Please cite the original version: Svärd, A. ; Pipping, H. ; Lahti, J. ; Mänty, M. ; Rahkonen, O. ; Lahelma, E. ; Lallukka, T. (2018) Joint association of overweight and common mental disorders with diagnosis-specific disability retirement. Journal of occupational and environmental medicine. July 16, 2018 - Volume Publish Ahead of Print.

doi: 10.1097/JOM.0000000000001409

Journal of Occupational and Environmental Medicine, Publish Ahead of Print

DOI : 10.1097/JOM.0000000000001409

Joint association of overweight and common mental disorders with diagnosis-specific disability retirement: A follow-up study among female and male employees

Running title: Overweight and common mental disorders

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Funding: AS was supported by Finska Läkaresällskapet. JL was supported by the Academy of Finland (Grant #1294566). MM was supported by the Finnish Work Environment Fund (grant #115182) and the Juho Vainio Foundation. OR was supported by the Academy of Finland (grant #1294514) and the Juho Vainio Foundation. EL was supported by the Academy of

Finland (grant #1257362). TL was supported by the Academy of Finland (grant #287488 and #294096).

Competing interests: The authors declare no conflict of interest.

Acknowledgments: We thank the City of Helsinki and all the participating employees.

Abstract

Objective: We examined the joint association of overweight and CMD (common mental disorders) with diagnosis-specific disability retirement among midlife employees.

Methods: Baseline surveys (n=8960, response rate 67%) were linked with registers of the Finnish Centre of Pensions. We calculated the hazard ratios (HR) for disability retirement due to any, musculoskeletal and mental diagnoses (ICD-10) with Cox regression analysis (mean follow-up 8.3 years) among normal weight (body mass index 18.5-25 kg/m²) and overweight (≥25 kg/m²) participants with or without CMD (General Health Questionnaire-12 score ≥3).

Results: Overweight was associated with disability retirement due to any and musculoskeletal diagnoses and CMD with any and mental diagnoses. The risk for disability retirement was additively higher for those with both overweight and CMD.

Conclusions: Preventing overweight and CMD, and especially considering those with both conditions simultaneously, likely helps maintain work ability.

Key words: Joint effect; overweight; General Health Questionnaire; register data; ageing employees; work disability

Introduction

Both overweight and mental ill-health are major public health issues. In Finland, as in many other Western countries, approximately half of adults are overweight, one-fifth are obese and one-fourth suffer from depressive symptoms annually.[1–3] Obesity and mental disorders are not only major risk factors for somatic ill-health,[4–8] but also for poor quality of life[9,10] and sickness absence[11–13] and disability retirement[14–20]. Together, mental disorders and musculoskeletal diseases account for two thirds of the disability retirements in Finland.[21]

A large number of studies have shown an association between overweight and mental disorders.[22–24] However, the association is complex and especially the joint association between simultaneous overweight and common mental disorders (CMD) is poorly understood, even though both conditions might share a biological pathway[22] and are associated with similar outcomes, including disability retirement.

Many studies have shown that obesity is associated with disability retirement due to musculoskeletal[14–17] and cardiovascular diseases,[14,15,18,19] but also due to mental disorders[14,15,19,20] However, a Finnish study found no association between obesity and disability retirement due to mental disorders[18] and another Finnish study using the present cohort found that the risk for disability retirement due to mental disorders was increased among obese, but not among overweight participants.[16]

Similarly, another study using the same cohort data as the present one found that common mental disorders (CMD), measured with the General Health Questionnaire-12 (GHQ-12), are strongly associated with disability retirement due to mental disorders, but also with disability retirement in general and due to musculoskeletal diseases.[25] A further Finnish study showed

that participants with both musculoskeletal diseases and common mental disorders had a four-fold additive risk for disability retirement.[26]

The joint association between overweight and CMD is important to study in order to increase the understanding of these two risk factors for disability retirement. Due to the inversed age structure and efforts to extend work careers, it is especially important to study factors contributing to maintaining good work ability among ageing employees. Understanding the joint association between overweight and CMD can help focus prevention efficiently. To the best of our knowledge, the joint association between overweight and CMD is not yet studied, even though both factors are common risk factors for disability retirement, and probably linked. Therefore, we aimed to examine the joint association of simultaneous overweight and common mental disorders with the risk of subsequent diagnosis-specific disability retirement among Finnish female and male employees. In addition, we considered covariates including age, sociodemographic factors, workload, health behaviours and somatic health.

