Evidence based cardiology: Psychosocial factors in the aetiology and prognosis of coronary heart disease: systematic review of prospective cohort studies

Harry Hemingway and Michael Marmot

BMJ 1999;318;1460-1467

Evidence based cardiology

Psychosocial factors in the aetiology and prognosis of coronary heart disease: systematic review of prospective cohort studies

Harry Hemingway, Michael Marmot

This is the third of four articles

International Centre for Health and Society, Department of Epidemiology and Public Health, University College London Medical School, London WC1E 6BT

Harry Hemingway, *senior lecturer in epidemiology*

Michael Marmot, *professor of epidemiology and public health*

Correspondence to: Dr H Hemingway, Department of Research and Development, Kensington and Chelsea and Westminster Health Authority, London W2 6LX
h.hemingway@public-health.ucl.ac.uk

BMJ 1999;318:1460–7

website *e*xtra

References in the tables are given on the BMJ website

www.bmj.com

Do psychosocial factors cause coronary heart disease or affect survival among patients with coronary heart disease? Here we use an explicit methodological quality filter to review systematically the prospective cohort studies testing specific psychosocial hypotheses. This review of the epidemiological literature identifies the psychosocial factors that have been most rigorously tested. Only four psychosocial factors met the quality filter: type A/hostility, depression and anxiety, work characteristics, and social supports. The importance of other study designs—for example, ecological[1] or nested case-control[2–4] studies—is acknowledged. The review should be seen as complementary to existing reviews[5–8] on single psychosocial factors and as a challenge to investigators in the field to ensure that the systematic review is made unbiased, kept up to date, and used to guide future hypothesis testing.

Summary points

In healthy populations, prospective cohort studies show a possible aetiological role for type A/hostility (6/14 studies), depression and anxiety (11/11 studies), psychosocial work characteristics (6/10 studies), social support (5/8 studies)

In populations of patients with coronary heart disease, prospective studies show a prognostic role for depression and anxiety (6/6 studies), psychosocial work characteristics (1/2 studies), and social support (9/10 studies); none of five studies showed a prognostic role for type A/hostility

Although this review can not discount the possibility of publication bias, prospective cohort studies provide strong evidence that psychosocial factors, particularly depression and social support, are independent aetiological and prognostic factors for coronary heart disease

What is a psychosocial factor?

A psychosocial factor may be defined as a measurement that potentially relates psychological phenomena to the social environment and to pathophysiological changes. The validity and reliability (precision) of the questionnaire based instruments used to measure psychosocial factors has been improved through the use of psychometric techniques. By avoiding the unhelpful general term of "stress," recent work has developed theoretical models—for example, the job control-demands-support model of psychosocial work characteristics—which generate specific hypotheses that can be tested.

How might psychosocial factors be linked to coronary heart disease?

Evidence of mechanisms linking psychosocial factors with coronary heart disease (reviewed elsewhere[9 10]) is important in making causal inferences and therefore in designing preventive interventions. Psychosocial factors may act alone or combine in clusters[11] and may exert effects at different stages of the life course.[12] Broadly, three interrelated pathways may be considered. Firstly, psychosocial factors may affect health related behaviours such as smoking, diet, alcohol consumption, or physical activity, which in turn may influence the risk of coronary heart disease.[13] If such behaviours do lie on the causal pathway between psychosocial factors and coronary heart disease, then treating them as confounding variables, as some studies do, must be questioned. Secondly, psychosocial factors may cause direct acute or chronic pathophysiological changes. Thirdly, access to and content of medical care may plausibly be influenced by, for example, social supports (but there is little direct evidence for this). Although it is beyond the scope of this review to consider the determinants of adverse psychosocial factors, socioeconomic status is inversely associated with coronary heart disease[14] and also with certain psychosocial factors, and it has been proposed that psychosocial pathways may play a mediating role.[15 16]

Table 1 Studies of type A behaviour, hostility, and coronary heart disease. References in this table are given on the *BMJ* website

