

Associations Between Working Conditions and Angina Pectoris Symptoms Among Employed Women

TEA LALLUKKA, MSc, PEKKA MARTIKAINEN, PhD, ANTTI REUNANEN, MD, PhD, EVA ROOS, PhD, SIRPA SARLIO-LAHTENKORVA, PhD, AND EERO LAHELMA, PhD

Objective: This study aimed to examine whether psychosocial working conditions are associated with angina pectoris (AP) symptoms in women. **Methods:** Data were derived from postal questionnaires filled in by 40- to 60-year-old women employed by the City of Helsinki, Finland, in 2000 to 2002 ($n = 7093$, response rate 67%). AP symptoms were measured by the Rose Questionnaire. Logistic regression analyses were carried out to examine AP symptoms as outcome. Independent variables consisted of Karasek's job demands and job control, work fatigue, working overtime, work-related mental and physical strain, the work-home interface, and social support, adjusted for age. Confounding effects of socioeconomic status, health behaviors (smoking, binge drinking, body mass index), and menopause were also examined. Pregnant women were excluded. **Results:** AP symptoms were reported by 6% of participants. Work fatigue was strongly associated with AP. In addition, working overtime, low job control, and high physical strain at work were associated with AP. The associations between psychosocial working conditions and AP symptoms were unaffected by health behaviors, socioeconomic status, or menopause. **Conclusions:** Working conditions were associated with the AP symptoms identified by the Rose Questionnaire. Longitudinal studies are needed to disentangle the causal relationships, i.e., whether psychosocial stress is a true risk factor/cause of angina symptoms and cardiovascular disease among women. **Key words:** working conditions, chest pain, women, Rose Questionnaire, angina pectoris symptoms, psychosocial factors.

AP = angina pectoris symptoms; BMI = body mass index.

INTRODUCTION

Angina pectoris (AP) is a condition in which arteries of the heart are narrowed by atherosclerosis, causing restricted blood flow and chest pain or discomfort on exertion. The Rose Questionnaire, also known as the London School of Hygiene Cardiovascular Questionnaire, is a standardized instrument for quick assessment of AP symptoms, which has been widely used in epidemiological studies for decades (1,2). The size of the population with angina has been estimated to be larger than that diagnosed, with the prognosis of undiagnosed and diagnosed populations being similar (3,4).

AP symptoms may coexist with symptoms of psychosocial stress, and separating these can be difficult because psychosocial stress commonly masquerades as cardiac symptoms. Psychosocial stress simultaneously is a coronary risk factor itself and is highly prevalent among patients with coronary heart disease (5). The associations between psychosocial stress and AP symptoms have not been thoroughly studied among employed women. This study, therefore, aims to shed light on associations between working conditions and reported symptoms of angina.

Working conditions have been shown to be associated with coronary heart disease risk factors (6,7), coronary disease itself (8–14), and also cardiac mortality (15–17). Karasek's job demand-control model has been widely used in epidemi-

ologic studies assessing coronary morbidity and mortality (7,9,11,18). Other conditions such as working overtime, physical and mental strain at work, the work-home interface (difficulty/ease of combining work and home life), and social support may also be relevant to coronary health (12). Because previous research in these areas is scarce, determining how AP symptoms are associated with these working conditions among women is important.

Health behaviors, socioeconomic status, and menopause should be considered alongside working conditions as potential confounders, and the independence of the associations needs to be established. Smoking, binge drinking, and overweight are known risk factors for coronary heart disease and have been shown to be associated with psychosocial working conditions (19). Menopause reflects age and is important because postmenopausal women are at much higher risk for coronary heart disease than their premenopausal counterparts (20,21). Menopause might also affect the validity of the Rose Questionnaire. Socioeconomic inequalities in both cardiovascular risk factors (22,23) and cardiovascular mortality (17,24) are well-established.

The aim of this study was to examine the associations between AP symptoms and working conditions among middle-aged employed women after first controlling for health behaviors, socioeconomic status, and menopause.

METHODS

Data

The data derive from cross-sectional Helsinki Health Study postal surveys distributed in 2000, 2001, and 2002 to employed women aged 40, 45, 50, 55, or 60 years. The total number of participants in the pooled data is 7093, with the response rate being 67%. A small number of pregnant ($n = 23$) or possibly pregnant ($n = 10$) women were excluded. The analyses were adjusted for age in 5-year age groups.

