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Psychosocial factors at work, long work hours, and obesity: a systematic review ¹

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¹ Appendices A–C

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Table A. Assessment of quality criteria

Criterion	Description	Classification
Initial selection of study subjects	1a. Defined target population representing the general population	1a and 1b: no selection bias
	1b. Representing a subgroup of the general population, e.g. women or men, certain age group, geographical area, certain industrial branch with several occupational groups	
	2. Narrow subgroup of the general population, e.g. certain occupational group, fixed-term employees	2: possible bias
	3. "Self-selected" volunteers, (i.e., study group not pre-defined by researchers)	3: definite bias
Representativeness	1. Participation rate is 80–100% or 60–80% and non-responder analysis (difference between participants and non-participants addressed in the analysed paper or papers published elsewhere and control for variables where difference found between participants and non-participants)	1: no selection bias
	2. Participation rate is 60–80% and no non-responder analysis	2: possible bias
	3. Participation rate is <60% or not reported	3: definite bias
Presence of selection bias		No or minor, moderate, severe, definite
Assessment method of exposure	1a. Validated and systematic assessment (validated and comprehensive instrument or questionnaire on eg, job characteristics, objective measurements of working hours); aggregate measures of exposure (work unit level and job exposure matrix)	1a and 1b: no bias
	1b. Part of an instrument or a single item, if validated within the study or elsewhere	
	2. Part of an instrument, e.g. only 1 item; also "self-made" 1-item questions	2: Possible bias
	3. Non-systematic exposure assessment (different methods used for one exposure) Needs to be assessed for each exposure separately!	3: definite bias
Recall bias	1. current or recent (within preceding year) exposure reported	1: no recall bias
	2. exposures for time in the past (>1 year) reported Needs to be assessed for each exposure separately!	2: possible bias
Performance bias		No, possible, definite

Clear definition of outcome (case)	<ol style="list-style-type: none"> 1. Yes (eg, prevalence, incidence, change) 2. No <p>All outcomes should be rated!</p>	<p>1: no bias 2: definite bias</p>
Standardized way of assessing outcome	<ol style="list-style-type: none"> 1. Measured 2. Self-reported 3. Non-systematic assessment of outcome 	<p>1: no bias 2: possible bias 3: definite</p>
Detection bias		<p>No, possible, definite</p>
Completeness of follow-up	<p>Specify length of follow-up and % of subjects caught for follow-up</p> <ol style="list-style-type: none"> 1. Acceptable (depending on % and length of follow-up) 2. Follow-up time <5 years and 50–70% <i>or</i> follow-up time <1 year and >70% 3. Follow-up time < 5 years and participation rate <50% <i>or</i> follow-up time <1 year and <70% 	<p>1: no bias 2: possible bias 3: definite bias</p>
Missing data	<ol style="list-style-type: none"> 1. Missing data <20% in the analysis 2. 20-40% with missing data 3. >40% with missing data 4. Not reported 	<p>1: no bias 2: possible bias 3 or 4: definite bias 4. Not reported</p>
Attrition bias		<p>No, possible, definite</p>

Table B1. Association of job demand, job control and job strain with weight-related outcomes organized by weight-related outcome group, by study quality, by adjustment group and by year of publication.

Author, year and country	Study population and design	Sample size, gender and age (years)	Exposures	Outcome	Results			Adjustment for covariates
					Job control	Job demands	Job strain	
Overweight or obesity								
Kuper and Marmot 2003, UK, Whitehall II	Civil servants, 11-year follow-up	9308 men and women 35-55 yrs at baseline	Job demand (score) Job control (score)	(1) BMI <20 kg/m ² (2) BMI <20-24.99 kg/m ² (3) Overweight BMI 25-29.99 kg/m ² (4) Obesity: BMI > 30.0 kg/m ²	<u>Mean job control score</u> M: -, p< 0.01 64.1, 68.8, 68.5, 66.2 W: -, p< 0.01 60.6, 57.7, 55.9, 55.5	<u>Mean job demand score</u> M: NS 57.7, 60.5, 60.1, 59.1 W: +, p< 0.01 56.9, 52.6, 51.3, 53.0		None
Brunner et al. 2007, UK Whitehall II	Civil servants, 19-year follow-up	9308 men and women 35-55 yrs at baseline	Number of times experienced high job demands: none (ref.), one, two, three, four Number of times experienced low decision authority: none (ref.), one, two, three, four	General obesity: BMI ≥ 30 kg/m ² Central obesity: waist > 102 cm (men) waist > 88 cm (women)	General obesity M: NS 1. OR=0.96 (0.69-1.32) 2. OR=0.96 (0.69-1.32) 3. OR=0.83 (0.57-1.2) 4. OR=1.05 (0.78-1.41) W: NS 1. OR=1.56 (0.98-2.47) 2. OR=1.58 (0.95-2.61) 3. OR=1.20 (0.7-2.04) 4. OR=1.24 (0.77-1.98) Central obesity M: NS 1. OR=0.95 (0.71-1.28) 2. OR=0.94 (0.68-1.31) 3. OR=0.75 (0.53-1.06) 4. OR=0.86 (0.65-1.14) W: NS 1. OR=1.63 (1.06-2.5) 2. OR=1.42 (0.88-2.28) 3. OR=1.33 (0.82-2.15) 4. OR=1.35 (0.88-2.08)	General obesity M: NS 1. OR=0.95 (0.66-1.37) 2. OR=0.88 (0.61-1.27) 3. OR=1.13 (0.81-1.58) 4. OR=1.22 (0.87-1.71) W: NS 1. OR=1.39 (0.78-2.47) 2. OR=1.33 (0.78-2.28) 3. OR=1.68 (0.98-2.89) 4. OR=1.39 (0.82-2.36) Central obesity M: NS 1. OR=1.04 (0.74-1.47) 2. OR=0.97 (0.68-1.37) 3. OR=1.31 (0.96-1.80) 4. OR=1.17 (0.84-1.62) W: NS 1. OR=0.92 (0.55-1.54) 2. OR=0.93 (0.58-1.49) 3. OR=1.22 (0.75-1.96) 4. OR=1.05 (0.66-1.67)		None
Wamala et	General	243	Job strain (ratio)	BMI <23.8 kg/m ²			NS, p=0.07	None