Author, year, country	Total sample (% women)	Age at entry	Exposure	Follow up (years)	No of events	Type of events	Adjustments	Relative risk*	Summary†
Prospective aetiological studies									
Jenkins 1974[w1] USA	2750 (0)	39-59	Type A	4	120	Non-fatal MI + angina	Age	1.8*	+
Rosenman 1976[w2] USA	3154 (0)	39-59	Type A	8.5	257	Fatal CHD + non-fatal MI	Age, smoking, cholesterol, family history, corneal arcus, schooling, β:α lipoprotein ratio	2.16*	++
Haynes 1980[w3] USA	1674 (57)	45-77	Type A (Framingham)	8	170	Fatal CHD + non-fatal MI + coronary insufficiency + angina	Age, smoking, blood pressure, cholesterol, glucose intolerance and other psychosocial factors	1.8*; among men, the effect was confined to white collar workers	+
Shekelle 1983[w4] USA	1877 (0)	40-55	Hostility (MMPI)	10	139	Fatal CHD + non-fatal MI	Age, smoking, blood pressure, cholesterol, alcohol	1.47*, but effect not linear	+
Cohen 1985[w5] USA	2187 (0)	57.8 (mean)	Type A (JAS)	8	190	Fatal CHD + non-fatal MI + angina	Smoking, blood pressure, cholesterol, body mass index, alcohol, and other biological factors	1.43, Type A associated with prevalence, not incidence or postmortem findings	0
Shekelle 1985[w6] USA	3110 (0)	46 (mean)	Type A (JAS)	7.1	554	Fatal CHD + non-fatal MI	Age, smoking, blood pressure, cholesterol, alcohol, education	0.87	0
Johnston 1987[w7] UK	5936 (0)	40-59	Type A (Bortner)	6.2	255	Fatal CHD + non-fatal MI	Age, social class	0.89	0
Ragland 1988[w8] USA	3154 (0)	39-59	Type A (SI)	22	214	Fatal CHD	Age, smoking, blood pressure, cholesterol	0.98	0
Hearn 1989[w9] USA	1399 (0)	19	Hostility (MMPI)	33	54	Fatal CHD + non-fatal MI + angina + coronary surgery	Smoking, hypertension, family history	1.1; no association in crude or risk factor adjusted analyses	0
Barefoot 1995[w10] USA	730 (44)	50	Hostility (Cook-Medley)	27	122	Non-fatal MI	Age, sex, smoking, blood pressure, triglycerides, exercise	1.26 (men) 2.95* (women)	0 (men) ++(women)
Bosma 1995[w11] Lithuania and Netherlands	5817 (0)	45-60	Type A (JAS)	9.5	394	Fatal CHD + non-fatal MI	Age	No association	0
Kawachi 1996[w12] USA	1305 (0)	40-90	MMPI-2 anger content scale	7	110	Fatal CHD + non-fatal MI + angina	Age, smoking, blood pressure, cholesterol, body mass index, family history, alcohol	2.66*	++
Everson 1997[w13] Finland	1599 (0)	42-60	Cynical hostility (Cook-Medley)	6	60	First MI	Age, biological, socioeconomic, behavioural, social support, prevalent diseases	1.43 (2.18* when adjusted for age only)	0
Tunstall-Pedoe 1997[w14] Scotland	11659 (50)	40-59	Type A (Bortner)	7.6	581	Fatal CHD + non-fatal MI + coronary surgery	Age	0.82* in women, ie type A protective	0
Prognostic studies									
Case 1985[w15] USA	516 (18) patients <14 days post MI	<70	Type A (JAS)	2	53	Fatal CHD and all cause mortality	Age, sex, education, rales, ejection fraction, New York Heart Assocation functional class, ventricular premature beats	0.8	0
Shekelle 1985[w16] USA	2314 (11) patients post MI	30-69	Type A (JAS)	3	294	Non-fatal MI and fatal CHD	Smoking, previous MI, angina, fasting glucose	No association	0
Ragland 1988[w17] USA	257 (0) with MI or angina	39-70	Type A (SI)	11.5	91	Fatal CHD	Age at initial event, follow up time, type of initial coronary event, smoking, blood pressure, cholesterol	0.58*; type A protective	0
Barefoot 1989[w18] USA	1467 (18) patients with angiographic disease	mean 52 (SD 9)	Type A (SI)	5	315	Fatal CVD + non-fatal MI	Stratified on clinical prognostic factors	No association with non-fatal MI	0
Jenkinson 1993[w19] UK	1376 (22) 7 days post-MI	25-84	Type A	3	247	All cause mortality	Age, previous MI,hospital complications, diabetes, hypertension, car ownership, sex	No association	0

CHD=coronary heart disease; MI=myocardial infarction; SI=structured interview; JAS=Jenkins activity survey; MMPI=Minnesota multiphasic personality inventory.
*P<0.05. †0=no association—that is, relative risk not significantly different from unity; +=moderate association (relative risk >1⩽2.0); ++=strong association (relative risk >2.0).

Method of systematic review

A methodological quality filter was used to select studies for inclusion in the systematic review, so that the strength of evidence could be compared across psychosocial factors. Prospective cohort studies are the best observational design for questions of aetiology and prognosis. The studies included had a prospective cohort design; a population based sample (aetiological studies in healthy populations); at least 500 participants (aetiological studies) or 100 participants (prognostic studies in populations of patients with coronary heart disease); measurements of a psychosocial factor used in at least two different study populations; outcomes of fatal coronary heart disease or non-fatal myocardial infarction or (prognostic studies only) all cause mortality.

Articles were identified by Medline search (1966-97), manual searching of the bibliographies ofretrieved articles, previous review articles, writing to researchersin the field, and an in-house bibliographic database. No register of published and unpublished studies with

Studies showing role of psychosocial factors

In healthy populations, prospective cohort studies suggest a possible aetiological role for:
- Type A/hostility (6/14 studies)
- Depression and anxiety (11/11 studies)
- Psychosocial work characteristics (6/10 studies)
- Social support (5/8 studies)

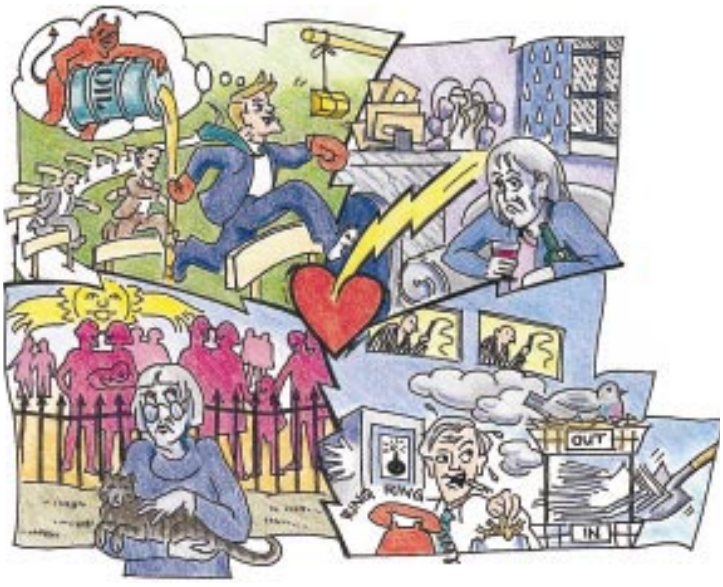
In coronary heart disease patient populations, prospective studies suggest a prognostic role for:
- Type A/hostility (0/5 studies)
- Depression and anxiety (6/6 studies)
- Psychosocial work characteristics (1/2 studies)
- Social support (9/10 studies)