The City of Helsinki is a large employer (approximately 40,000) offering a wide variety of jobs from manual, blue-collar positions to professional and managerial roles. Nursing and teaching are the most common occupations for women; for men, no predominant occupations have been identified. On average, however, more men than women are employed as managers. The employees of the City of Helsinki are representative of the Finnish working population within the public sector.

From the Departments of Public Health (T.L., E.R., S.S.-L., E.L.) and Sociology (P.M.), University of Helsinki, Helsinki, Finland; the National Public Health Institute (A.R.), Helsinki, Finland; and the Folkhälsan Research Centre (E.R.), Helsinki, Finland.

Address correspondence and reprint requests to Tea Lallukka, MSc, Department of Public Health, PO Box 41, 00014 University of Helsinki, Finland. E-mail: tea.lallukka@helsinki.fi

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This study was approved by the Ethics Committee of the Department of Public Health, University of Helsinki, and the Ethics Committee of the Health Authorities of the City of Helsinki.

Angina Pectoris Symptoms

The associations between AP symptoms (exertional chest pain), as measured by the Rose Angina Pectoris Questionnaire (2) and working conditions were examined in this study. Questionnaire data generally reflect *current* symptoms, but one should bear in mind that considerable *variability* in symptoms exists (25).

In the Rose Questionnaire, AP symptoms (exertional chest pain) are elicited by first inquiring whether the respondent has ever had any chest pain or discomfort. A positive response leads to a series of questions aimed at identifying atherosclerotic symptoms. Exertional chest pain is experienced while walking or hurrying, it forces the activity to be stopped or slowed, it is relieved within 10 minutes of cessation of effort, and it is situated over the sternum or in the left anterior chest and left arm. The complete Rose Questionnaire is included in Appendix I. Only participants fulfilling all original criteria and with no missing answers were regarded as having AP symptoms.

Working Conditions

More details on working condition variables can be found in a previous report (26). Job demands and job control were based on Karasek's model of job strain (27), which consists of 10 demand items and nine control items. Agreeing with a statement yielded one point. The lowest quartile of the sum index was the reference category for demands, and the highest quartile was the reference category for control. All items are listed in Appendix II.

A work fatigue index, predictive of burnout, consisted of the following six items: 1) I feel totally worn out after a day at work, 2) I feel tired in the morning when I have to get up and go to work, 3) I have to work too hard, 4) I feel like I am totally exhausted, 5) My work is definitely too stressful, and 6) I worry about my work even when I am off duty. If more than two answers were missing, the index value was not calculated. The sum index of the six items was divided into tertiles based on agreeing responses. The categories were "high work fatigue" (4+ items), "intermediate work fatigue" (1–3 items), and "no work fatigue" (zero items). The last category was used as a reference. Our work fatigue measure is based on the first part of a more extensive burnout inventory (28). There are three stages in this burnout construct, the first being work fatigue (exhaustive fatigue), followed by cynicism and loss of self-esteem at work, and finally, burnout. This inventory was originally developed for employees working in the human relations field. Items dealing with customer service and frustration were omitted from the Finnish version, developed at the Finnish Institute of Occupational Health (29).

The response alternatives for physical as well as mental strain at work were "very easy," "rather easy," "rather hard," and "very hard." Both were divided into tertiles of "low," "medium," and "high" strain, with "low" serving as the reference category.

The cutoff point for long working hours was set at more than 40 hours a week. Those working 40 hours or less formed the reference category.

In addition to specific working conditions, the interface between work and family life was included. Respondents were asked whether they were satisfied with combining paid employment and family life by a seven-point scale, ranging from "very dissatisfied" to "very satisfied." Tertiles used were as follows: "dissatisfied," "somewhat satisfied," and "satisfied," the last being the reference category.

Social support indicating both support at work and support at home from a spouse or friends was included. This was based on Sarason's (30) inventory of various sources of support and divided into the three categories of low, medium, and high social support according to the responses to a total of 24 questions. Those with the highest support were used as the reference category. Social support was included in the analyses because it is both a potential etiological factor and a prognostic factor for coronary heart disease (12).