al. 1997, Sweden Female Coronary Risk Study	population, cross-sectional	women, 30-65 yrs	of job demands to work decision latitude)	(ref.) Overweight: BMI 23.8-28.6 kg/m ² Obesity: BMI > 28.6 kg/m ²			0.71 (obese), 0.70 (overw.) vs. 0.69 (normal weight)	
Fernandez et al. 2010, USA	Employees of 11 worksites within a single corporation, cross-sectional	2 782 men and women, mean age 47 yrs	Job strain: passive work (ref.), high job strain (H), low job strain (L), active work (A)	Overweight/obesity BMI > 24.9 kg/m ²			H: OR=1.45 (1.09-1.95) L: OR=1.24 (0.95-1.62) A: OR=1.45 (1.09-1.94)	Age, gender, race, income, education, smoking and job insecurity
Kouvonen et al. 2007, Finland Finnish Public Sector Cohort Study	Public sector employees, cross-sectional	42212 men and women, 17-65 yrs	Job control: low, high (ref.) Job demands: high, low (ref.) Job strain: low strain (ref.), active work (A), passive work (P) and high strain (HS)	Overweight/obesity BMI \geq 25 kg/m ²	M: NS, data not shown W: NS, data not shown	M: NS W: + OR=1.11, (1.05-1.18)	M: NS (P) OR=1.14, (1.00-1.30) W: + (HS) OR=1.09, (1.02-1.17) (A) OR=1.11, (1.04-1.18) (P) OR=1.14, (1.00-1.30)	Age, education, marital status and type of job contract
Lallukka et al. 2008, UK, Finland, Japan Helsinki Health study Whitehall II Civil Servant	White-collar employees, cross-sectional	Both, 3 397 (UK) 6 070 (F) 2 213 (J) 45-60 yrs	Job strain: low strain (ref.), active work (A), passive work (P), high strain (H)	Obesity: BMI \geq 30 kg/m ² (UK & F) BMI \geq 25 kg/m ² (J)			<u>UK</u> M: NS (A) OR=0.99 (0.67-1.46) (P) OR=1.1 (0.75-1.62) (H) OR=1.35 (0.87-2.11) W: NS (A) OR=1.05 (0.59-1.85) (P) OR=1.36 (0.78-2.37) (H) OR=1.39 (0.71-2.72) <u>Finland</u> M: NS (A) OR= 0.91 (0.55-1.50) (P) OR=0.85 (0.51-1.39) (H) OR=1.22 (0.74-1.98) W: NS (A) OR=1.03 (0.82-1.31) (P) OR=0.93 (0.74-1.16) (H) OR=0.84 (0.66-1.079) <u>Japan</u> M: NS	Age, education and marital status

							(A) OR=1.03 (0.67-1.57) (P) OR=1.1 (0.71-1.79) (H) OR= 0.83 (0.50-1.38) W: NS (A) OR=1.58 (0.74-3.38) (P) OR=1.01 (0.45-2.27) (H) OR=1.74 (0.69-4.40)	
Choi et al. 2010, USA MIDUS II	General population, cross-sectional	2019 men and women, 32-69 yrs	Quantitative job demands: high, low (ref.) Job control: low, high (ref.)	General obesity: BMI \geq 30 kg/m ² Central obesity: WC >90 cm (men) > 88 cm (women)	General obesity M: NS, p > 0.05 30.0% vs. 27.9% W: -, p < 0.05 29.5% vs. 23.4% Central obesity M: NS, p > 0.05 33.5% vs. 32.9% W: -, p < 0.001 46.4% vs. 36.6%	General obesity M: NS, p > 0.05 30.2% vs. 27.9% W: NS, p > 0.05 27.3% vs. 25.8% Central obesity M: NS, p > 0.05 35.7% vs. 31.3% W: NS, p > 0.05 42.2% vs. 41.6%	None	
Nishitani & Sakakibara 2006, Japan	Industrial employees, cross-sectional	208 men, 19-60 yrs	Psychosocial demands: quantitative and qualitative workload Job latitude	Obesity: BMI \geq 25 kg/m ²	NS OR=1.09, (0.92-1.28)	<u>Quantitative workload</u> NS OR=1.07 (0.90-1.28) <u>Qualitative workload</u> NS OR=1.14 (0.96-1.36)	Age	
Uchiyama et al. 2005, Japan	Treated hypertensives, 4 to 6-year follow-up	1615 men, and women, 40-65 yrs	Job strain: low strain (L), passive (P), active (A), high strain (HS)	Obesity BMI > 25 kg/m ²		Prevalence of obesity (%): M: NS, p=0.164 29 (L), 38 (P), 48 (A) and 29 (HS) W: NS, p=0.263 41 (L), 49 (P), 25 (A) and 34 (HS)	None	
Belkić & Nedic 2007, Serbia	Physicians, cross-sectional	112 women, 35-60 yrs	Job strain (occupational stress index)	Obesity: BMI \geq 28 kg/m ²		+ OR=1.09, (1.02-1.16)	Age, number of children, number of cigarettes smoked per day, physician category	
Rosmond & Björntorp 1999, Sweden	General population, cross-sectional	1137 women, 40 yrs	Influence on work situation: high, low (ref.) Work demands: high, low (ref.)	Overweight/obesity: BMI \geq 25.05 kg/m ² Central obesity: WHR \geq 0.858	<u>Influence on work situation:</u> Overweight/obesity +, p < 0.001, OR=0.76 Central obesity	Overweight/obesity NS, data are not shown Central obesity NS, p= 0.09, OR=0.87	Smoking, alcohol use and waist-to-hip ratio	