Although this review cannot discount the possibility of publication bias, prospective cohort studies provide strong evidence that psychosocial factors, particularly depression and social support, are independent aetiological and prognostic factors for coronary heart disease.

psychosocial exposures exists, and hand searching of journals was not performed, so there is a serious potential for publication bias. For this reason as well as the lack of standardised methods of measurement of psychosocial factors, we carried out a narrative, rather than quantitative, systematic review. Given that randomised controlled trials, at least for primary prevention, are rarely feasible, observational studies are likely to remain the main type of evidence on which to base preventive action.

Evidence for specific psychosocial factors

Largely on the basis of studies in middle aged men (table 1), four groups of psychosocial factors were identified by using the predefined quality filter: psychological traits (type A behaviour, hostility), psychological states (depression, anxiety), psychological interaction with the organisation of work (job control-demands-support), and social networks and social support. In simple terms this corresponds to a spectrum with mainly psychological components at one end and a stronger social component at the other. The box summarises the key results.



SUE SHARPLES

Hostility and type A behaviour

Type A behaviour pattern—the only personality trait which met the criteria of our review—is characterised by hard driving and competitive behaviour, a potential for hostility, pronounced impatience, and vigorous speech stylistics. The instruments for measurement of type A behaviour and hostility—the Jenkins activity scale, the structured interview, the Minnesota multiphasic personality inventory (MMPI), the Bortner hostility scale—have been subjected to psychometric testing and incorporated into many cardiovascular cohort studies, including some that have not reported results. Unlike other psychosocial factors, type A is distinguished by being the subject of numerous intervention trials.[17] On the basis of early positive findings in the Framingham study[18] and the Western Collaborative Group's eight year follow up,[19] among other evidence, the National Institutes of Health declared type A an independent risk factor for coronary heart disease. However, with the publication of negative findings[20–22] it was proposed that a more specific component of type A, namely hostility, might be aetiological, although there are conflicting studies. None of the five studies that examined type A or hostility in relation to prognosis among patients with coronary heart disease showed an increased risk; indeed, one suggested a protective effect.

Depression and anxiety

The relation between depression and anxiety and coronary heart disease differs from those of other psychosocial factors for several reasons. Firstly, unlike other psychosocial factors, depression and anxiety represent well defined psychiatric disorders, with standardised instruments for measurement. Secondly, depression and anxiety are commonly the consequence of coronary heart disease, and the extent to which they are also the cause poses important methodological issues. Thirdly, the ability to diagnose and treat such disorders makes them attractive points for intervention. Finally, depression and coronary heart disease could share common antecedents—for example, environmental stressors and social supports.

Table 2 shows the results from the 11 prospective studies that investigated depression or anxiety in the aetiology of coronary heart disease, all of which were positive. All three of the prospective studies examining the effect of anxiety in the aetiology of coronary heart disease had positive results. Intriguingly, there is some evidence that this effect is strongest specifically for phobic anxiety and sudden cardiac death. Wassertheil-Smoller[23] reported the effect of depression in relation to cardiovascular events among 4367 healthy older people. An increase in depression symptoms (but not the baseline scores) predicted events, even when multiple covariates were controlled for. Such findings are compatible with the hypothesis that premonitory signs of coronary heart disease such as angina or breathlessness may have led to the increase in depression. Studies with longer periods of follow up are less likely to be confounded by the possibility of early disease causing depression, but raise further questions about

Table 2 Studies of depression and anxiety and coronary heart disease. References in the table are given on the *BMJ* website

