RESEARCH REPORT

Geographical variation in cardiovascular disease, risk factors, and their control in older women: British Women's Heart and Health Study

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Objectives: To measure the geographical variation in prevalence of cardiovascular disease, risk factors, and their control in a nationally representative sample of older British women.
Methods: Baseline survey using general practitioner record review, a self completed questionnaire, research nurse interview, and physical examination in a randomly selected sample of women aged 60–79 drawn from 23 towns in England, Scotland, and Wales.
Results: Of 7173 women invited and eligible to participate, information was obtained on 4286 (60%). One in five women had a doctor diagnosis of any one of myocardial infarction, angina, heart failure, stroke, or peripheral vascular disease. Fifty per cent of women were hypertensive, 12% smoked, and over one quarter were obese. Fifty per cent had a total cholesterol level greater than 6.5 mmol/l, though only 3% had low high density lipoprotein concentrations. Cardiovascular disease prevalence varied by geographical region being highest in Scotland: age adjusted prevalence (95% confidence intervals) 25.0% (21.5% to 28.8%) and lowest in South England: age adjusted prevalence (95% confidence intervals) 15.4% (13.5% to 17.6%). The geographical variations in cardiovascular disease prevalence were attenuated by adjustment for risk factors and socioeconomic position; further adjustment for health service use (as indicated by aspirin or statin use) reduced the differences further. However, variation remained even after full adjustment for these factors: odds ratio (95% confidence intervals) comparing Midlands and Wales to South England 1.15 (0.82 to 1.61) and comparing Scotland to South England 1.53 (1.08 to 2.14). Of women with cardiovascular disease, 12% were current smokers, a third had uncontrolled hypertension, a third were obese, and 90% had a blood cholesterol over 5 mmol/l. Only 41% were taking antiplatelet drugs and 22% were taking a statin.
Conclusions: Older British women have a higher prevalence of cardiovascular disease and risk factors than previously documented. The workload consequences of attempting to control risk factors and ensure optimal secondary prevention for older British women are considerable. Geographical variations in cardiovascular disease prevalence in older women are somewhat, but not fully, explained by variations in major risk factors, socioeconomic position, and health service utilisation.

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Cardiovascular disease (CVD) is the leading cause of death in women in most industrialised countries accounting for over 40% of deaths in women at all ages in Britain.[1 2] As a consequence of women's longer life expectancy the number of women suffering with and dying of CVD is similar to that of men; in 1997 there were 228 446 deaths from CVD (ICD-9 codes 390–459) in England and Wales, 52% of which were in women.[2] The occurrence of CVD rises rapidly in women after the age of 60 but little is known about the distribution of CVD, risk factors, and their control in older women.[3 4] Although geographical variation in the occurrence of CVD is recognised, an explanation for this variation remains unclear. In men major risk factors seem to play an important part,[5] but little is known about women.

The Health Survey for England and the General Practice Morbidity Surveys are the main source of information on CVD prevalence in Britain but neither provide comprehensive details of risk factor prevalence and management.[6 7] There are no details of aspirin or statin use in patients with CVD in the Health Survey for England[6] and the General Practice Morbidity Survey is primarily concerned with primary care workload.[7] It does not systematically collect information on disease and risk factor prevalence but summarises information from primary care consultations. Other established cohort studies—The Whitehall II,[8] Renfrew-Paisley,[9] Scottish heart health,[10] and Glasgow students[11] studies—have provided valuable aetiological insights and comparisons between women and men but have limited national representativeness or ability to assess geographical variations because of their single location. Estimates of myocardial infarction and angina prevalence among older women derived from these studies differ by almost eightfold and threefold respectively.[3]

The aim of this study is to measure geographical variation in the prevalence of CVD, risk factors, and their control in a nationally representative sample of older women.