+, p= 0.008, OR=0.81

Han & Trinkoff 2011, USA Nurses Worklife & Health Study	Nurses	2103 women mean age 47 yrs	Job demand (psychological exertion) Job control (enough work control)	Overweight/obesity BMI \geq 25 kg/m ²	NS, p= 0.47 OR=0.95, (0.84-1.08)	NS, p= 0.68 OR=1.02, (0.89-1.15)		Age, race, smoking, alcohol use, education, nursing position, physical job demands, support at work, depressive symptoms, exercise and sleep
Landsbergis et al. 1998, USA	Employees, cross-sectional Employees, 3-year follow-up	285 men, 30-60 yrs 200 men, 30-60 yrs at baseline	Decision latitude: (cont.) Job demand (cont.) Job strain: high vs. other (ref.)	Overweight at baseline: BMI > 27.8 kg/m ² Overweight: BMI > 27.8 kg/m ²	NS OR=1.0, (0.7-1.2) NS OR=1.1, (0.8-1.5)	NS OR=1.0, (0.7-1.4) NS OR=0.9, (0.6-1.3)	NS OR=1.8, (0.9-3.4) NS OR=0.9, (0.3-2.1)	Age, education, race, marital status and number of children

Changes in weight-related measures over time

Martikainen & Marmot, 1999, UK Whitehall II	Civil servants, 8-year follow-up	7973 men and women, 35-55 yrs at baseline	Job control: good (ref.), intermediate (I) and poor (P)	Gain in BMI from age of 25 yrs to the follow-up Gain of > 3 vs. gain of 0-3	M: + (I) OR=1.09 (0.93-1.27) (P) OR=1.23, (1.03-1.44) W: + (I) OR=1.26 (0.92-1.75), (P) OR=1.43 (1.05-1.93)		Age
Kivimäki et al. 2006, UK Whitehall II	Civil servants, 5-year follow-up	5 547 men, mean age 44 years	Job control (standardized mean score) Job demands (standardized mean score) Job strain: =job demand score - job control score	Weight gain and weight loss as 5-year change in BMI by baseline BMI (low, middle, high)	Weight gain by baseline BMI <u>Low</u> opposite OR=0.75, (0.63-0.90) <u>Middle</u> NS OR=0.94, (0.86-1.03) <u>High</u> NS OR=1.15, (0.97-1.37) Weight loss by baseline BMI <u>Low</u> opposite OR=1.33, (1.11-1.59) <u>Middle</u> NS OR=1.07, (0.97-1.17) <u>High</u> NS	Weight gain by baseline BMI <u>Low</u> NS OR=0.88, (0.76-1.01) <u>Middle</u> NS OR=1.00, (0.93-1.08) <u>High</u> + OR=1.22, (1.06-1.41) Weight loss by baseline BMI <u>Low</u> NS OR=1.14, (0.99-1.32) <u>Middle</u> NS OR=1.00, (0.99-1.08) <u>High</u> opposite	Age and employment grade

				OR=0.87, (0.73-1.03)		OR=0.82, (0.71-0.94)		
Ishizaki et al. 2008, Japan	Industrial employees, 6-year follow-up	2 200 men and 1 371 women, 30-53 y. old	6-year change in Job demand, job control and job strain (JD/JC): I (low) - low score at both time points, II (mixed) - low score at one point, high at another III (high)- high at both time points	6-year change in BMI (cont.)	M: NS, p=0.36 0.009, 0.013, 0.011 W: NS, p=0.56 0.021, 0.020, 0.017	M: NS, p=0.39 0.009, 0.010, 0.012 W: NS, p=0.92 0.019, 0.018, 0.019	M: NS, p=0.26 0.008, 0.010, 0.013 W: NS, p=0.26 0.018, 0.019, 0.020	Age, education, marital status sedentary job, sift work (men only), smoking, alcohol use, and exercise
				6-year change in waist circumference (cont.)	M: NS, p=0.16 0.018, 0.022, 0.016 W: NS, p=0.32 0.061, 0.057, 0.050	M: NS, p=0.18 0.016, 0.017, 0.021 W: NS, p=0.50 0.049, 0.057, 0.055	M: +, p=0.03 0.013, 0.019, 0.022, W: +, p=0.04 0.046, 0.055, 0.065,	
				Major changes in BMI above 75th percentile			M: NS II: OR= 1.05 (0.82-1.35) III: OR= 1.23 (0.95-1.59) W: NS II: OR= 1.05 (0.77-1.44) III: OR= 0.92 (0.66-1.29)	
				Major changes, above 75th percentile			M: + II: OR= 1.13 (0.87-1.46) III: OR= 1.39 (1.07-1.79) W: + II: OR= 1.27 (0.90-1.78) III: OR= 1.78 (1.26-2.52)	
				10- and 18- year weight gain		<u>10 year weight gain</u> M: NS, p=0.37 (a) 3.7 vs. (b) 3.0 W: + p=0.001 (a) 4.1 vs. (b) 0.7	<u>Change in mental strain before baseline and 10-year weight gain</u> M: NS, p=0.39 (a) 3.2 vs. (b) 4.0 W: NS, p=0.648 (a) 2.7 vs. (b) 2.3	Age
					<u>18 year weight gain</u> M: NS, p=0.62 (a) 7.1 vs. (b) 7.7 W: NS, p=0.63 (a) 9.6 vs. (b) 8.8	<u>18-year weight gain</u> M: NS, p=0.28 (a) 7.8 vs. (b) 6.6 W: NS, p=0.569 (a) 8.7 vs. (b) 9.7		
Lallukka et al. 2008, Finland Valmet	Industrial employees, 10- 18- and 28-year follow-up	449 men and women, 17-36 yrs at baseline	<u>Change in work pace (demands) before baseline</u> (a) increased (b)decreased/ same (ref.) <u>Change in mental strain</u>			<u>10 year change in mental strain and 18-year weight gain</u> M: NS, p=0.73 (a) 7.2 vs. (b) 7.5 W: NS, p=0.426 (a) 9.9 vs. (b) 8.6		

