.31	0.46–3.70	0.77	0.40–1.50	0.68	0.34–1.35
Increased (from low to high) [c]	1.68	0.87–3.24	1.93	0.98–3.78	0.81	0.25–2.58	1.13	0.33–3.88	2.66	1.17–6.06	2.93	1.26–6.82
Decreased (from high to low) [d]	1.78	0.98–3.23	1.72	0.94–3.16	4.51	1.66–12.22	4.11	1.48–11.40	0.82	0.34–1.94	0.81	0.34–1.94
High, no change [c]	0.92	0.54–1.57	1.13	0.65–1.98	0.48	0.18–1.27	0.77	0.27–2.17	1.30	0.67–2.53	1.48	0.74–2.94
Job control												
Low, no changed	1.36	0.84–2.20	1.07	0.63–1.83	1.60	0.77–3.33	1.26	0.55–2.91	1.21	0.64–2.32	0.93	0.45–1.89
Increased (from low to high) [c]	1.20	0.64–2.23	1.32	0.69–2.50	1.09	0.38–3.18	1.32	0.42–4.10	1.26	0.58–2–74	1.42	0.64–3.16
Decreased (from high to low) [d]	0.89	0.43–1.85	0.86	0.41–1.80	1.30	0.46–3.70	1.39	0.47–4.08	0.64	0.23–1.82	0.63	0.22–1.82
High, no change [c]	0.74	0.45–1.19	0.93	0.55–1.59	0.63	0.30–1.31	0.79	0.34–1.82	0.82	0.43–1.57	1.08	0.53–2.21
Job strain												
Low, no change (no job strain/other at both time points) [d]	1.54	0.64–3.73	1.69	0.69–4.12	1.18	0.33–4.20	1.18	0.32–4.39	1.88	0.54–6.48	2.15	0.61–7.50
Increased (from no job strain/other to high) [c]	0.95	0.46–1.93	0.98	0.47–2.01	0.61	0.17–2.14	0.81	0.22–2.95	1.23	0.51–2.96	1.23	0.50–2.99
Decreased (from high to no job strain/other) [d]	2.68	0.98–7.33	2.82	1.02–7.80	2.39	0.56–10.23	2.39	0.54–10.61	2.88	0.71–11.74	3.06	0.74–12.74
High, no change (high job strain at both time points) [c]	0.65	0.27–1.57	0.59	0.24–1.44	0.85	0.24–3.01	0.85	0.23–3.13	0.53	0.15–1.84	0.47	0.13–1.63

[a] Adjusted for age in phase 1.
[b] Adjusted for age in phase 1, baseline BMI, marital status, and occupational status.
[c] Reference group "low, no change".
[d] Reference group "high, no change".

(16). Since the group sizes among men were small, these results should be interpreted with caution.

We found no association between a change in job control and major weight gain among either gender, a finding in line with other prospective studies (11, 12). One study (24) suggested that the two components of job control – skill discretion and decision authority – may carry contradictory associations to waist circumference and BMI, possibly explaining the non-significant findings reported thus far.

The mechanisms behind weight gain under psychological strain remain unclear. There are stress-induced biochemical changes in the body homeostasis that promote habitual behavior and suppress cognitive decision-making (1). This results for example in changes in dietary behavior (25) and in physical activity (3). A comprehensive review (26) concluded that the effects of biochemical changes might be exacerbated in overweight and obese individuals, resulting in emotional eating, excess calorie intake, and increased weight gain. In addition, physically less active people are less likely to engage in physical activity under stressful periods (3), enhancing the possibility of weight gain. Moreover, the use of stress-coping strategies (27) results in individual differences in stress responses, making the associations even more complex.

These potential mechanisms cannot be addressed in this study, and thus more detailed explanations for the findings and the mechanisms remain speculative. Weight gain induced by psychological strain is more likely to be a multifactorial phenomenon, with environmental, behavioral, and biological mechanisms involved.

Methodological considerations

Comparing data collected across three different time points enabled us to evaluate long-term changes in the observed variables. However, 5–7 years between study phases may hide some changes. In addition, changes in psychosocial working conditions and weight were assessed during partially overlapping time periods, potentially affecting the observed associations.

The shortened version of the job demands–control scales used in this study appear to produce comparable results with the original job demands–control scales (28). Although the questionnaire has not been validated in our study population, it has been extensively used in other large municipality cohorts among the Finnish

population (29), with comparable results with the original questionnaire. When considering a change in job strain, combining active work, low strain, and passive work into a single group may mask some of the changes in these psychosocial working conditions. However, examining all possible changes is not feasible using all 16 categories. This would have created a very complex and detailed predictor, making interpretation of the results difficult.

We used a large data cohort representing employees from several occupational fields. However, this sample comprises municipal employees from a single employer; thus, our findings are not generalizable to the general working age population. Almost one-fourth of the respondents in phase 1 dropped out or died before phase 3. Nevertheless, the differences between respondents and non-respondents appeared negligible (18): non-respondents tended to be younger, from lower occupational classes, and have longer sickness absences during the study year. The non-response rate was higher among men than women. Male manual workers were slightly overrepresented among non-respondents. However, attrition due to health and workload is unlikely to be a problem issue, since the response rate was relatively high at both follow-ups. Non-respondents did not differ from respondents in terms of BMI. The obtained data were large enough to reduce random error; however, stratifying by gender and baseline BMI created groups with less statistical power, particularly among men. Self-reported data expose our results to bias, especially regarding body weight, since overweight individuals tend to under-report and underweight people tend to over-report their weight (30). However, previous studies among this study population have shown only a small inconsistency between self-reported weight data and data obtained from health check-ups carried out by occupational healthcare services (31). We included dietary habits and leisure-time physical activity as additional covariates in the analysis; however, they did not contribute to any associations. Besides acting as possible mediators in the examined association, these lifestyle factors can be directly associated with the predictors and the outcome. Hence, further evaluation of the role of these lifestyle factors would require more detailed assessment tools, which is beyond the scope of this study.

Concluding remarks

This study showed that a change in psychosocial working conditions is weakly associated with major weight gain and that baseline BMI contributes to that association. Possible mechanisms behind these results warrant further research. In addition, these associations should be studied among different age groups and among employers other than municipalities. Furthermore, changes in working conditions should be examined with shorter follow-up periods and additional measurement points for better and more accurate assessment.

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