Health Behaviors, Socioeconomic Status, and Menopause

Health behaviors (smoking, binge drinking, body mass index), socioeconomic status, and menopause were initially included in the analyses because of their potential confounding effects. Smoking status was divided into current smokers and nonsmokers, including exsmokers. Binge drinking was applied to respondents drinking more than six portions of alcohol on one occasion. A response of once a month or more often was categorized as binge drinking. The cutoff point was rather low because women seldom report binge drinking. Body mass index (BMI) was calculated based on self-reported height and weight (kg/m²). BMI was classified as underweight (BMI <20), normal weight (BMI 20–24.9), overweight (BMI 25–29.9), and obese (BMI ≥30). Socioeconomic status was categorized into four occupational classes (professionals and managers, semiprofessionals, routine nonmanual workers, and manual workers). Menopause was inquired about by asking whether the respondent's menstrual bleeding had stopped naturally.

Missing Values

The proportion of missing values was rather low, 1% to 2% per question. The missing values were either removed from the analyses (outcome variable) or included in the reference category when the proportion missing was less than 30% (job demands, job control, work fatigue). Missing values were included in the intermediate category for the work–home interface.

Statistical Analyses

Logistic regression analyses were carried out to examine associations between working conditions and AP symptoms. Base models adjusted for age show the association between each independent variable and AP. For these base models, we carried out eight separate logistic regression analyses, one for each working condition included in this study. The results for the base models are provided in the first column of Table 3, whereas the second column contains the results for the full model, which simultaneously included all variables studied. Health behaviors, socioeconomic status, and menopause did not confound these associations. They were therefore excluded from the final logistic regression models, and only descriptive statistics are shown for these variables. Furthermore, multicollinearity between working conditions was tested but not found. Descriptive statistics are based on *p* values derived from chi-squared tests. All analyses were performed using an SAS statistical program, version 8.2.

RESULTS

AP symptoms were reported by 6% of nonpregnant 40- to 60-year-old women. Table 1 shows the basic characteristics and background information of participants reporting and not reporting AP. Age was positively, whereas education was inversely, associated with AP symptoms. Socioeconomic status was also associated with AP, with manual and nonmanual workers being more likely to report AP than their higher-status counterparts. Smoking and binge drinking were not associated with AP, but overweight and obese women reported AP more often than normal-weight women. Although menopause was associated with AP, this mostly reflected age. Self-reported current medication for treatment of high blood pressure or serum cholesterol was also associated with AP.

Frequencies of the working conditions among those reporting and not reporting AP are displayed in Table 2. Based on these descriptive statistics, job control, work fatigue, physical and mental strain at work, the work–home interface, and social support were associated with AP, whereas job demands and working overtime were not. Those with high job demands or working overtime tended to more often report AP, but these differences did not reach statistical significance.

TABLE 1. Characteristics of Participants Reporting and Not Reporting Angina Pectoris (AP) Symptoms

	<i>n</i>	AP (%)	<i>p</i>
Age (years)			<.0001
40	1449	3.7	
45	1536	5.1	
50	1561	5.8	
55	1731	7.4	
60	816	8.6	
Socioeconomic status			<.0001
Professionals and managers	1883	4.2	
Semiprofessionals	1297	4.2	
Routine nonmanual workers	2945	7.2	
Manual workers	834	8.3	
Education			<.0001
Low	3093	7.7	
Medium	2286	5.1	
High	1714	3.9	
Smoking			NS
No	5483	5.9	
Yes	1610	6.1	
Binge drinking			NS
No	5857	5.8	
Yes (at least once a month)	1236	6.7	
Body mass index (BMI; kg/m ²)			<.0001
Underweight (BMI <20)	465	4.1	
Normal weight (BMI 20–24.9)	3353	3.8	
Overweight (BMI 25–29.9)	2188	7.4	
Obese (BMI =>30)	992	10.7	
Menopause			.002
No	5445	5.5	
Yes	1648	7.5	
Medication for high blood pressure			<.0001
No (or previously)	6035	4.9	
Yes	910	10.3	
Medication for high cholesterol			.0002
No (or previously)	6827	5.5	
Yes	118	13.6	

NS = not significant.