			(before baseline and during 10 years): (a) increased (b)decreased/ same (ref.)	28-year major weight gain (at least 15 kg)		<u>change before baseline</u> M: NS OR=1.5 (0.8-2.8) W: + OR=3.4 (1.4-8.5)	<u>change before baseline</u> M: NS OR=0.8 (0.4-1.4) W: NS OR=2.0 (0.9-4.9)	Age, baseline BMI, education and occupational status
							<u>10-year change</u> M: NS OR=0.7 (0.4-1.4) W: NS OR=2.0 (0.9-4.8)	
Lallukka et al. 2005, Finland Helsinki Health Study	White-collar employees, cross-sectional	8892 men and women, 40- 60 yrs	Job demands: very low (ref.), low (L), high (H), very high (VH) job control: very low (VL), low (L), high (H), very high (ref.), Mental strain: high (H), median (M), low (ref.)	Weight gain during preceding 12 months, self-reports (yes vs. no)	M: NS (VL) OR=0.95 (0.63-1.42) (L) OR=1.07 (0.74-1.55) (H) OR=0.92 (0.67-1.28) W: NS (VL) OR=0.96 (0.80-1.16) (L) OR=1.07 (0.90-1.26) (H) OR=1.03 (0.89-1.19)	M: NS (L) OR=0.69 (0.49-0.98) (H) OR=0.70 (0.48-1.03) (VH) OR=0.85 (0.57-1.28) W: NS (L) OR=1.11 (0.95-1.30) (H) OR=1.12 (0.94-1.32) (VH) OR=1.02 (0.85-1.23)	M: NS (M) OR=1.35 (0.95-1.90) (H) OR=1.45 (0.90-2.33) W: + (M) OR=1.10 (0.96-1.27) (H) OR=1.29 (1.06-1.55)	Age, education, marital status, physical strain at work and baseline BMI
Shields 1999, Canada, NPHS	General population, 2-year follow-up	3830 men and women, 25-54 yrs old	High job strain: yes/no	Unhealthy weight gain > 6.4% change in BMI (men) > 8.8% change in BMI (women)			M: NS OR=1.0, (0.6-1.7) W: + OR=1.8, (1.0-3.2)	Age, smoking, education, occupation, shift work, work hours and job insecurity
Hannerz et al. 2004, Denmark	Healthy employees 5-year follow-up	1980 men, 23-64 yrs at baseline	Decision authority: low (ref.), moderate (M), high (H) psychological demands: low (ref.), moderate (M), high (H)	5-year change in BMI	NS, p=0.2542 (H) -0.16, (-0.40, 0.08) (M) -0.03, (-0.28, 0.22)	NS, p=0.7602 for main effect (H) 0.06, (-0.15, 0.27) (M) 0.01, (-0.22, 0.23) + , p=0.0108 for interaction effect with baseline BMI largest gain in BMI was among obese at baseline with high job demands 1.22, (0.50-1.95)		Age, smoking, BMI at baseline, physical activity at work, and working hours
Overgaard et	Nurses,	6704	Busy in job (five	6-year weight	Job influence: -	Busy: U-shape		Job category,

al. 2004, Denmark Danish Nurse Cohort Study	6-year follow-up	women, 45-65 yrs	levels from never to often) Job speed (five levels from too low to too high) Job influence (four levels from major to no)	change	2.7, 2.7, 3.1, 4.1, p<0.05 for minor influence vs. major and p< 0.005 for no influence vs. major	3.5, 2.7, 2.5, 2.8, 3.1, p<0.05 for never busy and p< 0.001 for often busy vs. sometimes Speed: U-shape 4.0, 2.5, 2.6, 2.7, 2.9, p<0.005 for too high vs. suitable	weekly work hours, shift work, physical activity at job and at leisure, marital status, smoking, alcohol use, menopause, and baseline BMI	
Block et al. 2009, USA MIDUS	General population, 9-year follow-up	1355 men and women, < 65 yrs	Skill discretion Decision authority Job-related demands	9-year change in BMI Change by baseline BMI	<u>Skill discretion</u> M: NS, p=0.72, β =0.06, W: NS, p=0.84, β =-0.05 <u>Decision authority</u> M: NS, p=0.83, β =0.03 W: NS, p=0.3, β =0.23	<u>Main effect</u> M: NS, p=0.3 for main effect, β =0.18 W: NS, p=0.15 for main effect, β =0.38 <u>By baseline BMI</u> M: +, p< 0.001, β =0.16 W: +, p< 0.001, β =0.18	Age, race, income, smoking status, mental disorders (anxiety, depression or panic attacks), diabetes and self-rated health	
Landsbergis et al. 1998, USA	Employees, 3-year follow-up	200 men, 30-60 yrs	Change in decision latitude, job demand and job strain (high vs. other (ref.))	Overweight status at baseline and follow-up Normal weight (N) Overweight (O): BMI > 27.8 kg/m ² NN (ref.), NO, ON, OO	NS Mean scores 0.11 (NN), -0.19 (NO), 0.19 (ON) and 0.81 (OO)	NS Mean scores -0.33 (NN), -3.47 (NO), -6.32 (ON) and -0.49 (OO)	NS Mean scores -0.02 (NN), -0.11 (NO), -0.15 (ON) and -0.04 (OO)	Age, education, race, marital status and number of children
Continuous weight related-measures								
Kivimäki et al. 2006, UK Whitehall II	Civil servants, 5-year follow-up	7965 men and women, 35-55 yrs at baseline	Job control (standardized mean score) Job demands (standardized mean score) Job strain:=job demand score - job control score	BMI	M: NS, p=0.28, β =-0.028 W: NS, p=0.79, β =-0.013	M: NS, p=0.23, β =0.026 W: +, p=0.03, β =0.099	M: NS, p=0.82, β =0.005 W: NS, p=0.14, β =0.062	Age, employment grade and BMI at baseline
Kivimäki et al. 2002,	Industrial employees,	594 men and	Job control (tertiles)	BMI	Mean BMI H: 24.7; I: 25.1; L: 25.3	Mean BMI L: 24.8; I: 25.1; H: 25.2	Age, sex and baseline BMI	