METHODS

Selection of towns, practices, and participants

The selection of towns, practices, and participants was based on the British Regional Heart Study framework.[12 13] Detailed pilot studies were conducted in two of the British Regional Heart Study towns, Dewsbury and Maidstone. The original general practices of the remaining 22 towns plus one additional town (Bristol) formed the sampling frame for the main study. The study population consisted of women aged 60–79, the current age of men in the British Regional Heart Study. Sampling was stratified by town and by five year age group to ensure that the distribution was proportionately matched by town and age with that of the British Regional Heart Study men. Invitations were mailed to the sample with a further two postal reminders sent to non-responders. Those who wished to participate but could not attend because of mobility problems were offered transport to the examination

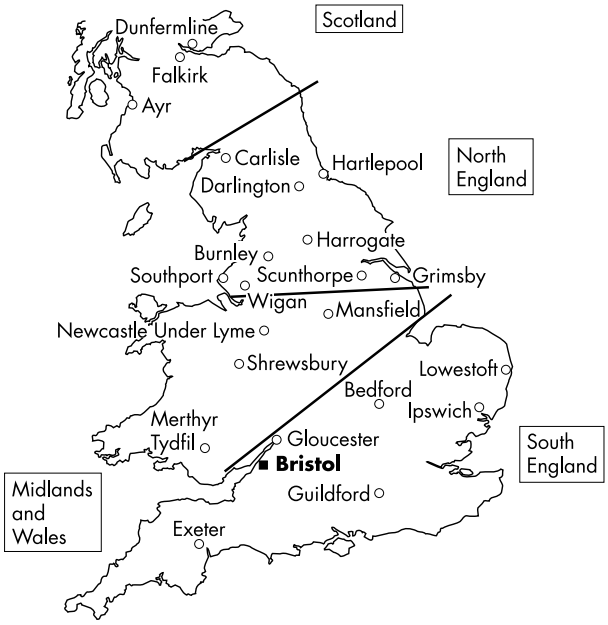

Figure 1 Towns and geographical areas in the British Women's Heart and Health Study.

centre. Baseline data collection took place between April 1999 and March 2001.

Risk factor and CVD assessment

A team of three field survey trained nurses administered questionnaires, conducted physical measurements, and took blood samples. Over the two years of the study two nurses left and were replaced with nurses trained to the same standards. High degrees of between observer and within observer agreement were ensured during the initial training, and variation was monitored as the study continued and retraining carried out at intervals.

General practitioner record review—A member of the primary health care team at each practice participating in the study extracted data (diagnosis and date) on CVD, diabetes, and cancer events from the general practitioner records of all subjects who were invited to participate. For major CVD events (myocardial infarction and stroke) a second request was made for a doctor in the practice to validate these according to WHO criteria.[14]

A self completed questionnaire included questions about symptoms, doctor diagnoses, and treatment of cardiovascular disease and other major diseases. Questions about a wide range of risk factors—smoking, alcohol consumption, physical activity, diet, socioeconomic factors, birth weight, timing and type of menopause, use of hormones, and family history of disease were included. Participants were asked to provide details of their husband's and their own longest held occupation. These data were used to derive social class according to the registrar general's classification. For married women social class was defined by their husband's occupation and for single women by their own longest held occupation.[15]

Research nurse interview The WHO Rose angina questionnaire was administered.[16] In addition detailed inquiry was made about symptoms, diagnosis and treatment of CHD, stroke, and claudication. Participants were asked to bring all medications to the interview and a detailed drug history was taken.

Anthropometric measurements Standing and seated height were measured without shoes using a Harpenden Stadiometer that recorded to the nearest millimetre. Weight was measured in light clothing without shoes to the nearest 0.1 kg using Soenhle portable scales. Waist measurements were taken using the midpoint between the lowest rib and iliac crest and

Table 1 Prevalence % (95% confidence intervals) of major risk factors by geographical area, British women aged 60–79

