

# Sex differences in cardiovascular disease: are women with low socioeconomic status at high risk?

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## SUMMARY

**Background.** Cardiovascular disease is still portrayed as a typical male disease, and men are more often submitted to invasive procedures or referred earlier.

**Aim.** To explore sex differences in morbidity and referral patterns in cardiovascular disease in general practice, and the role of age and socioeconomic status.

**Method.** Data were obtained from a continuous morbidity registration project in the Netherlands from 1986 to 1995 in which 12 000 patients were followed over 10 years. The effects of sex, age, and socioeconomic status on morbidity of cardiovascular disease and the referral patterns were established.

**Results.** The sex difference in morbidity becomes smaller with increasing age. Morbidity was highest in the lower socioeconomic status in general and for angina pectoris in particular. Women with angina pectoris with low socioeconomic status have a relative risk of 2.24 (CI = 1.17–3.26) compared with women with high socioeconomic status. In men, no significant difference was found between the socioeconomic status groups. For angina pectoris the sex difference in referral to the specialist was most significant: 50.6% and 26.6% ( $P = 0.002$ ) for men and women respectively.

**Conclusion.** For women, low socioeconomic status was associated with relatively higher morbidity of angina pectoris and myocardial infarction than for men. Women are less likely to be referred than men are, in particular for angina pectoris.

**Keywords:** sex differences; cardiovascular disease; referral; socioeconomic status.

## Introduction

CARDIOVASCULAR disease in the Netherlands, as in other Western countries, accounts for about 30% of all deaths in the population, including cerebrovascular accidents for up to 42% for men and 38% for women respectively.<sup>1</sup> As a consequence of the ageing population, the impact of this health problem on society is likely to increase.

Surprisingly, cardiovascular disease is still portrayed as a typical male disease, with preventive measures specifically targeted at men. Men are more often submitted to invasive diagnostic and therapeutic procedures, such as catheterization,<sup>2,3</sup> or are referred earlier<sup>4</sup> in the episode of a cardiovascular disease. Although

these observations have triggered speculation of possible sex-bias in the management of cardiovascular disease,<sup>3,4</sup> no comprehensive population-based data are available of sex-related incidence and referrals to secondary care.

The aim of this study was to assess the frequency of general practitioners' (GPs') referral ratios of episodes of ischaemic cardiovascular disease for men and women. This analysis took into account the influence of age and social class on referrals.

## Method

In this study, we used data derived from the Continuous Morbidity Registration of the Department of General Practice at the University of Nijmegen.<sup>5-8</sup> This database registers since 1971 every episode of morbidity presented to the GP in four affiliated practices. The patient population totals about 12 000 patients that, on age distribution, are representative of the population of the Netherlands. The relevance and limitations of this database are directly influenced by the Dutch health care structure: every general practice has a stable practice population and the practitioner is the key to access to specialist medical care. All specialists report back to the GP. Hence, the dataset consists of the entire primary health care provided to the population as well as referrals for health care. The diagnoses are registered in a primarily disease-oriented classification based on the International Classification of Health Problems in Primary Care (ICHPPC-2). Referral to the laboratory and X-ray unit, as well as for specialist and paramedical care, are recorded.

The sociodemographic data that are available for every patient are age, sex, and socioeconomic status and civil status. The socioeconomic status is assigned using a standardized list of occupations in the Netherlands, resulting in three categories: low, middle, and high. Women are classified by their partner's occupation.

This study reviewed cardiovascular morbidity and referrals during the 10 years between 1986 and 1995, and thus comprises 120 000 patient years.

## Definitions

According to the definitions used in the Continuous Morbidity Registration project, we selected four diagnoses: myocardial infarction, first attack angina pectoris, cerebrovascular accident, and transient ischaemic attack.