Finland Valmet	10-year follow-up	women, mean age 40 yrs	Job strain: high (H), low (L), intermediate (I)		p=0.008 for trend		p=0.151 for trend	
Fernandez et al. 2010, USA	Employees of 11 worksites within a single corporation, cross-sectional	2782 men and women, mean age 47 yrs	Job strain: passive (ref.), high (H), low (L), active (A)	BMI			H: $\beta=0.89$, $p < 0.05$, L: $\beta=0.09$, $p > 0.05$, A: $\beta=0.39$, $p > 0.05$	Age, gender, race, income, education, smoking and job insecurity
Jönsson et al. 1999, Sweden MONICA	General population, cross-sectional	1518 men and women, 25-64 yrs old	Decision latitude (tertiles) Psychological demand (tertiles) Job strain: high strain: no strain (ref.), other	BMI WHR	Mean BMI M: NS 26.3, 25.2, 25.9 W: NS 24.5, 24.5, 24.4	Mean BMI M: +, $p=0.01$ 25.4, 25.6, 26.3 W: NS 24.3, 24.4, 24.7	Mean BMI M: NS; 26.0, 25.7 W: NS; 24.3, 24.4 Mean WHR M: +, $p=0.025$; 0.92, 0.91 W: NS; 0.80, 0.79	Age
Hellerstedt & Jeffery, 1997, USA Healthy Worker Project	Employees of 32 worksites, cross-sectional	3843 men and women, mean age 38 yrs	Job latitude (quartiles) Job demands (quartiles) Job strain: high (H), low (L), active (A), passive (P)	BMI	M: NS 26.4, 26.3, 26.6, 26.6 W: NS 25.2, 25.1, 24.8, 25.0	M: NS 26.6, 26.5, 26.5, 26.6 W: +, $p < 0.05$ 24.7, 24.9, 25.1, 25.5	M: NS 26.6 (H), 26.7 (L), 26.5 (A), 26.4 (P) W: +, $p < 0.05$ 25.6 (H), 24.9 (L), 24.9 (A), 24.8 (P)	Age, race, marital status, education, job category, length of employment, salary, weekly working hours, environmental exposures and physical exertion
Ishizaki et al. 2004, Japan	Industrial employees, cross-sectional	6876 men and women, 20-58 yrs	Job demands (tertiles) Job controls (tertiles)	BMI WHR	M: NS, $p=0.11$, $\beta=-0.10$ W: NS, data not shown M: NS, data not shown W: NS, $p=0.1$, $\beta=0.003$	M: NS, data not shown W: NS, data not shown M: NS, $p=0.07$, $\beta=-0.001$ W: NS, $p=0.14$, $\beta=-0.002$		Age, education, smoking, alcohol use, exercise, sedentary work, shift work, overtime work and social support
Laaksonen et al. 2005, Finland Helsinki Health	White-collar employees, cross-sectional	8947 men and women, 40-60 yrs	Job demand Job control	BMI	M: NS, $p=0.10$, $r=-0.04$ W: -, $p < 0.001$, $r=-0.04$	M: NS, $p=0.23$, $r=-0.03$ W: NS, $p = 0.33$, $r=0.01$		Age

Study

Kouvonen et al. 2005, Finland Finnish Public Sector Cohort Study	Public sector employees, 10 towns and 21 hospitals, cross-sectional	45810 men and women, 17-65 yrs	Individual (I) and aggregated (A) stress scores: Job demand Job control Job strain (ratio of job demand to job control)	BMI	M: I: $\beta=-0.06$, $p<0.001$ A: $\beta=-0.12$, $p<0.001$ W: I: $\beta=-0.02$, $p<0.001$ A: $\beta=-0.09$, $p<0.001$	M: I: $\beta=0.00$, $p>0.05$ A: $\beta=-0.08$, $p<0.001$ W: I: $\beta=-0.01$, $p<0.05$ A: $\beta=-0.01$, $p>0.05$	M: I: $\beta=0.04$, $p<0.001$ A: $\beta=0.04$, $p<0.001$ W: I: $\beta=0.02$, $p<0.001$ A: $\beta=0.07$, $p<0.001$	Age, marital status, job contract, smoking, alcohol consumption, leisure-time physical activity and negative affectivity
Brisson et al. 2000, Canada	White-collar full-time workers, cross-sectional	6995 men and women, 18-65 yrs	Decision latitude (quartiles) Psychological demand (quartiles) Job strain: low (L), active (A), passive (P), high (H)	BMI	M: NS Mean 25.5, 25.4, 25.3, 25.6 W: NS Mean 23.7, 23.5, 23.5, 23.6	M: NS Mean 25.6, 25.4, 25.5, 25.4 W: NS Mean 23.4, 23.8, 23.6, 23.6	M: NS Mean 25.5 (L), 25.5 (A), 25.5 (P), 25.3 (H) W: NS Mean 23.6 (L), 23.4 (A), 23.6 (P), 23.6 (H)	Age, education, physical activity at work, social support at work and outside of work, and personality
Amick et al. 1998, USA	Nurses	33 689 women 45-72 yrs old	Job strain: low strain (L), high strain (HS), active (A), passive (P)	BMI			NS Mean 26.4 (L), 25.9 (HS), 25.9 (A), 26.1 (P)	Age
Ostry et al. 2006, Australia	General population, cross-sectional	882 men and women, 18-51 yrs old	Job demand: low (ref.), high Job control: high (ref.), low Job strain: low (ref.), active (A), passive (P), high (H)	BMI	M: NS, $p=0.34$, $\beta=-0.40$ W: NS, $p=0.31$, $\beta=-0.48$	M: +, $p=0.04$, $\beta=0.87$ W: NS, $p=0.61$, $\beta=0.23$,	M: NS A: $\beta=0.86$, $p=0.14$; P: $\beta=-0.34$, $p=0.54$; H: $\beta=0.50$, $p=0.42$ W: NS A: $\beta=-0.06$, $p=0.94$; P: $\beta=-0.68$, $p=0.29$; H: $\beta=-0.31$, $p=0.65$	Age, education and marital status
Kang et al. 2005, South Korea	Employees	152 men, mean age 35.1 yrs	Job demand Job control Job strain	BMI	NS, data not shown	NS, data not shown	NS, data not shown	None
Overgaard et al. 2004, Denmark Danish Nurse	Nurses, 6-year follow-up	6 704 women 45-65 yrs	Busy in job (five levels from never to often) Job speed (five levels from too	BMI	<u>Job influence:</u> in opposite direction, $p < 0.001$ 23.6, 23.4, 23.0, 23.1, 23.8	<u>Busy:</u> U-shape, $p=0.01$ 23.6, 23.1, 23.4, 23.5, 23.8		None