Methods

Data

The Helsinki Health Study (HHS) is a cohort study including municipal employees of the City of Helsinki, Finland.[27] The baseline mail surveys were sent to all employees turning 40, 45, 50, 55 and 60 in 2000-2002 (response rate 67%, N=8960). The majority of the respondents were women (82%), which reflects the gender distribution of the municipal sector in Finland. Of the participants 74% (n=6604) gave written consent to link the data with registers of the Finnish Centre for Pensions. Men, younger employees and manual workers were slightly

underrepresented, but according to non-response analyses, the data represent the target population satisfactorily.[27,28] We excluded pregnant (n=19), underweight (n=63, BMI <18.5 kg/m²), those who ever had received pension before the follow-up started (n=118), or retired (n=207) or died (n=4) during the first year of follow-up, and those with missing information on socioeconomic position (n=8), height or weight (n=38), or GHQ-12 (n=40). The final data consisted of 4776 women and 1331 men.

The ethics committees of the of the Department of Public Health, University of Helsinki and the health authorities of the City of Helsinki approved the Helsinki Health Study protocol.

Measures

Body mass index. We calculated the Body Mass Index (BMI) from the self-reported height (m) and weight (kg) by dividing the weight with the height squared (BMI=kg/m²). We used the World Health Organization criteria to categorize the participants as either normal weight (BMI 18.5-24.9 kg/m²) or overweight (BMI ≥25 kg/m²).

Common mental disorders. We used the 12-item General Health Questionnaire (GHQ-12) to examine common mental disorders (CMD).[29] GHQ-12 is an often used measure for CMD, consisting of twelve items, each with four response alternatives, scored 0-0-1-1, respectively.[30] A cut-off point between two and three scores (GHQ-12 score ≥3) has in previous studies shown optimal specificity and sensitivity for detecting more severe mental disorders among employees.[31]

Disability retirement. The data from the Finnish Centre for Pensions include information on all retirements in Finland. The data cover the date the disability retirement began, the type of retirement (permanent, temporary or part-time), and the medically confirmed diagnosis (ICD-

10) for the disability. We used the diagnoses to separately examine the risk for disability retirement due to musculoskeletal (M00-M99) and mental diagnoses (F00-F99) during a ten-year follow-up. The follow-up started when returning the baseline questionnaire in 2000-2002 and continued for ten years, or until the participant retired due to old age (n=768), could not anymore receive disability retirement due to old age (65 years before and 63 years after 2005) (n=1139), or died (n=67). Mean follow-up time was 8.3 years.

Covariates. Based on previous studies, we assumed that age, sociodemographic factors, workload, health behaviours and somatic health are associated with BMI, mental health and work disability, and these variables were therefore included as covariates.[16,20,25,26,32] Baseline age, calculated from the date of birth and the start of the follow-up, was treated as a continuous variable. Socioeconomic position (SEP) was derived from the employer's register or the baseline questionnaire and included four categories: managers and professionals, semi-professionals, routine non-manual employees, and manual workers. Marital status was dichotomized into married and cohabiting vs others. We used the CAGE-questionnaire[33] to measure drinking problems. Drinking problems were dichotomized using cut points two for women and three for men. Smoking status included smokers and non-smokers. Leisure-time physical activity was self-reported as an estimate of average weekly hours per four intensity grades i.e. walking, brisk walking, jogging, running, or their equivalent activities. Each physical activity intensity grade has a metabolic equivalent (MET) value[34], which when multiplied by the weekly hours and added together gives an estimate of the total leisure-time (MET) hours per week[35]. Participants with less than 14 MET-hours per week were categorized as physically inactive[36]. Work was categorized as physically strenuous or non-strenuous and similar procedure was followed for mental strenuousness of work. If the participant reported