For angina pectoris, one of the following criteria has to be met: precordial chestpain characteristic for angina pectoris, ischaemia on the electrocardiograph (ECG), or confirmed sclerosis on angiography. For myocardial infarction, the criteria are precordial pain typical for myocardial infarction longer than 15 minutes and one of the following: abnormal ST-T segments or Q waves on the ECG; raised serum levels of enzymes.

'Incidence' is the number of patients registered with a newly presented disease, per 1000 patient years.

No distinction is made in outcome: lethal and non-lethal myocardial infarction are included in the study.

Referral ratio is the percentage of all patients with a newly presented disease — who were referred for (a) additional investi-

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gations, or (b) for specialist and paramedical care — within three months after the diagnosis was made. The referral ratio is an indicator of the referral pattern of the GP per diagnosis.

### Statistical methods

Incidence and referral ratios were computed for myocardial infarction, angina pectoris, and neurovascular disease (i.e. cerebrovascular accident and transient ischaemic attack). The association between the demographic factors of age and socioeconomic status, and incidence, referral rate, and referral ratio were analysed for both sexes. Statistical differences between the sexes were determined in a two-sided chi-squared test. Relative risk (RR) was calculated in a two-sided chi-squared test and defined as the chance of women having, or being referred for, a diagnosis as compared with men.

## Results

### Sex differences in morbidity per diagnosis

The incidence of myocardial infarction and angina pectoris was 3.4 and 3.0 for men, and 2.1 and 2.1 for women ( $P < 0.01$ ) (Table 1). The incidence of cerebrovascular accident and transient ischaemic attack was 3.6 for women and 3.1 for men (not significant).

### Sex differences in morbidity by age

The incidence of myocardial infarction and angina pectoris increased with age for both sexes, but the sex difference decreased with increasing age. In the age group 45–64 years, the relative risk for myocardial infarction and angina pectoris were 3.58 (CI = 2.23–5.47) and 2.34 (CI = 1.62–3.39) respectively. In the age group 65–74 years, the relative risk for myocardial infarction was 2.68 (CI = 1.74–4.11), but no significant sex difference was found for angina pectoris. For the age group over 74 years, the sex differences were not significant. In all age groups we found no clear sex difference in incidence of neurovascular disease (Table 2).

**Table 1.** Incidence of cardiovascular diseases per diagnosis per 1000 men and 1000 women per year.

	Males	Females
Heart disease		
Myocardial infarction <sup>a</sup>	3.4	2.1
Angina pectoris <sup>b</sup>	3.0	2.1
Neurovascular disease		
CVA	1.9	2.1
TIA	1.2	1.5

<sup>a</sup> $P = 0.000007$ ; <sup>b</sup> $P = 0.002$ . CVA = cerebrovascular accident; TIA = transient ischaemic attack.

**Table 2.** Incidence of myocardial infarction, angina pectoris, TIA, and CVA per 1000 men and 1000 women per year, by age group.

	25–44 years		45–64 years		65–74 years		75+ years	
	Men	Women	Men	Women	Men	Women	Men	Women
Myocardial infarction	0.5	0.3	6.2 <sup>a</sup>	1.7	16.8 <sup>b</sup>	6.3	19.1	18.4
Angina pectoris	0.5	0.1	6.8 <sup>c</sup>	3.2	11.2	11.3	14.2	9.7
TIA	0.0	0.0	0.8	1.0	7.3	5.2	12.7	14.6
CVA	0.1	0.1	1.9	1.3	8.3	5.7	25.0	22.4

<sup>a</sup> $P = 0.000000$ ; <sup>b</sup> $P = 0.000003$ ; <sup>c</sup> $P = 0.00003$ . CVA = cerebrovascular accident; TIA = transient ischaemic attack.