	Total prevalence for all areas	Age adjusted prevalence by geographical area				Between region variation p
		South England	Midlands & Wales	North England	Scotland	
Mean age (y)	68.9 (68.7 to 69.1)	68.8 (68.5 to 69.1)	69.1 (68.7 to 69.4)	69.1 (68.8 to 69.3)	68.3 (67.9 to 68.8)	0.05
Hypertension (BP ⩾160/95 or taking antihypertensive medication) (%)	49.0 (47.5 to 50.6)	48.4 (45.6 to 51.3)	49.8 (45.8 to 53.7)	49.6 (47.1 to 52.2)	48.8 (44.6 to 53.1)	0.65
Uncontrolled hypertension (BP ⩾160/95 regardless of treatment) (%)	31.2 (27.72 to 32.7)	33.9 (31.3 to 36.7)	34.3 (30.7 to 38.2)	32.6 (30.3 to 35.1)	30.9 (27.1 to 35.0)	0.30
Untreated hypertension (BP ⩾160/95 and NOT on antihyperlensive medication) (%)	18.9 (17.7 to 20.2)	17.7 (15.6 to 19.9)	20.0 (17.0 to 23.3)	19.2 (17.3 to 21.3)	17.1 (14.1 to 20.5)	0.45
High cholesterol (⩾7.8 mmol/l) (%)	16.4 (15.2 to 17.6)	17.9 (15.8 to 20.2)	16.4 (13.7 to 19.6)	16.2 (14.5 to 18.2)	12.6 (10.0 to 15.7)	0.04
Low high density lipoprotein cholesterol (⩽0.9 mmol/l) (%)	3.0 (2.5 to 3.6)	2.5 (1.8 to 3.6)	4.2 (2.8 to 6.1)	2.1 (1.5 to 3.0)	5.0 (3.5 to 7.2)	0.001
Ex-smoker (%)	38.8 (37.3 to 40.3)	37.1 (34.5 to 39.7)	36.5 (33.2 to 40.0)	41.8 (39.4 to 44.2)	36.7 (32.7 to 40.8)	0.02
Current smoker (%)	11.9 (10.9 to 12.9)	8.1 (6.8 to 9.7)	13.4 (11.1 to 16.0)	12.0 (10.6 to 13.7)	16.8 (13.9 to 20.1)	<0.001
Obese (BMI >30 kg/m^2) (%)	26.8 (25.5 to 28.3)	24.9 (22.5 to 27.3)	30.8 (27.3 to 34.5)	26.9 (24.7 to 29.1)	26.0 (22.5 to 29.9)	0.05
Inactive (less than one episode moderate activity per week)(%)	19.2 (18.0 to 20.5)	13.4 (11.5 to 15.5)	29.4 (25.9 to 33.1)	20.1 (18.2 to 22.2)	13.0 (10.4 to 16.1)	<0.001
Low fruit intake (less than one portion fresh fruit per day) (%)	40.3 (38.8 to 41.9)	35.0 (32.4 to 37.7)	41.6 (38.0 to 45.2)	42.3 (39.8 to 44.9)	46.6 (42.1 to 51.1)	<0.001

Values for each area are age adjusted.

Table 2 Association between area of residence and prevalence of CVD. British women aged 60–79

	Age adjusted OR (95% CI)*	Age, risk factor and socioeconomic class adjusted OR (95% CI)†	Age, risk factor, socioeconomic class, and health service utilisation adjusted OR (95% CI)‡
South East England	1	1	1
Midlands and Wales	1.77 (1.40 to 2.24)	1.22 (0.91 to 1.65)	1.15 (0.82 to 1.61)
North England	1.27 (1.04 to 1.55)	1.14 (0.88 to 1.46)	1.01 (0.77 to 1.34)
Scotland	1.88 (1.47 to 2.41)	1.85 (1.37 to 2.50)	1.53 (1.08 to 2.14)

*Age added as a continuous variable; †Systolic blood pressure, diastolic blood pressure, total cholesterol, high density lipoprotein cholesterol, body mass index added as continuous variables, smoking (categorical—never, ex, current), physical activity (categorical—3 or more, 1–2 or less than one episode(s) activity per week), fruit consumption (categorical—more than one portion a day, one portion a day, most days, one or two days a week, less than once a week), social class based on registrar generals classification (categorical—I, II, III non-manual, III manual, IV, V); ‡health service utilisation: use of aspirin or statins.

hip measurements using the largest circumference below the waist. A flexible metal tape was used and two measurements taken to the nearest millimetre.

Blood pressure A Dinamap 1846SX vital signs monitor was used to measure blood pressure, mean arterial pressure, and heart rate. Measurements were taken twice in succession, using the right arm, with the participant seated and the arm supported on a cushion. Arm circumference was measured and the appropriate cuff size was used.