ever having been diagnosed with gout, arthrosis, rheumatoid arthritis, angina pectoris, myocardial infarction, cerebral circulation disturbance, claudication or epilepsy we considered the participant to have a somatic disease.

Statistical analyses

First, we used cross-tabulation to describe the distribution of baseline characteristics among women and men according to disability retirement (Table 1). Second, we calculated disability retirement events due to any, musculoskeletal, and mental diagnoses by the four exposure groups (Table 2). The examined groups were based on BMI and CMD at baseline as following: 1) normal weight participants without CMD (BMI=18,5-24.9, GHQ-12 score=0-2), 2) normal weight participants with CMD (BMI=18,5-24.9, GHQ-12 score≥3), 3) overweight participants without CMD (BMI≥25, GHQ-12 score=0-2), 4) overweight participants with CMD (BMI≥25, GHQ-12 score≥3). Third, we calculated Kaplan-Meier curves to estimate the proportion of participants without disability retirement by the exposure groups (Figure 1). Fourth, we used Cox regression to calculate the hazard ratios (HR) and 95% confidence intervals (95% CI) for subsequent disability retirement due to any, musculoskeletal, and mental diagnoses among the exposure groups (Table 3). Normal weight participants without CMD served as the reference group. Model 1 adjusted for age, and models 2, 3, 4, and 5 adjusted for age and additionally for socio-demographic factors, workload, health behaviours and somatic health, respectively. We calculated Schoenfeld's residuals and found that the Cox proportional hazards assumptions held.[37] Finally, we calculated the synergy index (S) in order to examine the synergistic interaction between BMI and CMD using this equation: S =HR (overweight with CMD−1)/[(HR normal weight with CMD−1) + (HR overweight without CMD−1)]. We calculated the synergy index using both adjusted and unadjusted HR, but chose

to present the unadjusted results as the results were similar. A synergy index > 1 suggests that the joint association is synergistic, whereas a synergy index equal to 1 suggests an additive association and a synergy index < 1 an antagonistic assocition.[38] Women and men were examined separately. We conducted the analyses with IBM SPSS Statistics 24.

Results

One-tenth of the employees retired due to disability during the follow-up of ten years (Table 1). The mean age at baseline was 48.7 years among women and 49.6 years among men. Those who retired due to disability during the follow-up were more often overweight and had more often CMD at baseline than those who did not (Table 1). Smoking, physical inactivity, physical strenuousness of work among women, being single and having a lower socioeconomic position were more common among those who retired due to disability.

Disability retirement due to any diagnosis, and also due to musculoskeletal diseases and mental disorders, was most common among women and men with both overweight and CMD during the follow-up of ten years (Table 2, Figure 1). Disability retirement due to any, musculoskeletal and mental causes was more common among those with overweight or CMD than among those without (Table 2). Disability retirement due to mental disorders was especially common among those with CMD, whereas disability retirement due to musculoskeletal diseases was common among those with overweight but also those with CMD.

Compared to normal weight women without CMD, Cox regression analysis showed an association with subsequent disability retirement due to any diagnosis among both normal weight women with CMD (HR=2.35; 95% CI=1.75-3.15) and overweight women without

CMD (HR=1.76; 95% CI=1.38-2.24) and with CMD (HR=3.39; 95% CI=2.59-4.43) (Table 3). The synergistic interaction was weak (S=1.13). Also among men, there was an association with disability retirement due to any diagnosis among normal weight men with CMD (HR=2.20; 95% CI=1.00-4.87) and overweight men without CMD (HR=1.74; 95% CI=1.02-2.97) and with CMD (HR=3.01; 95% CI=1.66-5.43). The interaction was additive (S=1.03). Adjusting for somatic health, smoking, and among men also physical activity, slightly attenuated the associations, but they remained statistically significant among women and borderline significant among men.

