Angina in primary care in Goa, India: sex differences and associated risk factors

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ABSTRACT

Background Little is known about the prevalence of angina in people seen in Indian general practices. The authors assessed the prevalence of angina and its associated risk factors in Goan general practices.
Methods Cross-sectional study on consecutive attendees in nine private general practices in Goa, India. All participants completed the Rose Angina Questionnaire, to ascertain the presence of angina. Other demographic, clinical and biochemical data were also collected.
Results 1556 (626 men and 930 women) consecutive attendees aged 30 to 75 years. Angina was detected in 37 (5.9%, 95% CI 2.4 to 9.4%) men and 99 (10.6%, 95% CI=7.4 to 11.2%) women. The prevalence of angina increased with age in both sexes but was greater in women between aged 46–60 (OR=4.3 (95% CI 2.0 to 9.2)) when compared with men. When compared with men, the odds of angina in women of all ages was 2.03 (95% CI 1.10 to 3.75) after controlling for confounders. Angina was associated with depressive and/or anxiety symptoms in both sexes (men OR=5.65, 95% CI=2.25 to 14.16; women OR=2.18, 95% CI=1.01 to 4.69) and with hypertension in men (OR=3.82, 95% CI=1.57 to 9.30) and family history of coronary heart disease (OR=1.53, 95% CI 1.05 to 2.24) in women. Borderline/high total cholesterol levels (OR=0.5, 95% CI 0.28 to 0.89) in women were associated with a reduced risk of angina.
Conclusion Women attending general practices in Goa, India are at greater risk of angina than men. Depression/anxiety is strongly associated with angina. Greater awareness of the general practitioners to the disparity in angina between the sexes and its association with psychological distress is required.

INTRODUCTION

Mortalities from coronary heart disease (CHD) in India range from 75 to 100 per 100 000 people in the sub-Himalayan states of Nagaland, Meghalaya, Himachal Pradesh and Sikkim to 340–430/100 000 in Andhra Pradesh, Tamil Nadu, Punjab and Goa, with the highest rates in Goa.[1] The community prevalence of CHD in urban Tamil Nadu increased from 35/1000 in men and 45/1000 in women[2] to 62/1000 in men and 93/1000 in women[3] from 1994 to 2001, but its prevalence among those seen in general practice in India is unknown.[4]

South Asian women are at greatest risk of CHD; nine of the 12 studies from urban India and six of nine from rural India reported higher rates in women than in men.[4] Data from two of three population-based studies that compared South Asians with white British people reported higher rates for CHD (ie, angina and MI) in South Asian women than men,[5–7] whereas white women had lower rates than white men in all three studies.[6–8] These studies, however, were limited by the lack of standardised assessments of angina.[6 8–10]

Little is known about the prevalence of angina in general practice attendees in India. Our objective was to compare rates of angina in men and women attending general practices in Goa and to examine the association of angina with known risk factors.

METHOD

Goa is India's smallest, but richest per capita, state in India, with a population of 1.3 million people. For approximately 450 years from the 16th century until 1961, when it became a part of India, it was governed directly from Portugal. It currently enjoys a reputation as the busiest Indian tourist destination.

Ten family practices across Goa who expressed an interest in research were approached. All were single-handed and included urban and rural private practitioners serving people from a spectrum of socio-economic circumstances. Although there is a government system of free public health, there are no publicly funded family practices in India. Primary medical care is provided through a combination of private general practices and government-funded public health services. At least 80% of people in India use private medical services as their first point of contact.[11 12]

The Independent Ethics Committee in Mumbai approved this study conducted in private general practices.

Recruitment of practices and participants

We recruited private general practices that had at least 20 patients consulting daily and room space to run the study. Participating doctors were briefed on the research protocol. All researchers were trained on study procedures by IN and MK with support from GD and RV.

Consecutive attendees (which included new and regular patients) aged 30 to 75 were approached and given a study information sheet. This was read out and explained to illiterate participants. We excluded pregnant women and those judged by the researcher and/or the doctor to be too unwell to participate. The study was conducted from April 2004 to January 2005. Those consenting provided information on the following.