Author, year, country	Total sample (% women)	Age at entry	Exposure	Follow up (years)	No of events	Type of events	Adjustments	Relative risk*	Summary†
Prospective aetiological studies									
Hallstrom 1986[w20] Sweden	795 (100)	38-54	Depression (Hamilton and psychiatric interview)	12	75	Non-fatal MI + angina + ischaemic changes on electrocardiograph	Age, social class, marital status, conventional risk factors	5.4* severity of depression predicted angina but not other outcomes	++
Hagman 1987[w21] Sweden	5735 (0)	55 (mean)	Anxiety ("stress")	2-7	162	Angina with or without MI	Age, smoking, blood pressure, cholesterol, relative weight	Strong predictor for angina alone	+
Haines 1987[w22] UK	1457 (0)	40-64	Phobic anxiety (Crown-Crisp)	10	113	Fatal CHD + non-fatal MI	fibrinogen, cholesterol, factor VII, systolic blood pressure	3.77* for fatal CHD	++
Appels 1990[w23] Netherlands	3877 (0)	39-65	Depression	4.2	59	Non-fatal MI + unstable angina + angina	Age, smoking, blood pressure, cholesterol	1.86* for unstable angina for combination of low mood, low energy, hopelessness, poor sleep (termed "vital exhaustion")	+
Anda 1993[w24] USA	2832 (52)	45-77	Depression (General Well Being)	12	394	Fatal CHD + non-fatal CHD hospitalisations	Age, sex, race, education, marital status, smoking, blood pressure, cholesterol, body mass index, alcohol, exercise	1.6*	+
Aromaa 1994[w25] Finland	5355 (55)	40-64	Depression (GHQ and PSE)	6.6	91	Fatal CHD	Age, pre-existing cardiovascular disease	3.36* (5.52 in those with pre-existing cardiovascular disease)	++
Kawachi 1994[w26] USA	33999 (0)	42-77	Phobic anxiety (Crown Crisp)	2	168	Fatal CHD + non-fatal MI	Age, smoking, blood pressure, cholesterol, body mass index, diabetes, parental history of MI, alcohol, exercise	3.01* (6.08 when sudden cardiac death examined)	++
Everson 1996[w27] Finland	2428 (0)	42-60	Hopelessness	6	95	Non-fatal MI	Age, smoking, blood pressure, cholesterol education, income, exercise, alcohol, lipids, social supports, depression	2.05*	++
Wassertheil-Smoller 1996[w28] USA	4367 (53)	72 (mean)	Depression (CES-D)	4.5	321	Non-fatal MI + non-fatal strokes	Age, smoking, baseline depression, sex, race, randomisation group, education, history of stroke, MI, diabetes, and baseline ADL	1.18* per 5 unit increase in depression score (baseline scores alone did not predict events)	+
Barefoot 1996[w29] Denmark	730 (44)	50 or 60	Depression (MMPI-obvious depression scale)	27	122	Non-fatal MI	Age, conventional CHD risk factors, baseline CHD	1.7* for 2 SD difference in depression score	+
Kubzansky 1997[w30] USA	1759 (0)	21-80	Social conditions worry scale	20	323	Fatal CHD + non-fatal MI + angina	Age, smoking, blood pressure, cholesterol, body mass index, family history, alcohol	1.23* per 1 point increase in social conditions worry scale	+
Prognostic studies									
Ahern 1990[31] USA	353		Depression (Beck), anxiety (Spielberger)	12		Fatal CHD	Age, left ventricular dysfunction and previous MI	1.3* for depression	+
Kop 1994[32] Netherlands	127 (17) patients 2 weeks after coronary angioplasty	56 (SD 9)	Maastricht questionnaire for vital exhaustion	1.5	29	Fatal CHD + non-fatal MI + further revascularisation + increase in coronary atherosclerosis + new angina	Age, sex, smoking, blood pressure, cholesterol, severity of coronary artery disease, clinical presentation	2.34 (P=0.06)	+
Ladwig 1994[33] Germany	377 (0) 17-21 days after acute MI	29-65	Depression (interview)	0.5		Angina, not returning to work, continuing to smoke	Age, social class, recurrent infarction, rehabilitation, cardiac events and helplessness	2.31* for the effect on angina; depression predicted all outcomes	++
Frasure-Smith 1995[w34] USA	222 (21) patients 5-15 days after acute MI	24-88	Depression (diagnostic interview schedule)	1.5	21	All cause mortality and fatal CHD	Age, Killip class, premature ventricular contractions and previous MI	6.64* effect of depression higher in those with (10 premature contractions per hour	++
Barefoot 1996[w35] USA	1250 (18) patients with angiographic disease	52 (mean)	Depression (Zung)	19.4	604	All cause mortality and fatal CHD	Disease severity, initial treatment	1.66*, 1.84* and 1.72* in three follow up periods (year 1, 5-10 and >10 respectively)	+
Denollet 1996[w36] Belgium	303 (12) patients with angiographic disease	31-79	Type D personality (suppression of emotional distress), depression, social alienation	7.9	38	All cause mortality and fatal CHD	Left ventricular function, number of diseased vessels, low exercise tolerance, lack of thrombolytic therapy	4.1* for type D and 2.7* for depression	++

CHD=coronary heart disease; MI=myocardial infarction; CES-D=Center for Epidemiological Studies-Depression scale; GHQ=general health questionnaire; PSE=present state examination; MMPI=Minnesota multiphasic personality inventory.
*P<0.05. †0=no association—that is, relative risk not significantly different from unity; +=moderate association (relative risk >1⩽2.0); ++=strong association (relative risk >2.0) association.

the time course of exposure. For example, it is possible that there is a common trigger (such as viral illness) that precipitates both symptoms of depression and atherothrombotic processes. By examination of subclinical manifestations of coronary heart disease (using non-invasive measures of arterial structure and function, for example) before the onset of symptoms, the temporal sequence of the relation might be better understood.

Depression in patients after myocardial infarction seems to be of prognostic importance beyond the severity of coronary artery disease. Although discrete major depressive episodes are not uncommon after a myocardial infarction, depressive symptoms are more prevalent. Given the graded relation between depression scores and risk, the long lasting nature of the effect, and the stability of the depression measured across time, it has been proposed that depression is a continuously distributed chronic psychological characteristic.

Psychosocial work characteristics

The longstanding observation that rates of coronary heart disease vary markedly among occupations—more than can be accounted for by conventional risk factors for coronary heart disease—has generated a quest for specific components of work that might be of aetiological importance. The dominant "job strain" model of psychosocial work characteristics, as proposed by Karasek and Theorell, grew out of secondary analyses of existing survey data on the labour force. This model proposes that people in jobs characterised by low control over work and high conflicting demands might be high strain. A subsequent addition to the model was that social support might buffer this effect. The advantage of the model is that it generates specific hypotheses for testing.