Compared to normal weight women without CMD, the association with disability retirement due to musculoskeletal diseases was stronger among overweight women without CMD (HR=1.88; 95% CI=1.32-2.68) and with CMD (HR=3.27; 95% CI=2.20-4.84) (Table 3). The interaction between BMI and CMD was synergistic (S=2.27) and dominated by overweight. Among men the risk for disability retirement due to musculoskeletal diseases was increased for both overweight men without CMD (HR=3.17; 95% CI= 1.07-9.37) and likely also for normal weight men with CMD (HR=3.47; 95% CI=0.77-15.50). The interaction was antagonistic (S=0.73). Adjusting for somatic health in model 5 attenuated the associations.

Compared to normal weight women without CMD, the association with disability retirement due to mental disorders was stronger among normal weight women with CMD (HR=5.68; 95% CI=3.31-9.73) and also among overweight women without CMD (HR=1.68; 95% CI=0.96-2.94) (Table 3). The association among overweight women with CMD (HR=5.62; 95% CI=3.24-9.75) was similar to that of normal weight women with CMD. Among men the association was strongest for overweight men with CMD (HR=3.45; 95% CI=1.34-8.89). Among men, the interaction between BMI and CMD was dominated by CMD and weakly

synergistic (S=1.24). Adjusting for physical activity among men, and physical activity and problem drinking among women attenuated the results. Further adjustments for somatic health attenuated the results among men.

Discussion

Principal findings

We found that both overweight and CMD were associated with an increased risk for subsequent disability retirement due to any diagnosis. The risk was highest for those with simultaneous overweight and CMD. CMD dominated the associations with disability retirement due to mental disorders and overweight the associations with disability retirement due to musculoskeletal diseases. Overweight was weakly associated with disability retirement due to mental disorders, whereas CMD among normal weight men were associated with disability retirement due to musculoskeletal diseases. Among women, CMD contributed synergistically to the association between overweight and disability retirement due to musculoskeletal diseases.

Comparison to previous studies

Our results are in accordance with previous studies showing that both obesity and mental ill-health are associated with an increased risk for disability retirement. As in a previous study[25] we found that common mental disorders were associated with disability retirement due to mental disorders, but also with disability retirement due to any cause and musculoskeletal diseases. As in previous studies,[16] also high BMI associated with an increased risk for disability retirement due to any and musculoskeletal causes. The association with disability retirement due to mental disorders was, however, non-significant among overweight men

without CMD. In a previous study on this cohort there was no association with disability retirement due to mental disorders among the overweight employees, but the association increased gradually among the obese and severely obese employees.[16] We examined the obese (BMI≥30 kg/m²) separately in sensitivity analysis and found that there was an increased risk of disability retirement due to mental disorders among obese women without CMD (HR=2.63; 95% CI=1.33-5.19).

We found that overweight dominated the association with disability retirement due to musculoskeletal diseases and CMD dominated the association with disability retirement due to mental disorders. Among normal weight women CMD was not independently associated with disability retirement due to musculoskeletal diseases, but among overweight women CMD contributed synergistically to the association between overweight and disability retirement due to musculoskeletal diseases. Among men, however, both overweight and CMD were associated independently with disability retirement due to musculoskeletal diseases. A likely explanation for this might be that disability retirement due to musculoskeletal diseases among the reference group of normal weight men without CMD was small, compared to normal weight women without CMD. Overall, disability retirement due to musculoskeletal diseases was almost twice as common among women than men, and women also reported twice as often as men to have a physically strenuous work. In the sensitivity analysis we found that 16% of women with both overweight and CMD retired due to musculoskeletal diseases if they reported to have a physically strenuous work, whereas the number was 5% if their work was physically non-strenuous.