Demography

Age, sex, birth place, religion, education, monthly income and details of current housing

Clinical measures of angina

1. The World Health Organization's Rose Angina Questionnaire provided a definite (Rose

Questionnaire Definite or RQD) or possible diagnosis of angina (Rose Questionnaire Possible or RQP).[13] Cross-sectional studies have shown that those positive on the Rose Angina Questionnaire have more risk factors, resting ECG abnormalities, carotid intimal thickness[14] and coronary artery calcification.[15] In South Asians, the capacity of the RQP to identify those reporting a doctor's diagnosis of angina (sensitivity) and those who reported no diagnosis (specificity) was 0.81 and 0.87, respectively, in men and 0.74 and 0.81 in women. These values were considerably lower for the RQD with the sensitivity and specificity at 0.21 and 0.97, respectively, in men and 0.08 and 0.96 in women.[16]
2. Past history of angina, hypertension or diabetes was recorded using questions from the Health Survey for England.[17]
3. A history of CHD in either parent or sibling was recorded using a standardised questionnaire.[18]

Known risk factors for CHD

1. Waist and hip sizes were measured in order to calculate the waist/hip ratio, and values greater than 0.95 in men and 0.8 in women were classified as abnormal.[19]
2. Participants with a self-reported history of hypertension and/or those with a blood pressure greater than 140 mm of Hg systolic or 90 mm of Hg diastolic on assessment were categorised as hypertensive.
3. Past or current use of tobacco (cigarettes, beedis (unfiltered cigarettes rolled in dried tobacco leaves), cigars and chewing tobacco) was recorded using modified questions derived from the Health Survey of Engalnd.[17]
4. Alcohol use was recorded as abstention or consumption.
5. We defined significant physical activity over the previous month as participation in at least one of the following activities: (i) brisk walking for at least 20 min three times a week; (ii) intensive physical activity at work (eg, digging, clearing rough ground, stone or bricklaying); or (iii) heavy household work (eg, spring cleaning, walking with heavy shopping). This was also derived from the Health Survey of England.[17]
6. Psychological distress was assessed using the K10, a WHO-validated screening instrument.[20] Moderate and high risk are defined as total scores greater than 6 and 9, respectively, out of a maximum possible score of 40.[20] This questionnaire has been tested in a Goan general practice population and against ICD 10 criteria for depression and anxiety. K10 was found to be highly sensitive and specific with an estimated area under the curve of 0.8774.[21]

Table 1 Demographic details of study sample

		Male	Percentage	Female	Percentage	
Total		626	40.2	930	59.8	
		Mean	SD	Mean	SD	Adjusted Wald Test*
Age					11.4	
		51.3	11.7	52.2	0	0.120
						Survey F test p value†
		N	Percentage	No	Percentage	
Marital status	Married	569	90.9	618	66.5	
	Single, never married	37	5.9	33	3.6	
	Widowed	17	2.7	270	29	
	Divorced or separated	3	0.5	9	1.0	<0.001
Occupation	Employed and full-time education	417	66.7	165	17.7	
	Unemployed	52	8.3	24	2.6	
	Retired or looking after family	156	25.0	741	79.7	<0.001
Accommodation	Owns home	552	88.2	847	91.1	
	Other	74	11.8	81	9.0	0.150
Living alone	No	609	97.3	874	94.0	
	Yes	17	2.7	56	6.0	0.073
Satisfaction with accommodation	Satisfied	567	90.6	780	83.9	
	Neutral	51	8.2	122	13.1	
	Dissatisfied	8	1.3	28	3.0	0.010
Ethnicity	Goan	560	89.5	845	90.9	
	Other	66	10.5	85	9.1	0.654
Religion	Hindu	238	38.0	229	24.6	
	Roman Catholic	363	58.0	682	73.3	
	Other	25	4.0	19	2.0	<0.001
Literacy	Literate	536	85.8	629	67.6	
	Non-literate	89	14.2	301	32.4	<0.001
Highest qualification	None	78	12.5	283	30.5	
	Up to Standard 4	127	20.3	224	24.1	
	Up to Standard 10	290	46.3	306	32.9	
	Up to Standard 12	36	5.8	54	5.8	
	Professional Qualification	95	15.2	62	6.7	<0.001
Annual family income (Rs)	<10000	36	5.8	68	7.3	
	10000–50000	303	48.4	520	55.9	
	50000–100000	212	33.9	289	31.1	
	100000–500000	75	12.0	53	5.7	0.011

*Survey Wald test to adjust for practice clustering.
†Survey F test to adjust for practice clustering.