Table 3 shows prospective cohort studies that have examined the relation between job strain and coronary heart disease. Both self reports and ecological

Table 3 Studies of psychosocial work characteristics and coronary heart disease. References in table are given on *BMJ* website

Author, year, country	Total sample (% women)	Age at entry	Exposure	Follow up (years)	No of events	Type of events	Adjustments	Relative risk*	Summary†
Prospective aetiological studies									
LaCroix 1984[w37] USA	876 (37)	45-64	Job control and demands (individual and ecological)	10	Not stated	Fatal CHD + non-fatal MI + coronary insufficiency + angina	Age, smoking, blood pressure, cholesterol	2.9* all women (clerical women RR=5.2) no association in men. Ecological exposure was associated with risk in men and women	+
Alfredsson 1985[w38] Sweden	958 096 (51)	20-64	Hectic work and few possibilities for learning (ecological)	1	1201	Non-fatal MI (hospitalisation)	Age, 10 sociodemographic factors, smoking, heavy lifting	1.5*	+
Haan 1988[w39] Finland	902 (33) factory workers	20-62	Job control, physical strain, variety (individual)	10	60	Fatal CHD + and non-fatal CHD	Age, smoking, blood pressure, cholesterol, alcohol, relative weight	4.95* for low control, low variety, high physical strain	++
Reed 1989[w40] Hawaii (Japanese ancestry)	4737 (0)	45-65	Job control, demands and their interaction (ecological)	18	359	Fatal CHD and non-fatal MI	Age	No effect of control, demands or their interaction (ns trend for lower strain men to have higher CHD)	0
Netterstrom 1993[w41] Denmark	2045 (0) bus drivers	21-64	Job variety, satisfaction	10	59	Fatal CHD	Age	2.1*—high job variety and satisfaction associated with CHD risk	0
Suadicani 1993[w42] Denmark	1752 (0)	59 (mean)	Job influence, monotony, pace, satisfaction, ability to relax	3	46	Fatal CHD + non-fatal MI	None	Only inability to relax after work associated with CHD	0
Alterman 1994w[43] USA	1683 (0)	38-56	Job control, demands and their interaction (ecological)	25	283	Fatal CHD	Age	1.4 for job strain	0
Bosma 1997[w44] UK	10 308 (33) civil servants	35-55	Job control, demands (individual, assessed twice 3 years apart, and ecological)	5	654	Angina + doctor diagnosed ischaemia	Age, smoking, blood pressure, cholesterol, body mass index, employment grade	1.93* self reported or externally assessed low job control predicted CHD	+
Lynch 1997[w45] Finland	1727 (0)	42-60	Job demands, resources, income	8.1	89	Fatal CHD + non-fatal MI	Age, behavioural, biological and psychosocial covariates	1.57* for the effect of high demands, low resources and low income; 2.59 when adjustment made for age only	+
Steenland 1997[w46] USA	3575 (0)	25-74	Job control and demands (ecological)	14	519	Fatal CHD + non-fatal MI	Age, smoking, blood pressure, cholesterol, education, body mass index, self reported diabetes	1.41* for low control	+
Prognostic studies									
Hlatky 1995[w47] USA	1489 (24) employed patients undergoing coronary angiography	41-59	Job control, demands (individual)	5	112	Fatal CHD + non-fatal MI prevalence of coronary artery disease	Ejection fraction, extent of coronary atherosclerosis, myocardial ischaemia	0.96 for effect of job strain on events. Job strain was associated with normal coronary arteries	-
Hoffmann 1995[w48] Switzerland	222 (0) after first MI	30-60	Job work load, locus of control, social supports	1	19	All cause mortality, reinfarction, severe symptoms, or poor exercise capacity	Age, severity of MI, exercise	High workload and low external locus of control associated with outcome	+

CHD=coronary heart disease; MI=myocardial infarction.
*P<0.05. †0=no association—that is, relative risk not significantly different from unity; +=moderate association (relative risk >1⩽2.0); ++=strong association (relative risk >2.0) association.

Table 4 Studies of social networks and social supports and coronary heart disease. References in table are given on *BMJ* website