Blood samples were taken after a 12 hour fast using evacuated tubes. Whole blood samples were collected at the end of the day by courier and sent for routine haematology. The remaining samples were spun and aliquotted within an hour of collection. The aliquots were then snap frozen on dry ice as required and placed in the freezer at −20°C. On completion of each two week block of fieldwork these samples were transferred for long term storage at −80°C. Total cholesterol, high density lipoprotein cholesterol, and triglycerides were measured on frozen serum samples using an Hitachi 747 analyser (Roche Diagnostics) and standard reagents. Low density lipoprotein cholesterol was estimated using the Friedwald equation (LDLc = total cholesterol minus (HDLc + triglycerides×0.45)).[17]

In this report we present findings on geographical variations in CVD, major risk factors, and their control. Doctor diagnosed CVD (that is, myocardial infarction, angina, heart failure, peripheral vascular disease, or stroke) was defined as either a record obtained from the general practice medical record review and/or from the participant giving a history of ever being diagnosed by a doctor with one of these conditions.[18 19]

Geographical variations in CVD and risk factor prevalence were assessed by categorising the town of residence of each participant into one of four regions (fig 1): South England—south of a line joining the Severn estuary and the Wash; Midlands and Wales—above the Severn-Wash line but below a line joining Liverpool and the mouth of the Humber; North England above the Liverpool-Humber line but below the Scottish border; Scotland.

Ethical committee approval was obtained for the study.

Statistical analysis

For comparisons of proportions of general practitioner recording of CVD, diabetes, and cancer between responders and non-responders 2×2 contingency tables were used with χ^2 tests for independence; difference in mean age between responders and non-responders was assessed using Student's *t* test. Analyses of variance were used to test for between nurse differences in examination measurements. Logistic regression was used to assess the association between area of residence and CVD prevalence, with multiple logistic regression used to assess the impact of potential explanatory factors on these associations. Robust estimates of standard errors were used to estimate 95% confidence intervals taking into account clustering within towns. All analysis was undertaken using Stata version 7.0.[20]

RESULTS

Of the 7304 women who were invited to participate 115 invitations were returned indicating that the address was incorrect and 16 women were discovered to have died before the invitation was mailed. The response for the 7173 women eligible to participate was 4286 (60%). Review of general practitioner records of 21 of the practices (two practices did not provided data for non-responders) showed that non-responders did not differ from responders in terms of coronary heart disease or cancer prevalence. However, non-responders were more likely to have suffered a stroke (3.3% versus 1.6%, $p<0.01$) or to have diabetes (7.7% versus 4.8%, $p<0.01$) and were slightly older (70.2 versus 68.9 years, $p<0.01$) than responders. After adjustment for town of examination there was no between nurse variation for height, weight, systolic, and diastolic blood pressure measurements.

Self report tended to exaggerate the prevalence of major CVD events: 34% of those who said that they had a doctor diagnosis of either myocardial infarction or stroke did not have a validated general practitioner recorded event. However, the majority of these (76%) did have some form of general practitioner recorded CVD, most commonly angina or heart failure. There was no difference between geographical areas in the tendency to over-report major CVD events ($p=0.6$).

CVD risk factor prevalence

Table 1 summarises risk factor prevalence for all participants and age adjusted risk factor prevalence by geographical area. Women from Scotland were slightly younger than those from the other three regions.

Blood pressure

The mean systolic and diastolic blood pressures were 147.1 mm Hg (SD 25.2) and 79.4 mm Hg (SD 11.7) respectively. Half (49.0%, 95% CI 47.5 to 50.6) of the participants were hypertensive—defined as systolic blood pressure =160 mm Hg or diastolic blood pressure = 95 mm Hg or taking blood pressure medication (old WHO criteria[21]). Nearly one third (31.2%) had uncontrolled hypertension regardless of whether they were receiving treatment or not. Using the new international criteria for hypertension (systolic =140 mm Hg or diastolic =90 mm Hg),[22 23] the overall prevalence of hypertension was 68.8% (67.4 to 70.3) and 60.7% (59.2 to 66.3) of participants had untreated hypertension. There was very little geographical variation in mean levels of blood pressure or in the prevalence of overall hypertension or uncontrolled hypertension.