### Sex differences in morbidity by socioeconomic status

Among patients with low socioeconomic status there was an excess of angina pectoris and myocardial infarction, and this was more pronounced for women than for men. Women with low socioeconomic status had a relative risk of 2.80 of getting myocardial infarction compared with women with high socioeconomic status (CI = 1.28–6.11). For men there was no difference between these groups. For angina pectoris, the difference between the low and high socioeconomic status was significant for women, with a relative risk of 2.24 (CI = 1.12–4.51); again, for men no significant difference was found (Table 3). The same pattern was seen for neurovascular disease: the relative risk for women with low socioeconomic status was 2.96 (CI = 1.17–3.26); for men there was no significant difference.

### Sex differences in referral pattern by diagnosis

Among the patients with myocardial infarction, nearly all were referred to the cardiologist: 90.0% of the men and 81.7% of the women. For both sexes the non-referred were mostly in the two highest age groups. For angina pectoris, 57.0% of the men and 40.7% of the women were referred in total. The referral ratio to the cardiologist in particular shows a striking difference: 50.6% for men and 26.6% for women respectively ( $P = 0.002$ ).

For angina pectoris we found a significantly lower referral ratio for women in all age groups; most striking in the age group 65–74 years. The percentage of men who had angina pectoris and were referred to the cardiologist in the age groups 45–64, 65–74, and 75+ years was 53.6%, 48.8%, and 28.0% respectively. For women this was 44.1%, 22.2%, and 15.2% (Table 4).

With regard to referrals by socioeconomic status we found no significant sex differences for myocardial infarction. For angina pectoris, however, we found a lower referral ratio for women with low and middle socioeconomic status. For men with low, middle, and high socioeconomic status, the referral ratio was 58.4%, 58.5%, and 46.7%; for women it was 42.1%, 38.6%, and 55.6%. The differences were not significant. Of these referrals only some were referred to the cardiologist.

Studying the percentages of those in the group with low socioeconomic status referred to the cardiologist, a difference was again found: 53.3% of the men and 21.1% of the women were referred to the cardiologist ( $P = 0.03$ ). In those with middle and high socioeconomic status, no significant difference was found (Table 5). Those with low, middle, and high socioeconomic status were also selected by age. Only for the age group 65–74 years were the numbers large enough to be significant. In this group we observed that the referral ratio of women with low socioeconomic status was significantly lower than for men in the same group. For men with low socioeconomic status the referral ratio was 52.2%, for women this was 15.4% ( $P = 0.02$ ). The sex differences among those with middle and high socioeconomic status were not significant.

For cerebrovascular accident and transient ischaemic attack,

**Table 3.** Incidence of diseases per 1000 men and 1000 women per year, by socioeconomic status.

	Men		Women		P-value <sup>a</sup>
	Low status	High status	Low status	High status	
Incidence of:					
Myocardial infarction	4.0	2.6	2.6	0.9	0.0070
Angina pectoris	3.4	2.0	2.7	1.2	0.019
CVA/TIA	3.2	2.7	4.4	2.2	0.0090

<sup>a</sup>P-value for women with low socioeconomic status compared with women with high economic status. CVA = cerebrovascular accident; TIA = transient ischaemic attack.

**Table 4.** Referral ratio to the cardiologist for angina pectoris for men and women by age group.

Age group	% Men	Total	% Women	Total	P-value
25–44 years	100	8	0	1	–
45–64 years	53.6	84	44.1	34	–
65–74 years	48.8	41	22.2	45	0.037
75 + years	28.0	25	15.2	33	–

**Table 5.** Referral ratio to the cardiologist for angina pectoris for men and women by socio-economic status.

Economic status	% Men	Total	% Women	Total	P-value
Low	53.3	77	21.1	57	0.03
Middle	53.9	65	31.9	44	–
High	26.7	15	44.4	9	–

referral ratios were 77.5% and 32.8% for men and 68.0% and 34.2% for women. The referral ratio to the neurologist for cerebrovascular accident was 65.0% and 57.7% for men and women respectively, and for transient ischaemic attack the ratio was 24.1% and 27.9%. The differences found are not significant. The referral ratio for neurovascular disease by age showed no significant sex difference. The non-referred appeared merely in the highest age group in both men and women. There was also no significant sex difference in referral ratio by socioeconomic status.