Logistic regression analyses were carried out in two phases (Table 3). Age-adjusted base models, including one working condition at a time, showed significant associations between AP and low job control, work fatigue, mental strain, dissatisfaction with the work–home interface, and low social support. These associations either slightly weakened or disappeared when all working conditions were mutually adjusted for. In these fully adjusted final models, working overtime and high physical strain at work were also associated with AP, whereas job demands, the work–home interface, and social support were not. The strongest associations were found between work fatigue and AP (odds ratio: 2.80; 95% confidence interval: 2.02–3.90). Those with very low job control were equally likely to report AP.

We also carried out separate analyses for grade 1 and grade 2 AP (data not shown). The more severe type (grade 2) refers to pain experienced when walking at an ordinary pace, whereas the milder pain (grade 1) is experienced only when walking uphill or hurrying (Appendix I). Of those reporting AP, 316 (75%) had grade 1 and 106 (25%) grade 2 AP

TABLE 2. Angina Pectoris (AP) Symptoms by Working Conditions^a

	<i>n</i>	AP (%)	<i>p</i>
AP symptoms	7093	6	
Job demands			NS
Very low	2168	5.3	
Low	1725	5.3	
High	1509	6.6	
Very high	1588	6.7	
Job control			<.0001
Very low	1143	9.7	
Low	1459	7.1	
High	2087	4.4	
Very high	2338	4.5	
Work fatigue			<.0001
No	3466	3.7	
Medium	2505	6.8	
High	1059	11.0	
Mental strain of work			.003
Low	1816	4.8	
Medium	4274	6.0	
High	1003	8.0	
Physical strain of work			.0002
Low	1322	4.4	
Medium	2965	5.4	
High	2806	7.3	
Working overtime			NS
No	6195	5.8	
Yes	898	7.2	
Work–home interface			.0002
Satisfied	3410	4.8	
Somewhat satisfied	3073	7.0	
Dissatisfied	610	7.2	
Social support			.0045
Low	2620	6.6	
Medium	2519	6.5	
High	1954	4.5	

^aNumber of cases, prevalence, and *p* from chi-squared tests. NS = not significant.

symptoms. However, the results for grade 1 were very similar to the earlier results in which the grades were combined. In the analyses of grade 1 AP, social support was weakly associated with AP symptoms, whereas this association in the combined analyses was statistically significant only in the age-adjusted base model. Otherwise, the associations and their strengths did not markedly differ from the results presented in Table 3. In the analyses of grade 2 AP, there were few significant associations between AP symptoms and working conditions; work fatigue and very low job control were associated with grade 2 angina. This is in accordance with the combined analyses, in which these two associations were the strongest ones. Although more severe pain may be more likely to indicate organic disease, the prevalence of severe pain is, however, very low (1.5%), and most associations were not significant. We therefore combined the two grades in this study.

DISCUSSION

Main Findings

We sought to examine associations between AP symptoms, as assessed by the Rose Questionnaire, and a range of working

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TABLE 3. Associations Between Angina Pectoris Symptoms and Working Conditions Among Women (*n* = 7093)^a

	Base Models (Age-Adjusted)			Full Model (Age-Adjusted)		
	OR	95% CI		OR	95% CI	
Job demands						
Very low	1.00			1.00		
Low	1.039	0.782	1.379	0.900	0.671	1.206
High	1.265	0.956	1.675	0.932	0.688	1.263
Very high	1.310	0.996	1.723	0.786	0.568	1.087
Job control						
Very low	2.260	1.709	2.990	2.036	1.505	2.754
Low	1.645	1.242	2.180	1.496	1.115	2.007
High	0.998	0.748	1.333	0.933	0.695	1.251
Very high	1.00			1.00		
Work fatigue						
No	1.00			1.00		
Medium	1.896	1.495	2.405	1.847	1.428	2.388
High	3.094	2.374	4.031	2.804	2.019	3.894
Mental strain of work						
Low	1.00			1.00		
Medium	1.295	1.000	1.676	1.194	0.906	1.575
High	1.816	1.317	2.503	1.270	0.874	1.843
Physical strain of work						
Low	1.00			1.00		
Medium	1.320	0.957	1.821	1.380	0.997	1.912
High	1.853	1.354	2.535	1.663	1.207	2.293
Working overtime						
No	1.00			1.00		
Yes	1.292	0.980	1.704	1.414	1.059	1.888
Work-home interface						
Satisfied	1.00			1.00		
Somewhat satisfied	1.525	1.231	1.888	1.109	0.883	1.393
Dissatisfied	1.760	1.237	2.504	0.997	0.677	1.469
Social support						
Low	1.356	1.033	1.779	1.105	0.834	1.464
Medium	1.439	1.098	1.888	1.270	0.963	1.676
High	1.00			1.00		