Blood cholesterol

The mean cholesterol level for the cohort was 6.64 (SD 1.21), with over 50% having a total cholesterol level equal to or above 6.5 mmol/l and 16% a level equal to or above 7.8 mmol.l. Scotland had the lowest mean cholesterol and the lowest proportion with high total cholesterol levels. This seemed to be attributable to variations in high density lipoprotein cholesterol (HDLc). The mean HDLc was 1.66 mmol/l (0.45), and

Table 3 Factors associated with use of aspirin and statins. British women aged 60–79 with cardiovascular disease (n=822)

	Number	Percent (95% CI) using aspirin/other antiplatelet	Age adjusted OR antiplatelets (95% CI)*	Fully adjusted OR antiplatelets (95% CI)†	Percent (95% CI) using statins	Age adjusted OR statins (95% CI)*	Fully adjusted OR statins (95% CI)†
Cardiovascular disease diagnosis‡							
MI	220	51.8 (45.0 to 58.6)	1	1	33.2 (27.0 to 39.8)	1	1
Stroke	109	48.6 (38.9 to 58.4)	0.87 (0.55 to 1.38)	1.02 (0.59 to 1.77)	20.2 (13.1 to 29.0)	0.52 (0.30 to 0.89)	0.62 (0.33 to 1.15)
Angina	442	33.3 (28.9 to 37.9)	0.46 (0.33 to 0.65)	0.46 (0.32 to 0.68)	16.7 (13.4 to 20.6)	0.40 (0.27 to 0.58)	0.37 (0.24 to 0.57)
Peripheral vascular disease	51	45.1 (31.1 to 59.7)	0.76 (0.41 to 1.40)	2.15 (0.22 to 21.14)	21.6 (11.3 to 35.3)	0.55 (0.26 to 1.13)	Insufficient data
Invasive procedure§							
No	692	43.4 (39.6 to 47.1)	1	1	21.2 (18.2 to 24.5)	1	1
Yes	66	56.1 (43.3 to 68.3)	1.70 (1.02 to 2.84)	1.29 (0.72 to 2.29)	48.5 (36.0 to 61.1)	3.40 (2.02 to 5.70)	3.41 (1.89 to 6.15)
Socioeconomic position							
Non-manual	262	42.4 (36.3 to 48.6)	1	1	25.6 (20.4 to 31.3)	1	1
Manual	440	39.8 (35.2 to 45.5)	0.90 (0.66 to 1.23)	0.87 (0.63 to 1.24)	20.5 (16.8 to 24.5)	0.74 (0.51 to 1.06)	0.75 (0.50 to 1.12)
Geographical area							
South England	202	36.1 (29.5 to 43.2)	1	1	24.8 (19.0 to 31.3)	1	1
Midlands and Wales	170	32.4 (25.4 to 39.9)	0.85 (0.40 to 1.77)	0.95 (0.58 to 1.57)	20.0 (14.3 to 26.8)	0.74 (0.45 to 1.22)	0.85 (0.48 to 1.49)
North England	311	46.0 (40.3 to 51.7)	1.52 (1.06 to 2.19)	1.65 (1.09 to 2.52)	21.5 (17.1 to 26.5)	0.82 (0.53 to 1.24)	0.78 (0.48 to 1.27)
Scotland	139	47.5 (39.0 to 56.1)	1.66 (1.07 to 2.59)	1.60 (0.95 to 2.72)	20.8 (14.4 to 28.6)	0.74 (0.44 to 1.25)	0.59 (0.31 to 1.10)
Date of most recent diagnosis							
Before January 1 1995	368	40.2 (35.2 to 45.4)	1	1	19.3 (15.4 to 23.7)	1	1
On or after January 1 1995	389	42.9 (38.0 to 48.0)	1.11 (0.83 to 1.48)	1.31 (0.95 to 1.83)	24.9 (20.7 to 29.5)	1.43 (1.01 to 2.02)	1.57 (1.06 to 2.32)
Age group							
60–69	347	37.8 (32.6 to 43.1)	1	1	23.3 (19.00 to 28.2)	1	1
70–79	475	43.4 (38.9 to 48.0)	1.26 (0.95 to 1.67)	1.20 (0.86 to 1.68)	20.8 (17.3 to 24.8)	0.86 (0.62 to 1.20)	0.75 (0.51 to 1.11)

