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Covert coping with unfair treatment at work and risk of incident myocardial infarction and cardiac death among men: Prospective cohort study

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“What this paper adds” box:

What is already known on this topic

Studies show associations between covert coping with unfair treatment at work, hypertension and unfavourable lipid patterns. It is not known **whether** covert coping **also** predicts coronary heart disease.

What this study adds

In a cohort of Swedish men apparently free of coronary heart disease at baseline, covert coping behaviour was associated with an increased risk **of** future myocardial infarction **and** cardiac death.

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ABSTRACT (200 words excluding headings)

Objective: Covert coping with unfair treatment at work – **occurring** when an employee does not show the ‘aggressor’ that he/she **feels** unfairly treated – has been found to be associated with cardiovascular risk factors. We examine whether covert coping **also** predicts incident coronary heart disease.

Design: Prospective cohort study (the WOLF Stockholm study).

Settings: Workplaces in the Stockholm area, Sweden.

Participants: 2,755 men with no history of myocardial infarction at baseline screening in 1992-1995.

Main outcome measure: Hospitalisation due to myocardial infarction or death from ischemic heart disease until 2003 obtained from national registers (mean follow-up 9.8 ± 0.9 years).

Results: 47 participants had myocardial infarction or died from ischemic heart disease during the follow-up. After adjustment for age, **socio-economic** factors, **risk behaviours, job strain and** biological risk factors at baseline, **there was** a dose-response relationship between covert coping and risk of incident myocardial infarction or cardiac death (**p for trend** = 0.10). Men who frequently **used** covert coping had a 2.29 (95 % CI: 1.00 to 5.29) times higher risk than those **who did no use** this coping. **Restricting the analysis** to direct coping **behaviours only strengthened this association** (**p for trend** = 0.02).

Conclusions: In this study, covert coping is strongly related to increased risk of hard-end-point cardiovascular disease.

INTRODUCTION

Coping is defined as action-oriented and intra-psychoic efforts to manage the demands created by stressful events, and various measures to assess coping in specific stressful situation have been developed. [1-3] Coping responses can be divided into problem-focused coping, which involves addressing the problem that causes distress, and emotion-focused coping, which is aimed at ameliorating the negative emotions associated with the problem. [4] Although there is a clear individual component to a preferred coping pattern, environmental factors also play an important role. For example, it has been shown that subjects with low job control at work more often used a covert, avoiding coping style. [5]

Avoidant coping responses have been operationalised by Harburg et al. [6] According to his definition, covert coping refers “to a strategy of walking away from the conflict dealing with it indirectly and introvertly”. [7] There is evidence to show that covert coping is related to signs of coronary heart disease, high blood pressure, high levels of Apo-lipoprotein A1, as well as increased rates of sickness absence. [5, 8, 9] However, the underlying mechanisms still remain largely unknown. An often stated hypothesis is that circumstances that frequently evoke anger may result in psychophysiological tension which, in turn, facilitates the development of hypertension and related illnesses, particularly when anger is not expressed. [8, 10] The basic idea is that arousal that ‘boils under the surface’ and is not allowed to be constructively dealt with will cause physiological reactions. Indeed, the perception of unfair treatment has been shown to be associated with risk factors for cardiovascular disease. [11-13]

The aim of the present study was to explore whether covert coping is prospectively associated with risk of myocardial infarction (MI) and cardiac death among working men.

METHODS

Study population

Data were drawn from the WOLF (WOrk, Lipids, and Fibrinogen) Stockholm study; a prospective cohort study of employees initially aged 19 to 70 years, working in companies in the Stockholm area. [5, 14] Twenty occupational health units carried out the baseline screening

between November 1992 and June 1995. With 76% participation, 3,239 men and 2,459 women participated in a clinical examination and questionnaire survey. A more detailed description of the study **has** been given elsewhere. [5, 15] Records of hospital admissions and deaths by the end of 2003 were obtained from national registers and linked to the data. We restricted the analyses to men only, since the number of myocardial infarctions and cardiac deaths among women was too low ($n = 7$). We also excluded **466** men who lacked complete data on the studied variables and/or any of the adjustment variables and 18 men who had prevalent myocardial infarction at inclusion in the WOLF study, leaving **2,755** men in the studied population. Ethical approval for the WOLF Stockholm study was obtained from the regional ethics committee in Stockholm.