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low to too high)
Job influence
(four levels
from major to
no)

Speed:
U-shape, $p=0.04$
23.5, 24.3, 23.3, 23.5,
23.5

Berset et al. 2011, Switzerland	Employees, 2-year follow-up	72 men and women, mean age 41.9 yrs	Job demand Job control	BMI	+, $p < 0.01$, $\beta = -0.14$	NS, $p > 0.05$, $\beta = 0.07$	Age, gender, education, baseline BMI
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Table B2. Association of effort-reward imbalance (ERI) model with weight-related outcomes organized by weight-related outcome group, by study quality, by adjustment group and by year of publication.

Author, year and country	Study population and design	Sample size, gender and age (years)	Exposures	Outcome	Results			Adjustment for covariates
					Effort	Reward	Effort-reward imbalance (ERI)	
Kouvonen et al. 2006, Finland Finnish Public Sector Cohort Study	Public sector employees, cross-sectional	36127 men and women, 17-65 yrs	Aggregated score for job effort (tertiles): low (ref.), middle (M), high (H) job reward (tertiles): low (L), middle (M), high (ref.) ERI as ratio of effort to reward (tertiles): low (ref.), middle (M), high (H)	Overweight/obesity: BMI \geq 25 kg/m ²	M: NS (M) OR=0.84, (0.71-0.99) (H) OR=0.96, (0.82-1.13) W: opposite (M) OR=0.99, (0.93-1.05) (H) OR=0.93, (0.87-0.99)	M: NS (M) OR=1.09, (0.93-1.29) (H) OR=1.12, (0.96-1.31) W: NS (M) OR=0.96 (0.90-1.02) (H) OR=1.03, (0.96-1.11)	M: NS (M) OR=1.00, (0.89-1.13) (H) OR=1.08, (0.95-1.23) W: + (M) OR=0.98, (0.92-1.04) (H) OR=1.08, (1.02-1.15)	Age, education, marital status and type of job contract
Inoue et al. 2010, Japan	Permanent and fixed-termed workers, cross-sectional	709 men, 30-49 yrs	ERI as ratio of effort to reward: < 1 -low ERI (ref.) \geq 1 high ERI	Obesity: BMI \geq 25 kg/m ²			Permanent: NS OR=1.90 (0.96-3.75) Fixed-term: + OR=2.84 (1.78-4.53)	Age, smoking, alcohol use, occupational category, working hours, exercise and sleep
Lallukka et al. 2008, Finland Valmet	Industrial employees, 10- 18- and 28-year follow-up	449 men and women, 17-36 yrs at baseline	Job efforts: low (L), medium (M), high (H) Job rewards: low (L), medium (M), high (H) ERI: low (L), medium (M), high (H)	10- and 18-year weight gain	<u>10 year weight gain</u> M: +, p=0.012 1.6 (L), 4.8 (M), 2.7 (H) W: NS, p=0.421 5.1 (L), 2.4 (M), 2.4 (H) <u>18 year weight gain</u> M: NS, p=0.289 9.3 (L), 6.5 (M), 7.6 (H) W: NS, p=0.173 7.3 (L), 11.0 (M), 8.1 (H)	<u>10 year weight gain</u> M: NS, p=0.234 3.2 (L), 4.2 (M), 2.7 (H) W: NS, p=0.540 2.5 (L), 3.1 (M), 1.8 (H) <u>18 year weight gain</u> M: NS, p=0.664 8.1 (L), 7.3 (M), 6.9 (H) W: NS, p=0.394 10.8 (L), 8.2 (M), 9.0 (H)	<u>10 year weight gain</u> M: NS, p=0.444 3.0 (L), 4.1 (M), 3.6 (H) W: NS, p=0.834 2.2 (L), 2.8 (M), 3.0 (H) <u>18 year weight gain</u> M: NS, p=0.433 7.3 (L), 6.7 (M), 8.7 (H) W: NS, p=0.594 8.3 (L), 9.7 (M), 10.5 (H)	Age
Kivimäki et al. 2002, Finland Valmet	Industrial employees, 10-year follow-up	594 men and women, mean 40 yrs	ERI (tertiles): low (L), intermediate (I), high (H)	BMI			+ , p=0.002 L: 24.8; I: 25.1; H: 25.4	Age, sex and baseline BMI
Kouvonen et al. 2005,	Public sector	45810 men	Individual (I) and aggregated (A)	BMI			M:	Age, marital status, job