Author, year, country	Total sample (% women)	Age at entry	Exposure	Follow up (years)	No of events	Type of events	Adjustments	Relative risk*	Summary†
Prospective aetiological studies									
Medalie 1976[w49] Israel	10 000 (0)	>40	Perceived love and support from spouse	5	300	Angina	Age, blood pressure, cholesterol, diabetes, ECG abnormalities	1.8*	+
House 1982[w50] USA	2754 (52)	35-69	Social relationships and activities	11	114	Fatal CHD	Age, baseline CHD, smoking, forced expiratory volume at 1 second	Not stated	+
Berkman 1983[w51] USA	4725 (53)	30-69	Social network index	9	120	Fatal CHD	Age	2.13*	++
Reed 1983[w52] USA	4653 (0)	52-71	Social network score	6	218	Fatal CHD + non-fatal	Age, blood pressure, cholesterol, glucose, uric acid, forced vital capacity, body mass index, exercise, alcohol, complex carbohydrate	Social network associated with CHD prevalence, but not incidence	0
Kaplan 1988[w53] Finland	13301	39-59	Social network index	5	223	Fatal CHD	Age, smoking, blood pressure, cholesterol, prevalent illness, urban/ rural residence	1.34 for men but not women	0
Vogt 1992[w54] USA	2603 (54)	18-75+	Network scope, network frequency, and network size	15	not stated	Fatal CHD + non-fatal CHD	Age, sex, SES, smoking and subjective health status at baseline	1.5* for effect of network scope on CHD incidence; all 3 measures predicted survival in those with CHD	+
Orth-Gomer 1993[w55] Sweden	736 (0)	50	Emotional support from close people and support from extended network (social integration)	6	25	Fatal CHD + non-fatal CHD	Age, cholesterol treatment of hypertension, diabetes, body mass index< smoking, physical activity	3.8* for social integration 3.1 for emotional support	++
Kawachi 1996[w56] USA	36 624 (0)	42-77	Social network index	4	403	Fatal CHD + non-fatal MI	Age, time period, smoking, blood pressure, cholesterol, diabetes, angina, body mass index, family history, alcohol, exercise	1.14. Some evidence for association with fatal CHD (particularly non-sudden cardiac death) rather than non-fatal MI	0
Prognostic studies									
Chandra 1983[w57] USA	1401	Not stated	Marital status	10	Not stated	All cause mortality	Age, race, smoking, severity of MI, medical care factors	Married men and women had better in hospital and 10 year survival	+
Ruberman 1984[w58] USA	2320 (0) patients with MI	30-69	Social support, life stress	3	128	All cause mortality, sudden cardiac death	Age, myocardial function, ventricular arrhythmia, smoking	4.5* for the effect of social isolation + high life stress on all cause mortality; 5.62 for sudden cardiac death	++
Wiklund 1988[w59] Sweden	201(0) patients with first MI	32-60	Social support, depression and other psychosocial factors	8.3	85	All cause mortality + recurrent non-fatal MI	Hypertension, smoking, angina	Being single increased risk of death	+
Case 1992[w60] USA	1234 (38) participants in diltiazem post-MI trial	25-75	Living alone, disrupted marriage	2	226	Fatal CHD + recurrent non-fatal MI	New York Heart Assocation functional class, ejection fraction, education, no β blockers, ventricular premature complexes, prior infarction	1.54* for effect of living alone. No effect of marital disruption	+
Hedblad 1992[61] Sweden	98 (0) men with ischaemic 24 hour ECG	68	Social support and social network	5	17	Fatal CHD + non-fatal MI	Age, smoking, blood pressure, cholesterol, alcohol, exercise, body mass index, triglycerides	5.6* and 4.1* for low informational support and low emotional support respectively	++
Williams 1992[w62] USA	1368 (18) patients with angiographicdis ease	52 (median)	Structural social support (marital status) and function social support	9	249	All cause mortality	Age, ejection fraction, non-invasive myocardial damage index, conduction disturbance, pain/ ischaemic index, mitral regurgitation, number of diseased vessels, % stenosis of left main stem and left anterior descending artery	3.34* for effect of unmarried patients without confidant	++
Berkman 1992[w63] USA	194 (48) patients with acute MI	65-85+	Emotional support	0.5	76	All cause mortality	Age, sex, Killip class, ejection fraction, reinfarction, comorbidity, functional disability, previous MI, ventricular tachycardia	2.9* for lack of emotional support	+
Gorkin 1993[w64] USA	1322 (17) patients with previous MI + ventricular premature complexes	60.8 (SD 9.9)	Social support	0.8	Not stated	All cause mortality	Ejection fraction, arrhythmia rates, CHD risk factors,	1.46* for 1 point decrease in social support	+
Jenkinson 1993[w19] UK	1376 (22) 7 days after MI	25-84	Social isolation, life stress, depression, type A	3	247	All cause mortality	Age, previous MI, hospital complications, diabetes, hypertension, car ownership, sex	1.33 for social support; no effect of type A or depression	0
Friedman 1995[w65] USA	369 (15) patients after acute MI with ventricular arrhythmias in the CAST	63 (SD 9)	Social support, life events, depression, anxiety, type A, anger	1	20	All cause mortality	Physiological severity, demographic and other psychosocial factors	Not stated	+

CHD=coronary heart disease; MI=myocardial infarction; CAST=cardiac arrhythmia suppression trial.
*P<0.05. †0=no association—that is, relative risk not significantly different from unity; +=moderate association (relative risk >1⩽2.0); ++=strong association (relative risk >2.0).

measurements (assigning a score on the basis of job title) of job strain have been made. Self reports may be biased by early manifestations of disease, and ecological measurements may lack precision. The finding that these methods tend to give reasonably consistent results suggests that they are complementary. Six of the 10 studies were had positive results. There is growing emphasis on the importance of low job control rather than on conflicting demands,[24] and it seems likely that these empirical results will lead to a reformulation of the model. Alternative models of psychosocial work characteristics involve an imbalance between the effort at work and rewards received.[25 26]

Social network structure and quality of social support

Social supports and networks relate to both the number of a person's social contacts and their quality (including emotional support and confiding support). Marital status—information routinely sought in clinical practice—is a simple measure of social support, and the ability of low social support to predict all cause mortality has long been recognised. It has been proposed that social supports may act to buffer the effect of various environmental stressors and hence increase susceptibility to disease,[27] but most of the evidence supports a direct role.

Five of the eight prospective cohort studies that investigated aspects of social support in relation to the incidence of coronary heart disease were positive (table 4). Nine of the 10 prognostic studies were positive, and the relative risks for three of these studies exceeded 3. Despite the strength and consistency of these findings, the relative effect of structural and functional aspects of social supports has yet to be delineated.

Modification of psychosocial factors

The main implications of these findings for clinical practice are summarised in the box. A recent meta-analysis found that psychosocial interventions are associated with improved survival after myocardial infarction.[28] However, two recent large randomised controlled trials of psychological rehabilitation after myocardial infarction found no difference in anxiety and depression, and this may in part explain the lack of effect on mortality.[29 30] Randomised controlled trials of modification of social supports after myocardial infarction show a decrease in cardiac death or reinfarction rates.[31] A patient's social circumstances should be elicited as part of the history, and the doctor may have a role in mobilising social support. A multicentre trial of 3000 patients after myocardial infarction (ENRICHD—enhancing recovery in coronary heart disease) is currently under way in the United States. It will target patients at high psychosocial risk (those who are depressed or socially isolated) and enrol large numbers of women and ethnic minorities.

The potential for primary prevention in relation to psychosocial factors lies largely outside the remit of clinicians. Psychosocial factors themselves are determined largely by social, political, and economic factors and it is therefore policy makers who influence the structure and function of communities—in the public and private domains—who may have scope for primary prevention.