Assessment of Covert Coping

Coping with unfair treatment at work was measured by means of a questionnaire focusing on two different factors, 'covert' and 'open coping' with unfair treatment. **This questionnaire is based on a Swedish version of a questionnaire originally developed for a U.S. study on high blood pressure and has been extensively tested.** [5, 6, 9, 16] **Here we focus on covert coping.** After an opening question which asks how the subject usually reacts when treated in an unfair way or when getting into conflict with (a) a superior, or (b) a workmate, different sub-questions are given. Four sub-questions measure covert coping or the results thereof: 'Let things pass without saying anything', 'Go away', 'Feeling bad (headache, stomach aching etc.)' and 'Get into a bad temper at home'. The first two sub-questions concern the immediate reaction, whereas the last two questions are about possible consequences of covert coping. For each alternative, the subject should indicate on a 4-point scale to what degree it applies **to them**, from 1='never' to 4='always'. The same questions are asked regarding both superiors and workmates. Cronbach's alpha for the covert coping scale was **0.77** for the entire scale on covert coping; when excluding the questions addressing consequences of covert coping, Cronbach's alpha increased to 0.83. A sum score of covert coping ranging from 8 to 32 was calculated. For statistical analyses covert coping was, following our practice, categorised into low (lowest quartile, score 8-14), medium (second and third quartile, score 15-18) and high (upper quartile, score 19-32). [8] In a further step, we restricted calculations to the two items measuring the direct reaction and a sum score of covert coping ranging from 4 to 16, which also was categorised into low (score 4-7), medium (score 8-10) and high (score 11-16). For calculating the effect of each one of the covert coping

items on myocardial infarction risk we combined the response options 'seldom/never' for 'let things pass without saying anything' and 'often/sometimes' for the remaining questions. We chose this categorization due to a low number of cases in some cells.

Covariates

Education, smoking status (current smoker versus non-smoker), **drinking problems**, physical activity (from 1="sedentary" to 4="regular exercise"), diabetes, job demands, decision latitude, **and conflicts at the workplace** were self-reported. Education was categorised into low (7 to 10 years of education), intermediate (vocational school, 10 or 11 years of education), high (12 years or more), **and other education. Drinking problems were measured by a single question: 'Have you sought help during the last 10 years because of drinking problems?' with response alternatives 'yes' and 'no'. Diabetes was recorded by means of the question 'Do you have diabetes?' with response options 'yes' and 'no'. Job demands (five-item scale) and decision latitude (six-item scale) were measured by the Swedish Demand-Control Questionnaire and dichotomised (lower 80 % vs. upper 20 %). [17] Conflicts at the workplace were measured by an opening question: 'During the past 12 months, have you experienced one of the following life events?' One of these is conflicts at the workplace. Response alternatives are 'yes' and 'no'. The gross salary of 1994 was derived from the Income and Tax Register (IoT) and divided into quartiles.**

Systolic and diastolic blood pressure (mmHg) was measured on the right arm in the supine position after 5 minutes rest twice with 1-minute intermission. Height and weight were measured to determine body mass index (BMI, kg/m²). Blood samples were taken after an overnight fast and analyzed in the same laboratory (CALAB Medical Laboratories AB, Stockholm, Sweden) accredited by Swedish Board for Accreditation and Conforming Assessment. Total cholesterol (mmol/L) and high density lipoprotein (HDL) cholesterol (mmol/L) were measured enzymatically after precipitation with phosphotungstic acid and magnesium chloride. Low density lipoprotein (LDL) cholesterol concentration was calculated by the Friedewald formula. Fibrinogen in plasma (mmol/L) was determined by spectrometric test. Blood pressure, BMI, total cholesterol level and triglycerin were divided following the recommendations of the American Heart Association. [18] Systolic and diastolic blood pressure was divided into optimal (≤ 119