Finland Finnish Public Sector Cohort Study	employees, cross- sectional	and women, 17-65 yrs	ERI (a ratio of effort to reward)				I: $\beta=0.03$, $p < 0.05$, A: $\beta=0.07$, $p < 0.001$ W: I: $\beta=0.01$, $p > 0.05$, A: $\beta=0.06$, $p < 0.001$	contract, smoking, alcohol consumption, leisure-time physical activity and negative affectivity
Ostry et al. 2006, Australia	General population, cross- sectional	882 men and women, 18-51 yrs old	Job effort: low (ref.), high Job reward: high (ref.) , low ERI -ratio of effort to reward (cut-off at 1.0)	BMI	M: +, $p < 0.01$, $\beta=1.26$ W: NS, $p=0.14$, $\beta=0.67$	M: NS, $p=0.76$, $\beta=-0.13$ W: NS, $p=0.05$, $\beta=-0.87$	M: NS, $p=0.26$, $\beta=-1.19$ W: NS, $p=0.44$, $\beta=-0.98$	Age, education and marital status
Berset et al. 2011, Switzerland	Employees, 2-year follow-up	72 men and women, mean 41.9 yrs	ERI (direct measure, not ratio)	BMI			NS, $p > 0.10$, $\beta=0.09$	Age, gender, education, baseline BMI

Table B3. Association of job insecurity with weight-related outcomes organized by adjustment group, by weight-related outcome group, by study quality and by year of publication.

Author, year and country	Study population	Sample size, gender and age (years)	Job insecurity	Outcome	Results	Adjustment for covariates
Fernandez et al. 2010, USA	Employees of 11 worksites within a single corporation	2782 men and women, mean 47 yrs	Job insecurity (scale)	Overweight/obesity: BMI > 24.9 kg/m ²	NS (OR=1.03, 0.98-1.09)	Age, gender, race, income, education, smoking and job strain
Ferrie et al. 2002, UK, Whitehall II	Civil servants, 2-year follow-up	3360 men and women, 35-55 yrs at baseline	2-year change in job insecurity: (a) insecure to secure (b) secure to insecure (c) chronic insecurity	2-year change in BMI	M: NS (a) 0.17 (-0.3 - 0.7), p=0.52 (b) -0.16 (-0.8 - 0.5), p=0.61 (c) -0.53 (-1.1 - 0.0), p=0.05 W: NS (a) 0.19 (0.0 - 0.4), p=0.08 (b) 0.23 (-0.1 - 0.5), p=0.16 (c) 0.06 (-0.2 - 0.3), p=0.64	Age, employment grade and baseline job insecurity
Shields 1999, Canada, NPHS	General population, 2-year follow-up	3830 men and women, 25-54 yrs	Job insecurity (yes/no)	Unhealthy weight gain > 6.4% change in BMI (men) > 8.8% change in BMI (women)	M: NS OR=1.3 (0.8-1.9) W: NS OR=0.9 (0.5-1.6)	Age, education, smoking, occupation, shift work, work hours and work stress
Hannerz et al. 2004, Denmark	Healthy employees, 5-year follow-up	1980 men 23-64 yrs at baseline	Job insecurity (yes/no)	5-year change in BMI	+, p=0.0157; 0.20 (0.04- 0.35)	Age, smoking, BMI at baseline, working hours, physical activity at work and psychological workload
Fernandez et al. 2010, USA	Employees of 11 worksites within a single corporation	2782 men and women, mean 47 yrs	Job insecurity (scale)	BMI	NS, p> 0.05, β=0.05	Age, gender, race, income, education, smoking and job strain

Table C. Association of long work hours with weight-related outcome organized by weight-related outcome group, by study quality, by adjustment group and by year of publication.

Author, year and country	Study population	Gender, age (years), sample size	Long working hours (LWH)	Outcome	Results	Adjustment for other covariates
Overweigh or obesity						
Lallukka et al. 2008, UK, Finland, Japan Helsinki Health study Whitehall II Civil Servant	White-collar employees, cross-sectional	Both, 45-60 yrs, 3397 (UK) 6070 (FIN) 2213 (J)	Working overtime (a) > 40 h/w; (b) ≤ 40 h/w (ref.)	Obesity: BMI ≥ 30 kg/m ² (UK & FIN), BMI ≥ 25 kg/m ² (J)	M: <u>UK</u> OR= 1.00 (0.81-1.49) <u>FIN</u> OR= 1.27 (0.83-1.95) <u>J</u> OR= 0.85 (0.61-1.88) W: <u>UK</u> OR= 1.68 (1.09-1.59) <u>FIN</u> OR= 1.09 (0.86-1.38) <u>J</u> OR= 0.72 (0.40-1.29)	Age, education and marital status
Choi et al. 2010, USA MIDUS II	General population, cross-sectional	219 men and women, 32-69 yrs.	Weekly working hours in the main job: (a) <40 h/w (ref.) (b) ≥ 40 h/w	General obesity: BMI ≥ 30 kg/m ² Central obesity: Waist > 90 cm (men), Waist > 88 cm (women)	<u>General obesity</u> M: NS, data not shown W: +, OR=1.66, (1.12-2.44) <u>Central obesity</u> M: NS, data not shown W: NS, data not shown	Age, gender, psychosocial working conditions, health status and health behaviors
Uchiyama et al. 2005, Japan	Treated hypertensives, cross-sectional	1615 men and women, 40-65 yrs	Long working hours: > 10 h/day ≤ 10 h/day (ref.)	Obesity: BMI > 25 kg/m ²	M: NS, p=0.673 LWH - 39%; other- 37% W: NS, p=0.493 LWH - 42%; other- 47%	None
Belkić & Nedic 2007, Serbia	Healthy physicians, cross-sectional	112 women, 35-60 yrs	Number of working hours: (a) ≤ 40 h/w (ref.) (b) 41-47 h/w; (c) ≥ 48 h/w	Obesity: BMI ≥ 28 kg/m ²	+ (c) OR=2.24 (1.11-4.50)	Age, number of children, number of cigarettes smoked per day and physician category
Han et al. 2011, USA Nurses Worklife & Health Study	Nurses, cross-sectional	2103 women, mean 47 yrs	Long working hours	Overweight/obesity: BMI ≥ 25 kg/m ²	+ , p= 0.03 OR=1.14 (1.01-1.28)	Age, race, education, nursing position, physical job demands, support at work, physical demands at home, depression, exercise, sleep, smoking and alcohol use
Weight change						