Psychosocial components of secondary prevention

Clinicians should consider:

- Detecting and treating depression
- Mobilising social support
- Using socioeconomic status and psychosocial factors to risk stratify patients

Conclusion

Of the large number of psychosocial factors that have been studied, only four met the quality filter: type A/hostility, depression and anxiety, work characteristics, and social supports. While this review cannot discount the possibility of publication bias, the prospective observational studies show aetiological roles for social supports, depression and anxiety, and work characteristics and prognostic roles for social supports and depression. Further evidence of a causal role is provided by human and other primate evidence of biological and behavioural pathways mediating these effects. However, conflicting data exist on whether psychosocial interventions reduce mortality after myocardial infarction. This systematic review should be updated and expanded to include other observational study designs and other endpoints (for example, all cause mortality) in order to focus future research and, ultimately, policy. In this expanding area, future primary research might investigate the:

- Interrelationships between different psychosocial factors
- Effect of change in and cumulative exposure to psychosocial factors
- Short and long term effects thoughout the life course
- Differences by sex, ethnic group, and country
- Behavioural and biological mechanisms involved
- Effect of psychosocial factors on different clinical and subclinical outcomes
- Appropriate primary and secondary preventive measures.

The comments of Lisa Berkman, Ichiro Kawachi, Redford Williams, and Mandy Feeney are gratefully acknowledged. To keep this review complete and up to date, we would be grateful to be informed of studies which we may have missed.

Funding: MM is supported by an MRC research professorship; his group investigating pyschosocial factors and health has been supported by the Agency for Health Care Policy and Research (5 RO1 HS06516); the New England Medical Centre-Division of Health Improvement; the National Heart Lung and Blood Institute (2RO1 HL36310); National Institute on Aging (RO1 AG13196-02); the John D and Catherine T MacArthur Foundation Research Network on Successful Midlife Development; the Institute for Work and Health, Ontario, Canada; the Volvo Research Foundation, Sweden; Medical Research Council; Health and Safety Executive; and British Heart Foundation (RG/28).

Contributors: HH designed and conducted the review in discussion with MM. HH wrote the first draft of the manuscript and incorporated MM's revisions.

1 Marmot MG. Improvement of social environment to improve health. *Lancet* 1998;351:57-60.
2 Hecker MHL, Chesney MA, Black GW. Coronary prone behaviour in the Western Collaborative Group study. *Psychosom Med* 1988;50:153-64.
3 Dembroski TM, MacDougall JM, Costa PT Jr. Components of hostility as predictors of sudden death and myocardial infarction in the multiple risk factor intervention trial. *Psychosom Med* 1989;51:514-22.

4 Johnson JV, Stewart W, Hall EM, Fredlund P, Theorell T. Long-term psychosocial work environment and cardiovascular mortality among Swedish men. *Am J Public Health* 1996;86:325-31.
5 Kubzansky LD, Kawachi I, Weiss ST, Sparrow D. Anxiety and coronary heart disease: a synthesis of epidemiological, psychological and experimental evidence. *Ann Behav Med* 1998;20:47-58.
6 Hayward C. Psychiatric illness and cardiovascular disease risk. *Epidemiol Rev* 1995;17:129-38.
7 Miller TQ, Smith TW, Turner CW, Guijarro ML, Hallet AJ. A meta-analytic review of research on hostility and physical health. *Psychol Bull* 1996;119:322-48.
8 Schnall PL, Landsbergis PA. Job strain and cardiovascular disease. *Ann Rev Public Health* 1994;15:381-411.
9 Schneiderman N, Skyler JS. Insulin metabolism, sympathetic nervous system regulation, and coronary heart disease prevention. In: Orth-Gomer K, Schneiderman N, eds. *Behavioural medicine approaches to cardiovascular disease prevention.* Mawah, NJ: Lawrence Erlbaum Associates, 1996.
10 Brunner EJ. Stress and the biology of inequality. *BMJ* 1997;314:1472-6.
11 Williams RB, Barefoot JC, Blumenthal JA, Helms MJ, Luecken L, Pieper CF, et al. Psychosocial correlates of job strain in a sample of working women. *Arch Gen Psychiatry* 1997;54:543-8.
12 Kuh D, Ben-Shlomo Y. *A life course approach to chronic disease epidemiology.* New York: Oxford University Press, 1997.
13 Pieper C, Lacroix AZ, Karasek RA. The relation of psychosocial dimensions of work with coronary heart disease risk factors: a meta-analysis of five United States data bases. *Am J Epidemiol* 1989;129:483-94.
14 Kaplan GA, Keil JE. Socioeconomic factors and cardiovascular disease: a review of the literature. *Circulation* 1993;88:1973-98.
15 Marmot M, Bosma H, Hemingway H, Brunner EJ, Stansfeld SA. Contribution of job control and other risk factors to social variations in coronary heart disease incidence. *Lancet* 1997;350:235-9.
16 Mittleman MA, Maclure M, Nachnani M, Sherwood JB, Muller JE. Educational attainment, anger and the risk of triggering myocardial infarction onset. The Determinants of Myocardial Infarction Onset Study Investigators. *Arch Intern Med* 1997;157:769-75.
17 Nunes EV, Frank KA, Kornfield DS. Psychologic treatment for the type A behaviour pattern and for coronary heart disease: a meta-analysis of the literature. *Psychosom Med* 1987;48:159-73.
18 Haynes SG, Feinleib M, Kannel WB. The relationship of psychosocial factors to coronary heart disease in the Framingham study: 3. Eight year incidence of coronary heart disease. *Am J Epidemiol* 1980;111:37-58.
19 Rosenman RH, Brand RJ, Sholtz RI, Friedman M. Multivariate prediction of coronary heart disease during 8.5 year follow-up in Western Collaborative Group Study. *Am J Cardiol* 1976;37:903-9.
20 Shekelle RB, Hulley SB, Neaton JD, Billings J, Borhani NO, Gerace TA, et al. The MRFIT behavior pattern study. II. Type A behavior and incidence of coronary heart disease. *Am J Epidemiol* 1985;122:559-70.
21 Johnston DW, Cook DG, Shaper AG. Type A behaviour and ischaemic heart disease in middle-aged British men. *BMJ* 1987;295:86-9.
22 Hearn M, Murray DM, Luepker RB. Hostility, coronary heart disease and total mortality: a 33 year follow up study of university students. *J Behav Med* 1989;12:105-21.
23 Wassertheil-Smoller S, Applegate WB, Berge K, Chang CJ, Davis BR, Grimm R Jr, et al. Change in depression as a precursor of cardiovascular events. *Arch Intern Med* 1996;156:553-61.
24 Bosma H, Marmot MG, Hemingway H, Nicholson A, Brunner EJ, Stansfeld S. Low job control and risk of coronary heart disease in the Whitehall II (prospective cohort) study. *BM J* 1997;314:558-65.
25 Siegrist J, Peter R, Junge A, Cremer P, Seidel D. Low status control, high effort at work and ischemic heart disease: prospective evidence from blue-collar men. *Soc Sci Med* 1990;31:1127-1134.
26 Bosma H, Peter R, Siegrist J, Marmot MG. Alternative job stress models and the risk of coronary heart disease: the effort-reward imbalance model and the job strain model. *Am J Public Health* 1998;88:68-74.
27 Alloway R. The buffer theory of social support-a review of the literature. *Psychol Med* 1987;17:91-108.
28 Linden W, Stossel C, Maurice J. Psychosocial interventions in patients with coronary artery disease: a meta-analysis. *Arch Intern Med* 1996;156:745-52.
29 Jones DA, West RR. Psychological rehabilitation after myocardial infarction: multicentre randomised controlled trial. *BMJ* 1996;313:1517-21.
30 Frasure Smith N, Lesperance F, Prince RH, Verrier P, Garber RA, Juneau M, et al. Randomised trail of home-based psychosocial nursing intervention for patients recovering from myocardial infarction. *Lancet* 1997;350:473-9.
31 Bucher HC. Social support and prognosis following first myocardial infarction. *J Gen Int Med* 1994;9:409-17.

