

Cardiovascular risk factors and disease in general practice: results of the Nijmegen Cohort Study

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SUMMARY

The relationship between risk factors and cardiovascular disease (CVD) was determined using data from the Nijmegen Cohort Study, an 18-year prospective study. In 1977, cardiovascular risk factors were measured in 7092 Caucasian males and females from six general practices: age, smoking, serum cholesterol, blood pressure, body mass index and a family history of CVD were related to subsequent CVD mortality and morbidity. Most patients had more than one risk factor, in particular among men. A significant relationship between risk factors and CVD was demonstrated. In men, a relative risk (RR) of 1.8 was found for both high blood pressure and smokers. A positive family history yielded a RR of 1.8. The risk increased gradually with the number of risk factors; 38% of the group with all risk factors suffered a CVD within 18 years. In women, comparable RRs were found but the low absolute risk of CVD should indicate against the treatment of cardiovascular risk factors.

Keywords: cardiovascular disease; risk factors.

Introduction

THE correlation between risk factors and subsequent cardiovascular disease (CVD) presents important information for its prevention and in this respect reference is often made to the Framingham study.¹ Its risk tables are widely used² but have been criticised for overestimating the likelihood of subsequent events.³

The effect of combined risk factors should also be taken into account — subsequent events vary between populations, making it essential to analyse CVD risk for populations under care. This study calculated CVD risk and events in a Dutch middle-aged general practice population from an intervention project.⁴

Method

The Nijmegen Cohort Study is an 18-year follow-up^{5,6} of a cohort of 7092 individuals aged 20 to 50 years in 1977, who were screened by their general practitioner for the following cardiovascular risk factors: family history of CVD, smoking, physical activity, body mass index (BMI), blood pressure, and serum cholesterol. The follow-up assessed mortality between 1977 and 1995, cause of death, and current cardiovascular health status up to 1996. Six general practices belonging to the Nijmegen academic networks recorded cardiovascular morbidity and mortality based on ICHPPC-2-defined criteria. For this study, the first onset of angina pectoris or myocardial infarction was taken as the outcome variable for CVD morbidity.

Analysis

Normal blood pressure was defined as a systolic blood pressure (SBP) of <140 mmHg and a diastolic blood pressure (DBP) of <90 mmHg. The high blood pressure group included those currently using antihypertensive medication. The definition of elevated serum total cholesterol was a measurement of ≥ 5.8 mmol/l and the definition of overweight was a BMI measurement of ≥ 27 kg/m². Cox proportional hazard regression was used with the onset of a first cardiovascular disease event as the outcome variable. Hazard ratios for separate and combined risk factors and relative risks were estimated.

Results

As virtually all cardiovascular events were encountered in patients who were 30 years of age or older in 1995, the analysis was restricted to this group ($n = 4207$). The 45 patients with a history of cardiovascular disease at the time of screening were excluded from this analysis. The 16% who

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HOW THIS FITS IN

What do we know?

Cardiovascular prevention is based on a 10-year risk calculation using the Framingham study, without familial risk taken in the tables.

What does this paper add?

Familial risk is an important risk factor, comparable with hypertension risk. Middle-aged men with multiple risk factors can be indentified at high risk over an 18-year period. Reservation in treating cardiovascular risk factors in middle-aged women is justified.



had moved and were lost to follow-up did not differ from participants with regard to risk factors. Of all deaths recorded (187), 43 were classified as cardiovascular owing to myocardial infarction (Table 1).

Most of the men (75%) and 59% of the women had one or more risk factors. The association between risk factors and CVD morbidity is shown in Table 2. Males and females had comparable relative risks; however, men had a higher absolute risk. Most male CVD deaths (27/36) had at least two risk factors; the seven females who died from a myocardial infarction all had a low-to-normal risk. Table 3 shows the observed CVD events for each risk factor. A separate risk factor indicates normal values for the other risk factors. Isolated risk factors were present in a minority: hypertension in 17% of the men and 31% of the women and elevated cholesterol in 29% of the men and 38% of the women. A combination of risk factors gave a higher CVD risk: 38% for men with all risk factors, with the lowest risk in patients with isolated high blood pressure or elevated cholesterol.

Extrapolating our figures to a 'standard' Dutch general practice with a total registered population of 2350, there would be 300 men and women aged 30 to 50 years. Of these, approximately 100 males and 80 females will have multiple risk factors, 125 males and 100 females will have one isolated risk factor, and 75 males and 120 females will have no risk factors.