^aOdds ratios (ORs) and their 95% confidence intervals (CIs) from logistic regression analyses.

conditions among women. After adjusting for age, mainly moderate associations between the psychosocial working conditions studied and AP symptoms were found. Work fatigue was, however, strongly associated with AP.

This study, therefore, adds evidence on the associations between strainful working conditions and coronary health. One should, however, bear in mind that previous findings between working conditions and coronary heart disease and risk factors are inconsistent, and have even been suggested to be spurious (31–35).

Study Strengths and Weaknesses

This study is based on contemporary data collected since 2000. Also included was detailed information on working conditions combined with validated measures of health, like the Rose Questionnaire, for identification of AP symptoms. The cross-sectional design does not, however, allow for an examination of causal relationships, and it remains uncertain whether stressful working conditions actually contributed to reported chest pain. Previous studies have mostly included men or only a few measures of work factors and health

indicators. Therefore, our emphasis on women and several dimensions of working conditions can be considered a strength. Results from nonresponse analyses suggest that nonresponse is unlikely to be a major source of bias in these data (36). A limitation of this study is that all information is self-reported, and a symptom-reporting disposition cannot be excluded as an explanation of the findings. Another limitation is that we did not have medically confirmed diagnoses for coronary heart disease to validate the reported AP symptoms. Coronary heart disease has, however, been demonstrated to be elevated in younger women and men reporting symptoms of AP, even in groups reporting high levels of general symptoms (37).

Previous Research

Despite many studies supporting the validity of the questionnaire as a measure of coronary disease (38,39), its use and predictive power for coronary events, particularly among premenopausal women, are, however, questionable (40,41). The questions may merely reflect psychological, psychosocial, or somatic symptoms, symptom-reporting predisposition, or other general symptoms (37). Angina has, however, been shown to be

associated with an adverse risk factor profile among younger women (37). Separating these alternative interpretations has proven difficult, and the validity and predictive power of reported AP symptoms remain open questions requiring further scrutiny, especially among middle-aged women.

The Rose Questionnaire has been shown to be a reliable and valid tool for assessing prevalence of AP in a Spanish population aged 45 to 74 years, in which prevalence rates are similar to other industrialized countries with high coronary morbidity and mortality (38). Although persistent symptoms and a more severe grading of AP are likely to indicate more severe disease, only one report using the Rose Questionnaire has been found to be valid, showing a moderate association with both risk factors and true coronary heart disease (39). However, weak associations between questionnaire-assessed AP and medically confirmed measures of myocardial ischemia have also been reported (40). Although the Rose Questionnaire is likely to be a less reliable and specific measure of coronary heart disease among younger women, it has nevertheless been suggested to be an unbiased tool for epidemiological studies (40,42).

In previous cross-sectional settings, reported AP symptoms have been associated with, for instance, coronary calcification (43), coronary heart disease risk factors, resting electrocardiogram changes (41), and more severe angina symptoms (grade 2) with intima media thickness of the carotid artery (39).

In the largest study using the Rose Questionnaire, angina has been shown to be a powerful predictor of women's mortality; the risk of dying from cardiovascular disease was elevated approximately threefold among those reporting AP symptoms (44). Symptoms of AP measured by the questionnaire have proven to be a good indicator of later ischemic heart disease mortality among middle-aged women and men in many subsequent studies, too (45–47). Risk of death or nonfatal myocardial infarction is also higher among people with angina symptoms (4). In addition, a markedly higher all-cause mortality has been observed among women reporting AP symptoms but with no documented history of ischemic heart disease (48). Those who report angina symptoms with or without a diagnosis also experience impaired physical functioning at follow up compared with those without angina (4).