*Age added as continuous variable (odds ratio for age group not age adjusted); †simultaneously adjusted for all other factors in first column (age entered as continuous variable all others categorical); ‡mutually exclusive hierarchical categories—that is, women in higher categories cannot appear in ones below; §invasive procedure—CABG, angioplasty, or carotidendarterectomy.

only 3.0% (2.5 to 3.6) of the total cohort had a high density lipoprotein cholesterol (HDLc) of 0.9 mmol/l or less, but the age adjusted prevalence of how HDLc of women in Scotland was 5.0% (3.3 to 7.2).

Obesity, smoking physical activity, and diet

Over one quarter of the participants were obese (BMI >30 kg/m^2) with the mean BMI of the sample being 27.7 kg/m^2 (SD 5.2). Obesity was most prevalent in the Midlands and Wales. Fifty per cent had been regular smokers at some time during their lives and 11.9% (95% CI 10.9 to 12.9) still smoked. Current smoking was most prevalent in Scotland. One fifth (19.2%, 18.0% to 20.5%) of the sample were inactive (participated in less than one episode of moderate activity per week), with women in Midlands and Wales being the most inactive. Two fifths (40.3%, 38.8% to 41.9%) of women did not eat a portion of fresh fruit at least daily, with women from Scotland being least likely to eat fresh fruit.

Cardiovascular disease prevalence and risk factors

All risk factors were independently (with adjustment for other risk factors) associated with prevalent cardiovascular disease in the direction and magnitude expected from previous studies[24]: odds ratio (95% confidence intervals) for cardiovascular disease associated with hypertension 1.58 (1.30 to 1.92); low (<0.9 mmol/l) high density lipoprotein cholesterol 1.96 (1.25 to 3.09); obesity 1.34 (1.10 to 1.65); current smoking 1.14 (0.85 to 1.55); not eating a portion of fruit daily 1.11 (0.92 to 1.33); inactivity 1.48 (1.32 to 1.65); age 1.06 (1.04 to 1.08) per each year of age.

One in five (20.3% 19.1, 21.6%) of the women had a doctor diagnosis of some form of CVD, with 16.4% (15.3% to 17.5%) having coronary heart disease (myocardial infarction, angina or failure) and 3.1% (2.6% to 3.7%) having had a stroke. There were no women with heart failure who did not also have either a diagnosis of myocardial infarction or angina. Age adjusted prevalent CVD varied by geographical area being lowest in South England: 15.4% (13.5% to 17.6%) and highest in Scotland: 25.0% (21.5% to 28.8%); the prevalence in Midlands and Wales was 24. 8% (21.7% to 28.2%) and in North England was 19.1% (17.2% to 21.2%). The age adjusted CVD prevalence between towns varied from 8.4% (5.4% to 12.8%) in Guildford to 31.3% (24.1% to 39. 6%) in Methyr Tydfil.

After adjustment for CVD risk factors and socioeconomic position the geographical variation in CVD prevalence was attenuated, though some difference remained (table 2). In particular, the odds of having CVD for a women living in Scotland compared with one living in the South of England remained 85% greater after adjustment for these factors. With further adjustment for health service utilisation (use of aspirin or statins as a proxy measure for health service use) there was further attenuation in the geographical variation though the odds of having CVD in Wales and the Midlands compared with South England remained 15% greater and the odds comparing Scotland to South England were 50% higher.

Control of risk factors in women with CVD

Quitting smoking

Of the 822 women with any form of doctor diagnosed CVD, 12.0% (9.8% to 14.4%) were current smokers and 42.1% (38.7% to 45.6%) were ex-smokers. Of the 344 ex-smokers with CVD, 287 (84%) gave a main reason for quitting smoking: personal choice was the commonest—39.4% (33.7% to 45.3%), with 26.1% (21.5% to 31.6%) giving "health precaution", 11.5% (8.0% to 15.8%) "illness or ill health" and 13.6% (9.1% to 18.2%) giving doctors advice. Most (62.6%, 56.7% to 68.3%) ex-smokers with CVD had quit more than five years before their CVD event.