mmHg and ≤ 79 mmHg, respectively), pre-hypertensive (120-139 mmHg and 80-89 mmHg) and hypertensive (≥ 140 mmHg and ≥ 90 mmHg). BMI was divided into underweight and normal (< 25), overweight (25-29.9) and obese (≥ 30). Total cholesterol was divided into desirable (≤ 5.19 mmol/L), borderline-high risk (5.20-6.25 mmol/L) and high risk (> 6.25 mmol/L). Triglycerides were divided into normal (< 1.7 mmol/L), borderline (1.7-2.2 mmol/L) and high (> 2.2 mmol/L). The quotient total/HDL was following the literature divided into low (< 4.0) and high (≥ 4.0). [19, 20] Fibrinogen was divided into low (≤ 3.0 mmol/L) and high (> 3.0 mmol/L). [21]

Follow-up

Hard endpoint outcome for acute myocardial infarction was defined as *hospital admission* with a main diagnosis registered as acute myocardial infarction (the International Classification of Diseases, version 9 [ICD-9] code 410 or version 10 [ICD-10] code I21); or *death* with a registered underlying cause of coronary disease (ICD-9: 410-414; ICD-10: I20-I25) or cardiac arrest (ICD-9: 427; ICD-10: I46). Records of hospital admissions and deaths were obtained from 14 March 1963 until 31 December 2003. Incident cases were defined as the first event occurring after the baseline screening (November 1992 to June 1995). Those with prevalent ischemic disease at baseline were determined by a **registered** hospital admission for myocardial infarction between 1963 and the baseline screening, and they were excluded from the analysis (18 men). Follow-up time for cases was defined as the difference between the year of inclusion in the study and the year of the first event. The range was between one and 11 years.

Statistical Analysis

Time to the event was defined as the number of days between baseline screening and the first diagnosis after baseline and before 31 December 2003. For subjects with no events, the end of follow-up was 31 December 2003, or the date of death if earlier. Outcome of the analyses was a composite **measure** of acute MI and cardiac death. Cox proportional hazard regression models adjusting for potential confounders were constructed. Hazard ratios (HRs) are presented with their 95 % confidence intervals (CIs). In a first step we controlled for age solely. In further **successive** steps we additionally controlled for (a) demographic and socioeconomic factors (i.e. education, supervisory status, and income); (b) **behavioural risk factors (i.e. smoking, physical activity, and drinking problems;** (c) **job demands and decision latitude;** and (d) biological

risk factors (i.e. BMI, systolic and diastolic blood pressure, total cholesterol, total cholesterol/HDL cholesterol ratio, triglycerides, fibrinogen, and diabetes). The significance of the trend was assessed by using covert coping as a continuous variable in the regression model. Chi-square tests and analyses of variance were performed to evaluate the association between covert coping and control variables. **All individuals with any missing data on exposure or any covariate were excluded from any analyses.** We used SPSS for Windows version **17.0** for the statistical analyses.

RESULTS

Sample **characteristics by level of covert coping** are shown in Table 1. The participants were on average 41.5 years old at baseline and most of them highly educated and non-smokers. About a quarter of the subjects had supervisory status. Around half of the participants or more had favourable values on physiological risk factors. Among the **2,755** men included in the study, a total of **47** incident MI or cardiac death occurred during the mean follow-up period of 9.8 ± 0.9 years.