Hannerz et al. 2004, Denmark	Healthy employees, 5-year follow-up	1980 men, 23-64 yrs. at baseline	Long working hours: (a) < 35 h/w (ref.) (b) 35-39 h/w (c) > 40 h/w	5-year change in BMI	NS , p=0.3728 (b) 0.13 (-0.22, 0.48); (c) 0.22 (-0.14, 0.59)	Age, smoking, BMI at baseline, physical activity at work and psychological work environment
Lallukka et al. 2008, Finland Valmet	Industrial employees, 10- and 28-year follow-up	449 men and women, 17-36 yrs. at baseline	Working overtime at baseline: (a) no or occasionally, (b) 1-5 h weekly, (c) \geq 6 h weekly 10-year change in working hours: (a) no change, (b) reduced, (c) increased	10- and 18- year weight gain	Working overtime at baseline and <u>10-year weight gain</u> M: + , p=0.046 for trend (a) 2.7, (b) 3.4, (c) 5.3, p< 0.0005 W: opposite , p=0.03 for trend (a) 2.7, (b) 4.8, p< 0.0005, (c) -0.4 <u>18-year weight gain</u> M: NS , p=0.270 for trend (a) 6.8, (b) 7.2, (c) 9.0, W: NS , p=0.999 for trend (a) 9.2, (b) 9.3, (c) 9.1, 10-year change in working time and <u>18-year weight gain</u> M: NS , p=0.708 for trend (a) 7.3, (b) 7.9, (c) 6.7 W: NS , p=0.843 for trend (a) 9.4, (b) 9.2, (c) 8.2	Age
Lallukka et al. 2008, Finland Valmet	Industrial employees, 10- and 28-year follow-up	449 men and women, 17-36 yrs old at baseline	Working overtime at baseline: (a) no or occasionally, (b) 1-5 h weekly, (c) \geq 6 h weekly 10-year change in working hours: (a) no change, (b) reduced, (c) increased	Major weight gain (gained at least 15 kg) during 28 years	<u>Working overtime at baseline</u> M: + (b) OR=1.9 (0.9-4.0) (c) OR=3.6 (1.6-8.2) W: + (b) OR=1.5 (0.4-4.8) (c) OR=2.9 (0.99-8.7) <u>10-year change in working hours</u> M: opposite (b) OR=3.3 (1.5-7.6) (c) OR=1.6 (0.4-2.8) W: NS (b) OR=1.2 (0.3-4.2) (c) OR=0.6 (0.1-2.7)	Age, baseline BMI, education, occupational status and baseline BMI
Lallukka et al. 2005, Finland Helsinki Health Study	White-collar employees, cross-sectional	8892 men and women, 40-60 yrs.	Working overtime: (a) > 40 h/w; (b) \leq 40 h/w (ref)	1-year (retrospective) weight gain: yes vs. no	M: + , OR=1.36 (1.00-1.83) W: + , OR=1.21 (1.02-1.43)	Age, education, marital status and physical strain at work

Shields 1999, Canada, NPHS	General population, 2-year follow-up	3830 men and women, 25-54 yrs old	2-year change in working hours reduced: <34 h/w standard: 35-40 h/w long: >41h/w (1) stand- stand (ref.) (2) stand-long (3) stand-red (4) Long-long (5) long-red	Unhealthy weight gain > 6.4% change in BMI (men) > 8.8% change in BMI (women)	M: + (2) OR=2.2 (1.2-4.0) (3) OR=1.5 (0.7-3.4) (4) OR=1.3 (0.8-2.1) (5) OR=1.2 (0.6-2.1) W: NS (2) OR=0.8 (0.3-2.2) (3) OR=0.6 (0.2-1.3) (4) OR=0.9 (0.4-1.9) (5) OR=0.5 (0.2-1.1)	Age, smoking, education, occupation, shift work, job insecurity and work stress
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Continues weight related measure

Ishizaki et al. 2004, Japan	Industrial employees, cross-sectional	6742 men and women, 20-58 yrs.	Sum of overtime working hours during the past month M: < 20 h, 20-40 h, 40-60 h ≥ 60h, W: < 20 h, ≥ 20h	BMI Waist-hip-ratio (WHR)	BMI M: NS (data not shown) W: NS (data not shown) WHR M: NS (data not shown) W: NS (data not shown)	Age, education, smoking, exercise, alcohol use, sedentary work, shift work and social support
Virtanen et al. 2010, UK Whitehall II	White-collar employees, cross-sectional	7287 men and women, mean 48.7 yrs.	Overtime hours (a) no overtime (b) 1h (c) 2h (d) 3-4 h	BMI	NS, p=0.48 (a) 25.1, (b) 25.1, (c) 25.3 and (d) 25.23	None
Nakamura et al. 1998 Japan	White-collar workers, 3-year follow-up	248 men	Working time during the previous 3 years LWH: > 40 h/w no: < 40 h/w	3-year change in BMI 3-year change in waist circumference	+ , p=0.0289; β=-0.103 + , p=0.0175; β=0.0405	Age
Tarumi et al. 2003, Japan	White-collar workers, cross-sectional	867 men and women, 20-60 yrs.	Working hours: (a) < 44.9 h/w (b) 45-49.9 h/w (c) ≥ 50 h/w	BMI	+ , p< 0.001 (a) 22.6, (b) 23.6 and (c) 23.8	None
Ostry et al. 2006, Australia	General population, cross-sectional	882 men and women, 18-51 yrs.	Number of hours worked per week: (a) ≤ 35 h/w (b) 36 - 40 h/w (c) ≥50 h/w	BMI	M: +, (a) β=1.35, p=0.03; (b) β=1.86, p<0.01 W: NS, (a) β=0.05, p=0.92; (b) β=0.48, p=0.47	Age, education and marital status