Blood pressure control and obesity

One third—32.2% (28.8% to 35.6%)—of women with CVD had uncontrolled hypertension (BP=160/95) regardless of whether or not they were on treatment and one third—(34.1%, 30.7% to 37.6%) were obese (BMI >30).

Blood cholesterol, statin, and aspirin use

The majority (89.36%, 85.1% to 90.1%) of women with CVD had a fasting cholesterol level ≥5 mmol/l. Only 41.0% (35.6% to 42.5%) reported that they were taking aspirin or antiplatelet medication and 21.9% (19.1% to 24.9%) were taking a statin. Of those taking aspirin, the majority said this was for prevention of CVD and only 2% gave analgesia as a reason.

Women with angina (but no history of a myocardial infarction or stroke) were less likely than women with other forms of CVD to be taking either aspirin or statins. Women who had had an invasive procedure, compared with those who had not, those with a CVD event diagnosed after 1995, compared with those with an earlier diagnosis and those from non-manual compared with manual social classes were more likely to be taking either aspirin or a statin. Aspirin use was greater in Scotland and the North of England compared with the South of England and was also greater in women aged 70–79 years compared with those aged 60–69, whereas statin use was considerably lower in Scotland and the North of England and in women aged 70–79 compared with those in their 60s (table 3).

DISCUSSION

This newly established, nationally representative study of CVD and risk factor prevalence in a large sample of older British women has demonstrated a higher prevalence of CVD than hitherto expected among older British women.[3] Geographical variation is marked and though is explained to some extent by differences in major risk factors and health service utilisation, some geographical variation remains even after adjustment for these factors. Secondary prevention measures are poorly applied and also show regional variation with more antiplatelet treatment reported by women in the north of England and Scotland but less statin use in these regions.

Study limitations

The response achieved, while lower than anticipated, is consistent with other baseline data collection in large epidemiological surveys including that for the Health Survey for England in which participants were visited in their own homes.[6] The sampling procedure was age stratified to produce equal numbers of women in four age categories. However, the response was lower in older age categories and our final age distribution is similar to that of the population for England and Wales as a whole based on population projections from the 1991 census. The social class distribution of the British Women's Heart and Health Study is similar to that found for the 1991 census (52% manual social class in British Women's Heart and Health Study compared with 55% older adults in the 1991 census). Study respondents had similar levels of coronary heart disease to non-respondents but were less likely to have a GP record of stroke and were slightly younger. Our estimates of stroke prevalence may, therefore, be conservative. Our estimates of prevalence of myocardial infarction are similar to the Health Survey for England[6] but are considerably higher than those reported by the General Practitioner Morbidity Survey.[7] Our estimates of angina prevalence were higher than all previous reports.[3] In the Health Survey for England fewer than 1000 women aged 65–74 were recruited and confidence intervals around estimates are wide and include our point estimate for angina. Methodological differences probably explain the difference with the General Practitioner Morbidity Survey as estimates were based on consultations over a one year period for myocardial infarction and angina, rather than any history of disease.

Key points

- One fifth of British women aged 60–79 have cardiovascular disease.
- Half of British women aged 60–79 are hypertensive, 12% are current smokers, over one quarter are obese, and one fifth are inactive. Over 50% have a total cholesterol concentration of equal or greater to 6.5 mmol/l, but only 3% have a low high density lipoprotein cholesterol level.
- Cardiovascular disease prevalence varies by geographical area being highest in Scotland and lowest in South England.
- Geographical variations in cardiovascular disease prevalence among older British women are in part explained by geographical variations in major risk factors, socioeconomic position, and health service use though even after adjustment for these factors some variation remains.
- Among older women with cardiovascular disease 12% are smokers, one third have uncontrolled high blood pressure and 90% have a cholesterol concentration of 5 mmol/l or more. Only 41% are on antiplatelet medication and 22% are taking a statin.