Table 1. Sample Characteristics stratified by Covert Coping, Short Index incl. only Behaviour
(n = 2,755 men)

Risk Factor at Baseline	Covert coping, short index (mean ± SD)		
	low	intermediate	high
Age, yrs*	40.9±10.6	41.4±10.6	42.4±11.7
Mean income 1994, US\$1000 per yr***	205±109	209±108	182±89
Demands (scale 1-4)**	2.1±0.4	2.1±0.4	2.2±0.4
Decision latitude (scale 1-4)***	1.9±0.6	1.9±0.5	2.0±0.6
	% (n)		
BMI			
Normal (<25 kg/m ²)	50.6 (362)	51.1 (669)	51.4 (375)
Overweight (25-29.9 kg/m ²)	42.2 (302)	40.5 (531)	40.8 (398)
Obese (≥ 30 kg/m ²)	7.1 (51)	8.4 (110)	7.8 (57)
Systolic blood pressure			
Optimal (≤ 119 mmHg)	37.5 (268)	38.2 (501)	36.6 (267)
Pre-hypertensive (120-139 mmHg)	50.5 (361)	47.2 (619)	47.9 (350)
Hypertensive (≥ 140 mmHg)	12.0 (86)	14.6 (191)	15.5 (113)
Diastolic blood pressure			
Optimal (≤ 79 mmHg)	63.8 (456)	65.0 (852)	61.8 (451)
Pre-hypertensive (80-89 mmHg)	28.5 (204)	26.4 (346)	28.1 (205)
Hypertensive (≥ 90 mmHg)	7.7 (55)	8.5 (112)	10.1 (74)
Total cholesterol			
Desirable (≤ 5.19 mmol/L)	41.4 (296)	41.2 (540)	40.5 (296)
Borderline risk (5.20-6.25 mmol/L)	34.7 (248)	33.4 (437)	37.1 (271)
High risk (>6.25 mmol/L)	23.9 (171)	25.4 (333)	22.3 (163)
Total / HDL cholesterol ratio			
Normal (<4.0 mmol/L)	52.7 (377)	48.9 (640)	49.2 (359)
High (≥ 4.0 mmol/L)	47.3 (338)	51.1 (670)	50.8 (371)
Triglycerides			
Normal (<1.7 mmol/L)	75.9 (543)	75.0 (982)	71.9 (525)
Borderline (1.7-2.2 mmol/L)	12.3 (88)	12.7 (166)	15.9 (116)
High/very high (>2.2 mmol/L)	11.7(84)	12.4 (162)	12.2 (89)
Fibrinogen			
Normal (≤ 3.0 mmol/L)	73.3 (524)	72.7 (953)	70.3 (513)
High (> 3.0 mmol/L)	26.7 (191)	27.3 (357)	29.7 (217)
Diabetes, yes	0.7 (6)	1.6 (21)	1.9 (14)
Education***			
Low	17.8 (127)	15.1 (298)	21.1 (154)
Intermediate	29.5 (211)	26.3 (345)	28.4 (207)
High	52.7 (377)	58.5 (767)	50.5 (369)
Supervisory status, yes***	27.8 (199)	26.5 (347)	14.1 (103)
Sought help for drinking problems, yes	1.3 (9)	1.1 (15)	1.1 (8)
Current smoker, yes	24.9 (178)	22.4 (294)	23.3 (170)

*** p ≤ .001; ** p ≤ .01; * p ≤ .05

Statistically significant differences between covert coping groups were found with regard to **age, income, demands and decision latitude at work, education, and supervisory status.**

Table 2 and 3 shows results **on the associations between** individual covert coping items **and risk**

of acute **myocardial infarction and** cardiac death. Men who **reported ‘going away’ when having a conflict with a workmate or a supervisor sometimes or often** had a more than tripled risk for MI or cardiac death compared with those who never go away. Showing this behaviour **seldom** when having a conflict with a **workmate also increased the risk noticeably. Those who ‘Let things pass without saying anything’ sometimes or often compared with those seldom or never let this happen had an increased risk for MI or cardiac death, although this did not reach statistical significance.** ‘Feeling bad’ and ‘getting into a bad temper at home’ were not associated with an increased risk of acute myocardial infarction or cardiac death.

Table 2. Age-adjusted Associations of Covert Coping When Treated Unfairly **by a Boss** with Hard End Point Myocardial Infarction or Cardiac Death among Men free of Myocardial Infarction at Baseline (n=2755).