Nevertheless, a paradox exists here. Although myocardial infarction is diagnosed twice as often among men than among women, women report as much or more angina symptoms than men (38). It is unlikely that the high prevalence of angina among women is just an artifact of the Rose Questionnaire because data from an American managed care population show that women have higher rates of use of long-acting nitrates, drugs prescribed specifically for alleviation of angina symptoms (3). This suggests that these AP symptoms may indeed be a marker of coronary heart disease also among women, but the clinical manifestation or the end point is not as often myocardial infarction for women as it is for men.

Psychological distress and psychiatric disorders are common among patients with chest pain coronary heart disease (49–53). However, some studies suggest that patients with

chest pain with and without coronary heart disease do not differ in their disposition to report psychological symptoms (54). Psychosocial factors may also be related to chest pain, rather than being a cause of pain (55). Furthermore, a recent study concluded that patients with chest pain with normal coronary angiograms are predominantly women whose prognosis is not as benign as previously thought (56), but who instead might be at risk for future coronary events. Women with chest pain should therefore be examined carefully, especially when coronary risk factors are present.

CONCLUSIONS

Chest pain is a common problem among women, but its correlates are not yet fully understood. The original purpose of the Rose Questionnaire was to measure the prevalence of coronary heart disease, which is rare in working-aged women. However, to better prevent coronary heart disease—a major public health problem—recognizing the earliest symptoms and associated risk factors is paramount. Improved understanding of psychosocial links and pathways to chest pain is also required.

Because previous studies among employed women are scarce, we sought to trace the various correlates of chest pain among women and to examine the need for taking working conditions better into consideration in prevention programs. The challenge for future research is to disentangle the relevance, consequences, and risks of reported AP symptoms among employed women. To prevent, diagnose, and treat AP symptoms, identifying both their determinants and correlates is crucial. Future studies are expected to elucidate the predictive power of reported AP symptoms for coronary heart disease morbidity and mortality among middle-aged women.

APPENDIX I

Angina Pectoris Questionnaire

Diagnostic criteria for angina pectoris (1,2)

“Angina” is defined as being present in respondents who answer as follows:

1. “Yes”
 2. or 3. “Yes”
 4. “Stop or slow down”
 5. “Relieved”
 6. “In ten minutes or less”
 7. “Sternum (upper or middle, or lower) OR left anterior chest and left arm”
1. Have you ever had any pain or discomfort in your chest?
(a) yes, (b) no
 2. Do you get this pain or discomfort when you walk uphill or hurry?
(a) yes, (b) no
 3. Do you get this pain or discomfort when you walk at an ordinary pace on a level surface?
(a) yes, (b) no

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- When you get any pain or discomfort in your chest, what do you do?
(a) stop, (b) slow down, (c) continue at the same pace
- What happens to the pain when you stand still?
(a) the pain relieves, (b) the pain does not relieve
- How soon does the pain go away?
(a) in 10 minutes or less, (b) more than 10 minutes
- Where do you get this pain or discomfort?
 - Sternum (upper or middle)
 - Sternum (lower)
 - Left anterior chest
 - Left arm
 - Other. Where? (mark the place(s) on the diagram)

APPENDIX II

Karasek's job demands and job control items (27)

Do you agree or disagree with the following statements?

- fully agree, b) somewhat agree, c) do not agree or disagree, d) somewhat disagree, e) fully disagree

Job Demands

- I have to work very fast.
- I have to work very hard.
- My workload is not unreasonable.
- I have enough time to do everything.
- Others do not have controversial expectations of me.
- My work is very intense.
- My tasks require longstanding concentration.
- I am often interrupted in my work so that I have to get back to my tasks later.
- My work performance is slowed down by other employees or departments (waiting for tasks, etc.).
- In my work, I constantly have to fulfill simultaneous and contradictory expectations.

Job Control

- I can make decisions concerning my work independently.
- My work requires creativity.
- My work demands learning new things.
- My tasks involve repetition.
- I have a great deal of say in my work and tasks.
- My work demands a high level of skill and expertise.
- My work involves a lot of different tasks.
- I have an opportunity to develop special skills of mine at work.
- I have very little freedom in deciding how to do my work.

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