In the British Regional Heart Study of men it was found that, compared with WHO criteria for myocardial infarction and stroke, self report of a doctor diagnosis tended to over estimate the prevalence whereas general practitioner record review tended to under report these events.[18] Among subjects who over-reported a diagnosis of myocardial infarction or stroke the majority (78%) had some other CVD diagnosis, most commonly angina.[18] Our definition of CVD used presence of a GP record and/or self report of a relevant doctor diagnosis that takes into consideration the possibility that self report may exaggerate levels while GP record may under report. Within our study we found a tendency, as in men, for self report to exaggerate major CVD diagnoses (myocardial infarction and stroke). The majority of women reporting a major CVD diagnosis not specifically confirmed in their general practice records did have a medically recorded diagnosis of some form of CVD. The criteria for the diagnosis of myocardial damage is shifting with the emergence of troponine levels as a diagnostic criterion,[25] but the importance in primary care of modifying risk factors in any individual with a CVD diagnosis, supports the use of a combination of self report and general practice recorded diagnosis, which may give a more accurate reflection of the true prevalence of total CVD than reliance upon only one method. There was no geographical variation in over-reporting of major CVD events suggesting that any geographical variation in CVD prevalence is not related to differences in tendency to over report. Self report or general practitioner record of heart failure in the absence of echocardiograms may be inaccurate. However, none of the women in our study had heart failure in the absence of another coronary heart disease diagnosis; our results are not, therefore, biased by inaccurate reporting of heart failure.

Levels of physical activity among older British women seem to be higher than might be expected with over two thirds taking part in vigorous or moderate activity at least three times a week. This may be explained by the inclusion of heavy housework in our assessments of physical activity.[26] It remains to be seen whether housework has a similar effect in reducing risk of CVD as other forms of physical exercise.

Comparison with other studies

Geographical variations in CVD prevalence and risk factors have been reported both between and within countries.[5 21 27–31] Geographical variations in CVD have been explained by variations in major risk factors and/or socioeconomic factors in a number of studies but, as with our findings, some variation tends to remains even after control for these factors.[5 29–31]

Remaining variation may be explained by geographical variations in health service access and/or quality. To assess this possibility we made further adjustment for use of aspirin and statins as a proxy indicator of health service utilisation. With this adjustment there was further attenuation in geographical variation, however, some variation remained, in particular, CVD prevalence in Scotland remained considerably higher than in South England. Measurement error resulting in residual confounding, together with early life risk factors such as intra-uterine and childhood growth and childhood socioeconomic position may also contribute to explaining geographical variations in CVD prevalence.[24]

Antihypertensives, statins, and aspirin are effective in reducing risk of CVD in both men and women, and at older ages.[32–35] We found that the control of risk factors in older women with established CVD was far from optimal. Use of aspirin and statins seems to be determined by geographical region of residence, social class, and age as much as by clinical need, but is suboptimal in all groups. Women with CVD in our study were much less likely to be taking aspirin or statins than women and men under 70 years of age from mainland Europe[36] or than women and men aged 35–74 from one region of England.[37] Studies have highlighted gender differences and ageism in the treatment of CVD[37 38] and our results may reflect these prejudices. It is tempting to ascribe the higher rates of use of aspirin in Scotland and the north of England to the very active promotion of clinical guidelines through the Scottish Intercollegiate Guidelines Network (SIGN) and the north of England guidelines group.[39 40] However, no information on use of guidelines among participating practices is available.

Implications

CVD represents a considerable burden of ill health in older British women. Women from Scotland have an excess of CVD even after taking into account differences in age, major risk factors, and health service factors. People with CVD are at greatly increased risk of further CVD events and death; they are highlighted in the National Service Framework for Coronary Heart Disease[41] and other European guidelines[42 43] as a high risk group in whom risk factor modification and treatment with aspirin and statins should be targeted. Our results demonstrate that the need for better management of risk factors and secondary prevention is greater than might have been thought among older British women. Attempting to control these risk factors and extend treatment with aspirin and statins to those who would benefit represents a considerable work load.

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Contributors

All authors took part in the design and supervised data collection for the study. DAL undertook the analysis, DAL wrote the initial draft of the paper and all authors have contributed to the final version. DAL will act as guarantor.

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