Serological risk factors for CHD

Participants provided fasting blood samples collected 2–3 days after interview. These were delivered on the same day to a central laboratory for analysis using a SLIM (SEAC) semiautoanalyser. We estimated serum total cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), triglyceride and blood glucose, and classified the results accordingly:

1. Diabetes: based on the National Heart, Lung and Blood Institute of the USA (http://www.nhlbi.nih.gov/) that classifies fasting blood glucose of under 100 mg/dl as normal; 100–125 mg/dl prediabetic and over 125 mg/dl diabetic. People giving a history of diabetes and/or those with a fasting glucose over 125 mg/dl were categorised as diabetic.
2. Elevated serum lipid levels: based on the National Heart, Lung and Blood Institute recommendations of serum cholesterol (high ≥240 mg/dl, borderline 200–239 mg/dl), HDL (low ≤40 mg/dl in men and ≤50 mg/dl in women), LDL (high ≥160 mg/dl, borderline 130–159 mg/dl), triglycerides (high ≥150 mg/dl) and the ratio of total cholesterol to HDL ≤4 as a normal level in both sexes.

SAMPLE SIZE ESTIMATION

The prevalence of angina in this population is not known. However, using a conservative estimate of a prevalence of 5% in men, if we were to demonstrate a higher prevalence of 7.5% in women at 90% power and 5% significance, we would need to recruit 620 men and women to the study.

ANALYSIS

All statistical analyses were conducted using Stata Release 9.1 (Stata, College Station, Texas).[22] We used Stata Survey commands to adjust for clustering within general practices. We tested the independence of categorical factors using the Pearson χ^2 statistic corrected by the second-order Rao–Scott correction[23 24] to produce an F statistic and adjusted Wald tests for continuous normally distributed factors such as age. We compared responses in men and women to individual questions

Table 2 Coronary heart disease risk factor details of study sample

	Men		Women		Between sex difference? Survey F test p value*
Total	**N 626**	**Percentage 40.2**	**N 930**	**Percentage 59.8**	
Waist–hip ratio					
Healthy: men <0.95, women<0.8	332	53.2	96	10.3	
Other: men ≥0.95, women≥0.8	292	46.8	834	89.7	<0.001
BP >140/90 or history of hypertension					
No	413	66.1	599	64.6	
Yes	212	33.9	329	35.5	0.779
BG >125 or history of diabetes mellitus					
No	414	66.1	665	71.5	
Yes	212	33.9	265	28.5	<0.001
Total cholesterol					
Optimal <200	372	59.4	436	46.9	
Borderline 201–39	170	27.2	299	32.2	
High risk >240	84	13.4	195	21.0	0.006
High-density lipoprotein					
Optimal >60 md/dl	152	24.3	317	34.3	
Borderline 40–59 mg/dl	326	52.2	474	51.2	
High risk <40 mg/dl	147	23.5	134	14.5	0.002
Low-density lipoprotein					
Optimal <130 mg/dl	425	68.1	509	55.1	
Borderline 130–159 mg/dl	123	19.7	224	24.2	
High risk ≥160 mg/dl	76	12.2	191	20.7	0.002
Triglycerides					
Optimal <150 mg/dl	395	63.1	712	76.6	
Borderline 150–199 mg/dl	112	17.9	123	13.2	
High risk ≥200 mg/dl	119	19.0	94	10.1	<0.001
Family history of coronary heart disease					
No	378	69.1	495	63.5	
Yes	169	30.9	285	36.5	0.029
Use tobacco now					
No	509	81.3	905	97.3	
Yes	117	18.7	25	2.7	<0.001
Alcohol					
Not teetotal	344	55.0	129	13.9	
Teetotal	282	45.0	801	86.1	0.001
Physical activity					
No	345	55.1	395	42.5	
Regular	281	44.9	535	57.5	0.005
K10 risk of mental illness					
No or low risk	534	85.3	657	70.7	
Medium or high	92	14.7	273	29.4	<0.001