For disability retirement due to any diagnosis, the interaction between overweight and CMD was additive. This is in line with another Finnish study, which found that participants with musculoskeletal and common mental disorders were at a four-fold additive risk for disability retirement.[26] The authors concluded that those who had both disorders retired due to mental disorders more often than for other reasons. Similarly in our study, mental disorders was the most common cause of disability retirement among men with simultaneous overweight and CMD, whereas musculoskeletal diseases was the most common cause among women with simultaneous overweight and CMD.

Methodological considerations

The main strength of this study was the use of the prospective data based on a relatively large cohort of midlife female and male employees representing hundreds of different occupations. The register data on disability retirement included information on the medically confirmed diagnosis (ICD-10) for the disability retirement, which enabled us to deepen the understanding of the association between overweight, CMD and disability retirement. In addition, we were able to adjust for several relevant covariates.

There are also limitations. Firstly, women were in the majority in our cohort, however, this is in line with the gender distribution of the municipal sector in Finland. Due to the small number of men the statistical power was weak in some analyses. Secondly, data on height, weight, CMD and covariates were based on self-reports. However, previous studies have shown that the General Health Questionnaire-12 is a reliable and valid measure of self-reported mental disorders among employees,[31] and in a previous study on this cohort, self-reported BMI did predict sickness absence as accurately as measured BMI.[39] In the sensitivity

analysis we found that the estimates were higher for the obese than the overweight, but we chose to include four exposure groups because we were interested in examining the synergistic effect, which is based on an equation for four groups.[38] Thirdly, the baseline survey response rate (67%) and the number of participants consenting to register linkage (74%) were acceptable. However, non-response and healthy worker effect might be a problem, even though our previous non-response analysis has shown that these data represent the target population satisfactorily.[28,27] Finally, the study covered only midlife municipal Finnish employees and thus the generalization of the results on other populations is limited.

In sensitivity analyses we also tested that the estimates for a shorter (5 years) and a longer (13-15 years) follow-up were similar to the chosen follow-up of ten years. We chose to examine the risk for the first disability retirement, even though it is theoretically possible to have several periods of disability retirement with different diagnosis. However, such events occurred for less than one percent of the participants who had disability retirement in our cohort.

Conclusions

The risk for disability retirement was highest among those with simultaneous overweight and common mental disorders. Preventing overweight and common mental disorders, and especially considering those with both conditions simultaneously, likely helps maintain work ability.

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Figure legend

Figure 1. Estimated proportions of women and men without disability retirement by the exposure groups: Kaplan-Meier curves.