How do you usually react if you are unjustly treated or become involved in a conflict...	No. of Men	Acute MI or Cardiac Death*	
		No. of (Events)	Hazard Ratio (95% CI)
...with a boss?			
Let things pass without saying anything			
Seldom or never	1406	17	1
Sometimes	954	20	1.76 (0.92-3.56)
Often	348	10	2.09 (0.95-4.60)
Go away			
Never	779	6	1
Seldom	1123	20	2.38 (0.95-5.92)
Sometimes or often	806	21	3.05 (1.23-7.58)
Feel bad (head or stomach ache etc)			
Never	1035	16	1
Seldom	1028	19	1.06 (0.54-2.206)
Sometimes or often	645	12	1.05 (0.49-2.22)
Get into a bad temper at home			
Never	761	15	1
Seldom	1114	16	0.72 (0.36-1.46)
Sometimes or often	833	16	1.03 (0.51-2.09)

*Includes acute MI (ICD-10: I21) necessitating hospitalization or death from ischemic heart disease (ICD-10:I20-level)

Table 3. Age-adjusted Associations of Covert Coping When Treated Unfairly *by a Workmate* with Hard End Point Myocardial Infarction or Cardiac Death among Men free of Myocardial Infarction at Baseline (n=2755).

How do you usually react if you are unjustly treated or become involved in a conflict...	No. of Men	Acute MI or Cardiac Death*	
		No. of (Events)	Hazard Ratio (95% CI)
...with a workmate?			
Let things pass without saying anything			
Seldom or never	1514	18	1
Sometimes	919	20	1.75 (0.92-3.31)
Often	275	9	2.10 (0.94-4.73)
Go away			
Never	788	4	1
Seldom	1123	23	4.08 (1.41-11.80)
Sometimes or often	797	20	4.45 (1.52-13.04)
Feel bad (head or stomach ache etc)			
Never	1077	17	1
Seldom	1070	21	1.12 (0.59-2.13)
Sometimes or often	5861	9	0.90 (0.40-2.02)
Get into a bad temper at home			
Never	829	17	1
Seldom	1147	16	0.76 (0.39-1.47)
Sometimes or often	732	12	0.86 (0.41-1.81)

*Includes acute MI (ICD-10: I21) necessitating hospitalization or death from ischemic heart disease (ICD-10:I20-level)

Table 4 shows the associations of covert coping with risk of acute myocardial infarction or cardiac death. A high score on covert coping **was associated with** more than **double** risk of acute myocardial infarction or cardiac death. The test for linear trend showed a **tendency** towards a significant effect, **which however decreased with adjustments for covariates.**

Table 4. Associations of Covert Coping (long scale) when Treated Unfairly with Hard End Point Acute Myocardial Infarction (MI) or Cardiac Death Among Men Free of Apparent MI at Baseline after Adjustment for Different Risk Factors at Baseline (n=2755).

				Model 1	Model 2	Model 3	Model 4	Model 5
	Score	n	Event (n)	HR (95 % CI) ^a	HR (95 % CI) ^b	HR (95 % CI) ^c	HR (95 % CI) ^d	HR (95 % CI) ^e
Long scale (behaviour and consequences)								
low	8-14	861	8	1	1	1	1	1
intermediate	15-18	988	18	1.81 (0.78-4.16)	1.84 (0.80-4.23)	1.92 (0.83-4.43)	1.92 (0.83-4.44)	1.72 (0.74-4.00)
high	19-32	859	21	2.30 (1.02-5.21)	2.31 (1.02-5.23)	2.36 (1.04-5.35)	2.35 (1.03-5.36)	2.29 (1.00-5.29)
Test for linear trend		2755	47	<i>P</i> = 0.079	<i>P</i> = 0.082	<i>P</i> = 0.080	<i>P</i> = 0.085	<i>P</i> = 0.098
Short scale (only behaviour)								
low	4-7	712	3	1	1	1	1	1
intermediate	8-10	1288	22	3.94 (1.18-13.16)	4.07 (1.21-13.63)	4.27 (1.27-14.32)	4.26 (1.27-14.30)	4.20 (1.25-14.13)
high	11-16	708	22	6.40 (1.91-21.45)	6.24 (1.86-21.00)	6.48 (1.92-21.81)	6.45 (1.92-21.75)	5.94 (1.75-20.20)
Test for linear trend		2755	47	<i>P</i> = 0.005	<i>P</i> = 0.008	<i>P</i> = 0.007	<i>P</i> = 0.007	<i>P</i> = 0.023