## Discussion

Men have a higher incidence of coronary heart disease in all age groups; however, the sex difference reduces with age. We only found a significant difference for angina pectoris in the age group 45–64 years. The incidence increases with age for both men and women. Postmenopausal women lose their protection for cardiovascular disease,<sup>9,10</sup> and the incidence of cardiovascular disease in women at higher age found in our study, close to that of men, can be explained by this process.

Our study confirmed that coronary heart disease varies by socioeconomic status: the lower the socioeconomic status, the higher the morbidity. In particular for women, the relative risk for low socioeconomic status compared with those with high socioeconomic status is higher than for men for all studied diseases. This pattern is in accordance with the literature,<sup>11–16</sup> where studies on risk factors and incidence rates of coronary heart disease were population based. However, studies in primary care on this subject were not found.

Differences in smoking habits could be a reason for the excess of women with low socioeconomic status with angina pectoris.<sup>17</sup> Data on smoking habits in the Netherlands show that, for both sexes, smoking is more common among people with low socioeconomic status. The ratio of smokers among people with low socioeconomic status versus those with high socioeconomic sta-

tus is 1.67 and 1.50 for men and women respectively.<sup>18</sup> Hence, the smoking habits cannot explain the sex differences.

Other factors in the risk profile have to be different for women. In the study data used, we found no significant higher incidence of hypertension in women with lower socioeconomic status. Maybe the figures were too small to be significant because, in the literature, a higher incidence of hypertension in women with low socioeconomic status is described.<sup>11</sup> Explanations mentioned are differences in body mass index, physical activity, and consumption of specific food items. Another possible reason is that women with lower socioeconomic status are far less likely to be employed, and being a housewife and living under poor circumstances could be a stress factor leading to cardiovascular disease.<sup>12</sup>

With regard to the referral pattern, sex differences were most clearly found for angina pectoris. For angina pectoris, a much lower referral to cardiologists was found for women in the age group 65–74 years than for men in the same age group. This difference could be caused by the angina pectoris being more severe in men owing to different co-morbidity and risk factors. However, in this age group the prevalence of diabetes is the same for men and women.<sup>19</sup> Another factor that could play a role is the physician's interpretation of whether the angina pectoris is mild or severe. Men might be diagnosed as suffering from severe angina pectoris more often than women because of physician bias.<sup>3</sup>

Another striking finding was that women with low socioeconomic status were referred significantly less than men. Diagnostic differences between women versus men should be considered; women could present with atypical angina pectoris more often than men could, which has been found in earlier research.<sup>2</sup>

Socioeconomic status could result in the undertreatment of women. Low socioeconomic status could strengthen this effect of undertreatment in women. In the literature, delayed referral in women has been described,<sup>3,4</sup> but smaller sex differences were

found and no differences between the socioeconomic classes were studied. These studies derive data from secondary care, while our findings concern primary care. Does the difference lie in the severity of the cases or in the physician bias in primary care? Further study on this is required.

Finally we wish to pay attention to some limitations of this study. All morbidity figures consist of the health problems presented to the physician only. However, our study looks at more serious diseases for which most of the cases will be presented to the physician. Secondly, the diagnostic process of angina pectoris depends also on the presentation of the health problem by the patient and the capacity of the physician to recognize atypical angina pectoris. Further study is required to understand the contribution of the sex difference in this. Thirdly, there were no data available on severity of angina pectoris. This might play a role in the referral pattern. Lastly, we were not able to involve other risk factors, such as smoking habits and serum cholesterol levels in our study because these data were not registered.

Notwithstanding these limitations, the study reveals important sex differences in incidence rates and referral patterns in primary care, particularly in coronary heart disease by socioeconomic status.

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