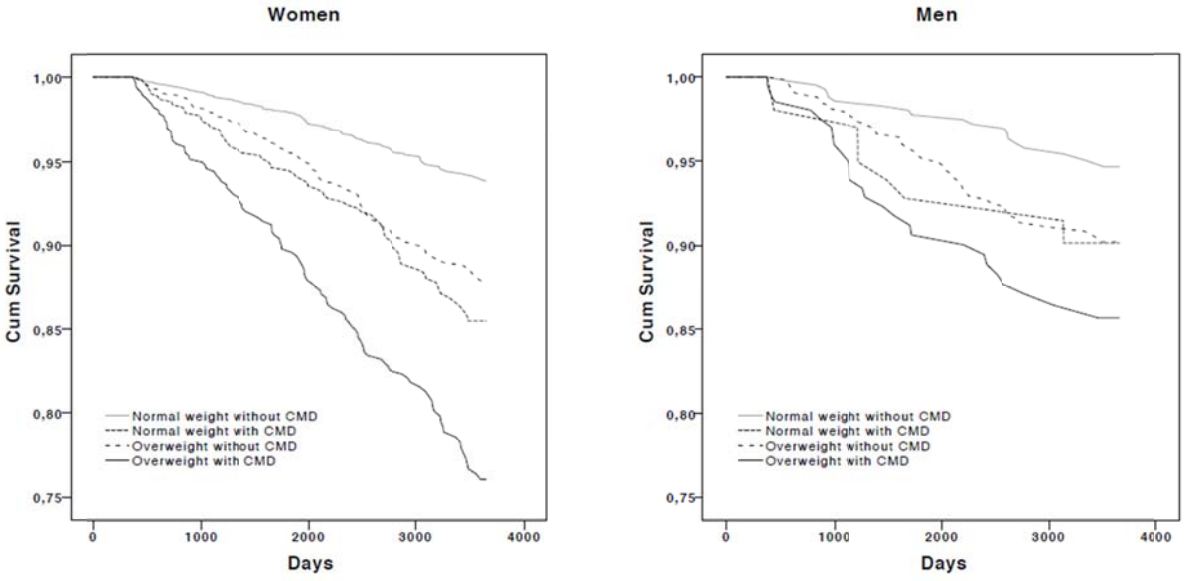

Table 1. Baseline characteristics among women and men according to subsequent disability retirement.

	Women				Men			
Characteristics at Phase 1	All n	no DP %	DP %	P-value[c]	All n	no DP %	DP %	P-value[c]
BMI[a]				0.00				0.01
Normal weight	2215	55	40		529	41	28	
Overweight or obese	2561	45	60		802	59	72	
CMD[b]	1169	23	40	0.00	306	22	35	0.004
Married/Cohabiting	3259	69	62	0.003	1026	78	69	0.053
Socioeconomic position				0.000				0.000
Managers/professionals	1344	30	14		592	46	26	
Semi-professionals	925	20	17		274	20	23	
Routine non-manual	976	41	48		126	9	19	
Manual workers	531	10	22		339	25	33	
Physically strenuous work	1788	35	56	0.00	196	14	20	0.134
Mentally strenuous work	3592	75	76	0.588	986	74	77	0.453
Smoker	1066	21	31	0.00	342	25	37	0.009
Drinking problem (CAGE)	769	16	19	0.128	317	24	26	0.636

Physically inactive (MET)	1129	23	27	0.043	341	25	40	0.001
Somatic health problem	1008	19	40	0.00	266	19	35	0.00
Total n (%)	4776	4313 (90)	463 (10)		1331	1230 (92)	101 (8)	

[a] Body mass index (BMI): normal weight 18.5-24.9 kg/m², overweight ≥ 25 kg/m²

[b] Common mental disorders (CMD, General Health Questionnaire-12 score ≥ 3)

[c] Chi-square test for proportions

Table 2. Disability retirement events (%) due to any, musculoskeletal, and mental diagnoses by the exposure groups.

	Joint group	n	Any	Musculoskeletal	Mental
Women	Normal weight without CMD	1949	5.5	2.5	1.1
	Normal weight with CMD	612	12.6	2.8	5.9
	Overweight without CMD	1658	10.2	5.2	1.8
	Overweight with CMD	557	19.7	9.3	5.9
	p-value		<0.001	<0.001	<0.001
	All overweight	2215	12.6	6.3	2.8
	All with CMD	1169	16.0	5.9	5.9
	Total	4776	9.7	4.3	2.5
Men	Normal weight without CMD	427	4.4	0.9	1.6
	Normal weight with CMD	102	8.8	2.9	3.9
	Overweight without CMD	598	7.9	3.0	2.3
	Overweight with CMD	204	12.7	3.9	5.4
	p-value		<0.01	0.08	0.04
	All overweight	802	9.1	3.2	3.1
	All with CMD	306	11.4	3.6	4.9
	Total	1331	7.6	2.5	2.7

Table 3. Joint association of BMI and CMD with subsequent disability retirement due to any, musculoskeletal, and mental diagnoses. Cox regression analysis, hazard ratios (HR) and 95% confidence intervals (95% CI).