a adjusted for age, b adjusted for age and demographic and socioeconomic factors; c adjusted for **the same variables as in model 2** and **behavioural risk factors**; d adjusted for **the same variables as in model 3** and decision latitude and demand at work; e adjusted for **the same variables as in model 4** and **biological risk factors**

Tables 2 and 3 clearly show that only the two items measuring the immediate response to an unfair treatment were related to the outcome, **or showed a clear tendency of doing so**, but not those that **concerned** consequences of covert coping, i.e. ‘Feeling bad’ and ‘Getting into a bad temper at home’. Thus, in a further step, we restricted our analyses to the two items corresponding to the immediate response (or ‘avoidance and passive expectancy’ according to the Utrecht coping scale), [22] **and excluded the remaining items from the covert coping scale**. Subjects who often use covert coping **according to this shortened scale** had a more than 5-fold increased risk (HR=5.94; 95 % CI: 1.75 to 20.20) of myocardial infarction or cardiac death after adjustment for confounding variables (table 4). **Controlling for conflict at the workplace did not change the results substantially (HR=4.20; 95 % CI: 1.25 to 14.14 and HR=5.94; 95 % CI: 1.75 to 20.19).**

Figure 1 provides the Kaplan-Meier survival curve for the cumulative hazard rates of MI or cardiac death by levels of covert coping. An increased risk of MI or cardiac death appears soon after baseline. The separation in cumulative rates between the groups widens throughout the follow-up period.

----- figure 1 in here -----

Figure1. Age-adjusted survival function of cumulative hazard rates of myocardial infarction or cardiac death by levels of covert coping (short scale) among men free of cardiac disease at baseline (n=2755).

DISCUSSION

In this cohort of Swedish men, covert coping was associated with increased risk of future acute myocardial infarction and cardiac death. **Analyses of the original covert coping scale showed that** men who have a **pronouncedly** covert coping style **had approximately two times greater risk** compared with men **with low levels of** covert coping. As **this scale combines** covert coping **with consequences of such coping**, we **ran subsidiary analyses using data exclusively**

from the two items **that most directly** assess direct covert coping, **i.e.**, ‘Let things pass without saying anything’ and ‘Going away’. **Based on this refined scale, men who often used covert coping had a more than 5-fold risk of myocardial infarction or cardiac death. As an indication of dose-response, those with less consistent patterns of covert coping had also less pronounced excess risk and the trend across levels of covert coping reached statistical significance. Expected associations between conventional risk factors and risk of myocardial infarction or cardiac death, such as drinking problems (HR=4.10; 95 % CI: 1.06-15.82), elevated triglycerides (HR=2.32; 95 % CI: 1.12-4.84) and diabetes (HR=4.04; 95 % CI: 1.36-12.02) provide support for the validity of our findings (all multivariate adjusted as in model 5, table 4).**

We refined the covert coping scale after performing an item-based analysis; the results based on these post hoc modifications in the exposure measure should therefore be interpreted cautiously and replicated in independent data sets. We believe that the observed association is real rather than attributable to chance. The two items in the refined scale were conceptually relevant, capturing immediate response to unfair treatment rather than longer-term consequences. The two items are also included in the Utrecht coping list (UCL) and the CODE scale, which partly builds on the UCL. [22, 23] In the UCL these two items are part of the same subscale ‘Avoidance and passive expectancy’ and in CODE this scale loads negatively on the coping factor ‘Instrumental mastery-orientated coping’, which **may indicate that these two items are **distinct** from the other two covert coping items. **It is noteworthy** that our findings **are consistent with previous studies using slightly different measures. For example,** in the Framingham Study men **who exhibited** suppressed hostility (i.e. not showing anger) were found to be at increased risk of developing CHD and in a study **by** Julius et al. higher risk of ischemic heart disease (IHD) was found for those who suppressed anger. [24, 25] In the Caerphilly study anger out and suppressed anger were **both** predictive of incident IHD over a 9 year follow-up period. [26] Engebretson et al. proposed a matching hypothesis whereby adaptive responses to anger-provocation would occur among people who could use their preferred mode of anger management. [27] A ‘mismatch’, **in contrast, occurs,** for instance, **when** people who habitually express anger are forced by circumstances, experimental manipulations or real-life social constraints, to suppress it.**