Discussion

On an individual level, risk factors were more often combined, while single risk factors were present in only a minority of those identified with risk factors. In males (but not in females), CVD mortality was related to the presence of (multiple) risk factors.

For CVD morbidity, the relative risk associated with hypertension — 1.8 in males and 1.7 in females — was comparable with findings of other studies.⁷ Only the Framingham Offspring Study, consisting of offspring of the original Framingham cohort, revealed no association between hypertension and CVD in men, presumably owing to the effects of treatment.⁸ A positive family history yielded a relative risk of 1.8, emphasising the need to consider family history in treatment decisions.

The relationship between the number of risk factors and the CVD risk (a cumulative risk of 38% for those with all risk factors) is comparable with others.⁹ The analysis in this study confirms at least that low cholesterol, in the presence of other risk factors, is accompanied by lower CVD risk: 1% of all CVD morbidity occurred in patients with cholesterol below 4.2 mmol/l.¹⁰

Given its prevalence, treatment should focus on patients with multiple risk factors, including BMI and family history. Generally, it can be expected that one-third of middle-aged men have a low CVD risk, one-third have one risk factor, and

Table 1. Characteristics of the study population in 1977 (aged 30 to 50 years). Values in parentheses are standard deviations.

	Males (n = 2055)	Females (n = 2152)
Mean age (years)	38.7 (range = 30–50)	38.8 (range = 30–50)
Blood pressure (mmHg)		
DBP	83 (11)	82 (10)
SBP	135 (115)	131 (16)
Cholesterol (mmol/l)	5.5 (1.05)	5.2 (0.99)
BMI (kg/m ²)	24.9 (2.8)	24.4 (3.5)
Smoking habit (>10 cigarettes per day)	46.1%	27.4%
Number with CVD	199	58
Deaths from CVD	36	7
Other deaths	86	58

Table 2. Number of participants with an elevated risk factor for each category and relative risk.

	Males (n = 2055)			Females (n = 2152)		
	n (%)	% CVD	RR	n (%)	% CVD	RR
No risk factor	513 (25.0)	4	0.3 (0.2–0.6)	901 (41.8)	2	0.4 (0.2–0.7)
High blood pressure	340 (16.6)	21	1.8 (1.2–2.3)	329 (15.3)	8	1.7 (0.8–2.5)
Heavy smoker	944 (46.1)	15	1.8 (1.2–2.4)	588 (27.4)	5	1.4 (0.8–2.4)
Total cholesterol ≥5.8 mmol/l	794 (38.6)	19	2.5 (1.9–2.9)	490 (22.7)	7	1.9 (1.1–3.4)
BMI ≥27 kg m ⁻²	436 (21.2)	17	1.6 (1.2–2.0)	448 (20.8)	8	1.9 (1.1–2.8)
Positive family history	371 (18.1)	15	1.8 (1.3–2.5)	439 (20.4)	4	1.9 (1.1–3.3)

% CVD = percentage of events; RR = adjusted relative risk and 95% confidence interval determined by Cox proportional hazard regressions with all five risk factors and age included.

Table 3. Observed numbers of patients who suffered a CVD in each risk category, indicating the predictive value for each separate risk factor (with normal values for the other risk factors) and for the combination of risk factors. Practice means expected numbers in a standard general practice.

	Males (n = 2055)			Females (n = 2152)		
	n	CVD (%)	Practice (n = 300)	n	CVD (%)	Practice (n = 300)
No risk factor	513	17 (3)	75	901	9 (1)	123
High blood pressure ($\geq 140/90$)	57	2 (4)	9	101	5 (5)	15
Total cholesterol ≥ 5.8 mmol/l	231	17 (7)	33	185	5 (3)	27
Body mass index ≥ 27 kg m ⁻²	104	5 (5)	15	169	7 (4)	24
Smoker	429	23 (5)	60	340	5 (1)	48
High blood pressure + high total cholesterol	54	8 (15)	9	40	3 (8)	6
High total cholesterol + smoker	228	41 (18)	33	91	3 (3)	13
High blood pressure + high total cholesterol + smoker	51	12 (23)	9	19	00	
All risk factors	37	14 (38)	6	15	1 (7)	3

one-third are at a moderate-to-high risk of CVD. Reservations in treating cardiovascular risks in women are justified and should therefore concentrate on body weight and smoking risk factors.

The importance of this study is that it is based on Dutch general practice population data. This makes it also a relevant reference for the calculation of the potential costs and benefits of general practice-based individual prevention in other West European countries.

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