		Model 1		Model 2		Model 3		Model 4		Model 5	
Any		HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Women	Normal weight without CMD	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
	Normal weight with CMD	2.35	1.75-3.15	2.47	1.84-3.32	2.35	1.75-3.15	2.34	1.75-3.14	2.25	1.68-3.02
	Overweight without CMD	1.76	1.38-2.24	1.57	1.23-2.01	1.68	1.31-2.14	1.77	1.38-2.26	1.68	1.31-2.14
	Overweight with CMD	3.39	2.59-4.43	3.28	2.51-4.30	3.34	2.55-4.37	3.26	2.49-4.29	3.04	2.32-3.98
Men	Normal weight without CMD	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
	Normal weight with CMD	2.20	1.00-4.87	2.24	1.01-4.96	2.10	0.95-4.65	1.95	0.88-4.33	2.04	0.92-4.52
	Overweight without CMD	1.74	1.02-2.97	1.56	0.91-2.66	1.74	1.02-2.96	1.66	0.97-2.84	1.61	0.94-2.75
	Overweight with CMD	3.01	1.66-5.43	3.01	1.67-5.45	2.93	1.61-5.31	2.60	1.42-4.74	2.67	1.47-4.86
Musculoskeletal		HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Women	Normal weight without CMD	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
	Normal weight with CMD	1.12	0.64-1.94	1.22	0.70-2.13	1.13	0.65-1.96	1.15	0.66-2.00	1.03	0.59-1.79
	Overweight without CMD	1.88	1.32-2.68	1.58	1.11-2.25	1.74	1.23-2.48	1.91	1.34-2.72	1.72	1.21-2.45

	Overweight with CMD	3.27	2.20-4.84	3.09	2.09-4.59	3.22	2.17-4.79	3.36	2.25-5.00	2.68	1.80-3.98
Men	Normal weight without CMD	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
	Normal weight with CMD	3.47	0.77-15.50	3.66	0.82-16.41	3.14	0.70-14.13	3.26	0.72-14.72	3.03	0.67-13.57
	Overweight without CMD	3.17	1.07-9.37	2.65	0.90-7.86	3.11	1.05-9.21	3.21	1.09-9.51	2.74	0.92-8.16
	Overweight with CMD	4.37	1.31-14.50	4.62	1.39-15.36	4.41	1.32-14.76	4.28	1.27-14.40	3.53	1.05-11.86
Mental		HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Women	Normal weight without CMD	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
	Normal weight with CMD	5.68	3.31-9.73	5.67	3.31-9.71	5.42	3.16-9.29	5.17	3.01-8.89	5.76	3.36-9.88
	Overweight without CMD	1.68	0.96-2.94	1.66	0.95-2.91	1.66	0.95-2.91	1.62	0.92-2.84	1.71	0.98-2.99
	Overweight with CMD	5.62	3.24-9.75	5.51	3.17-9.55	5.30	3.04-9.21	4.66	2.66-8.14	5.85	3.36-10.17
Men	Normal weight without CMD	1.00	-	1.00	-	1.00	-	1.00	-	1.00	-
	Normal weight with CMD	2.49	0.73-8.51	2.46	0.72-8.45	2.43	0.71-8.35	2.37	0.69-8.16	2.32	0.68-7.97
	Overweight without CMD	1.49	0.60-3.69	1.35	0.54-3.35	1.48	0.60-3.68	1.40	0.56-3.49	1.38	0.55-3.44
	Overweight with CMD	3.45	1.34-8.89	3.36	1.30-8.69	3.41	1.31-8.85	3.02	1.15-7.95	3.08	1.18-8.02

Model 1: Adjusted for age

Model 2: Adjusted for age and sociodemographic factors (marital status

and socioeconomic position)

Model 3: Adjusted for age and physical and mental workload

Model 4: Adjusted for age and health behaviours (smoking, problem drinking and physical activity)

Model 5: Adjusted for age and somatic health