The items of the covert coping scale do not specify whether the respondent had actually been exposed to conflicts and unfair treatment at work, or how frequently they used covert coping. Furthermore, the questions were framed to involve unfair treatment and a conflict at work, which is a relatively specific context for a measurement of coping and corresponds to that used in the Whitehall II study. [28] Unlike the Framingham scales for anger management, which includes more generally framed questions (e.g., “When really angry or annoyed do you keep it to yourself?”), the covert coping scale is not limited to anger episodes. Indeed, although anger is a common reaction to unfair treatment; a proportion of people might react in other ways, e.g. by getting upset, sad or feeling guilty.

Confounding is a possible explanation for any findings of associations in observational studies. Given that high levels of covert coping are associated with low decision latitude, which in turn has been shown to be related to increased risk of myocardial infarction, it is possible that the association between covert coping and risk of myocardial infarction is driven by low decision latitude. [29] In the present study, however, this is unlikely because the association between covert coping and cardiac events remained after controlling for decision latitude and job demands. An alternative hypothesis regarding the association between covert coping and coronary events is that it may induce acute physiological reactions, such as a dramatic but momentary increase in blood pressure, which are harmless to the healthy person and leave no physiological traces, but which could act on an underlying or subclinical cardiovascular disease and trigger an MI. [30] If covert coping patterns are relatively stable, this could explain the association.

If the association between covert coping and increased heart disease is indeed causal, then avoidance of covert coping may lead to health benefits and other studies additionally suggest that low exposure to unfair treatment may also reduce risk of coronary heart disease incidence and cardiovascular mortality. [31, 32] Our data provide no answer to the question what might be a particularly healthy coping strategy. In the questionnaire, open coping was assessed by items requesting whether the respondent would ‘Protest directly’, ‘Talk to the person right away’, ‘Yell at the person right away’, and ‘Speak to the person

later when things have calmed down' when experiencing unfair treatment or facing with a conflict. However, there was no association between such active (“open”) coping strategies and myocardial infarction or cardiac death.

Our study has several major strengths. Our data is based on a longitudinal study and loss to follow-up was minimal and comprised only those individuals who emigrated during the study period. The outcomes we used, myocardial infarction and cardiac death, were based on objective criteria (e.g. electrocardiography and enzymes) and **are** not self-reported. However, despite the longitudinal nature of our study, we cannot draw definite conclusions about causation. On the basis of this present dataset it is not possible to attribute with any certainty the association observed to coping behaviour; other factors could also operate as risk determinants, such as a personality trait or some other personal characteristic underlying the coping pattern.

Furthermore, the measure of covert coping we used may capture subjection to unfair treatment rather than a pure coping style. However, the term “covert coping” has been used earlier and we decided to follow this tradition. Because of an insufficient number of cardiac events among women, only men were included in the analyses. Analyses with the total cohort combining men and women yielded nearly identical results to the one reported here (results not shown) but do not justify conclusions regarding the effects of covert coping on myocardial infarction and cardiac death risk among women.

In sum, these data raise an interesting hypothesis which needs to be confirmed or refuted by future studies. Important directions into the future include a closer investigation of the concept of covert coping, including testing of its psychometric properties. Ultimately, further research should examine whether interventions designed to reduce covert coping would alter risk of myocardial infarction and cardiac death.

COMPETING INTEREST

All authors declare that the answer to the questions on your competing interest form are all No and therefore have nothing to declare

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