Studying for the MRCP—was it worth while?

When in 1996 I decided to do part of my further vocational training in Britain, I also decided to attempt the membership examination of the Royal College of Physicians. I knew it was said to be difficult, but as I was advanced in my training and always had passed examinations easily, I thought of it as a challenge.

I started studying and soon was annoyed by the multiple choice questions. So many of them were irrelevant to clinical medicine. Does it really matter whether I know all the rare associations of rare diseases? In a preparation course for part 1 I learnt that questions starting "there is a recognised association" almost always are true while questions containing the words "always" or "never" almost always are wrong. This knowledge helped me to pass the MRCP1—it did not enable me to treat my patients any better.

Part 2 had the same preoccupation with rare diseases. To pass the MRCP, it is more important to know about secondary hypertension caused by endocrine disorders than to know about idiopathic hypertension. You are more likely to encounter a question about pseudopseudohypoparathyroidism than about osteoporosis. Did you ever meet a patient with pseudopseudohypoparathyroidism in real life? Simply to learn how to pronounce this word took me hours of hard work. In the MRCP, a patient with neuropathy will have porphyria or lead intoxication in real life the diagnosis will be diabetes or alcoholism. In Germany I have done close to 1000 echocardiography studies, but I never saw an atrial myxoma until I started learning for the MRCP.

The training of an examination routine for the short cases had some advantages, but once again, the emphasis was placed on details of little meaning. The examination routine taught in Germany is slightly different from the one taught for the MRCP. I had to readjust to the British routine, not because it was better but because it was what the examiners were looking for. By the way, I never saw one of my consultants perform the complete MRCP routine while examining a patient in outpatients or during a ward round.

I tried part 2 three times and failed. I then returned to Germany where I passed the German examination and now hold the German equivalent of the certificate of completion of specialist training.

Has all the studying been worth while? I learnt hundreds of small facts I have already forgotten again—if I ever need them I know where to look them up; I got proficient at a routine I have shed again; and whenever I notice my consultant's vitiligo I tell myself he is perfectly healthy and unlikely to develop an autoimmune disease. This is real life, after all.

"Non scholae sed vitae discimus"—we learn not for school, but for life—was written above the main entrance of my school. Much of what I learnt in those two years in Britain was for the MRCP and not for practice. Instead of studying most of my time off duty, I could have gone out with friends, visited famous places, enjoyed walking in the Midlands. I would not have worked so hard if I had not wanted to pass the MRCP. I failed, but yes, I would do it again. And I will come back to Britain in my holidays to enjoy all those things I missed because of my studies.

Waltraud Finckh, *specialising in internal medicine, Bad Kissingen, Germany*

We welcome articles up to 600 words on topics such as *A memorable patient, A paper that changed my practice, My most unfortunate mistake,* or any other piece conveying instruction, pathos, or humour. If possible the article should be supplied on a disk. Permission is needed from the patient or a relative if an identifiable patient is referred to. We also welcome contributions for "Endpieces," consisting of quotations of up to 80 words (but most are considerably shorter) from any source, ancient or modern, which have appealed to the reader.