*Stata Survey F test to adjust for practice clustering.
BG, blood glucose.

of the Rose Angina Questionnaire for possible (RQP) and definite (RQD) criteria, to evaluate whether there were any significantly different symptoms profiles between the sexes. We calculated age-standardised rates of angina in men and women using the age bands 30–45, 46–60 and 61–75 of the Goa Census data.[25]

Multivariable analyses

We identified identify clinical and serological risk factors associated with angina and sex (ie, being male of female) at or below a p value of 0.1. These were fitted a final model for men and women separately. Using a stepwise deletion based on α of 0.1, we then identified the final set of variables most strongly associated with angina.

RESULTS

Response rates

Nine of the 10 practices approached participated. Only four people were judged to be too ill to take part on account of advanced terminal illnesses. We approached 1556 (626 men and 930 women) general practice attendees, and all of those approached agreed to participate. The offer of a free blood test served as a strong incentive to participate. There were sex differences in literacy, educational qualifications, employment, family annual income, religious denomination (table 1), waist–hip measurements, blood glucose, HDL, LDL and triglyceride levels, use of tobacco and alcohol, depressive and/or anxiety symptoms, and family history of CHD between men and women (table 2).

Prevalence of angina and demographic factors

In both sexes, the prevalence of angina increased with age with variable estimates in the nine practices (range: men=2.2 to 12.5%; women=4.9 to 20.3%). Women were at greater risk than men at all ages, but this was significant in the age group 46–60 (table 3). Highest qualification and annual family income were identified as possible confounders (ie, these were associated with both having angina and being male or female at the 0.1 level). After adjustment for these two factors, angina remained significantly higher in women (OR=2.03, 95% CI=1.10 to 3.75).

Of the people identified with angina, only one woman and three men had a previous history of a myocardial infract, and only one man reported a prior history of stroke.

Demographic and CHD risk factors associated with angina

On univariate analyses in women, angina was associated with living alone, religious group, borderline or high total cholesterol levels and depressive and/or anxiety symptoms. In men, it was associated with home ownership, satisfaction with their living arrangements, not being born in Goa, elevated blood pressure and risk of depression and anxiety disorder (table 4 & 5).

On multivariable analysis in women, angina was more likely to be associated with a family history of CHD and risk of depression and anxiety disorders, and less likely to be associated with borderline or high cholesterol levels. In men, it was associated with elevated blood pressure and symptoms of depression and/or anxiety (table 6).

There were, however, a large number of participants (229, 15%) who were unable to provide information on their family history of CHD. It is very likely that these data were missing at random. On further inspection of the data missing on this variable, we did not find any demographic difference between the people with missing information and the rest of our sample. Nevertheless, since 15% of the information on family history of CHD was missing, we ran the multivariable analyses once again without this variable. This led to minimal changes to our findings. In addition to the rest of the variables in table 6 which were retained in the model, borderline or high levels of triglycerides (OR 1.70, 1.07 to 2.69) became directly associated with angina in women, and a weak association between angina and drinking alcohol (OR 1.72, 0.94 to 3.17) was found in men.

We conducted a search for relevant interactions between the variables associated with angina on multivariable analyses in men and women. In women, there were no significant interactions, but in men, we observed an interaction between high blood pressure and symptoms of depression and/or anxiety (p=0.045). Thus, a further analysis was done separately on men who had symptoms of depression and/or anxiety but no high blood pressure and men with both, high blood pressure and the presence of depressive and/or anxiety symptoms. We found a non-significant trend for angina (OR=2.1, 95% CI 0.42 to 11)

Table 3 Prevalence of coronary heart disease: age and sex breakdown

Sex	Age group	Total	History of angina		Definite angina (rose)		Possible+definite angina (Rose)		History of angina +definite angina		History of angina+possible (Rose) angina†		
		N	N	Percentage	N	Percentage	N	Percentage	N	Percentage	N	Percentage	95% CI*
Male	30–45	219	1	0.5	1	0.5	8	3.7	2	0.9	9	4.1	0 to 9.6
	46–60	246	1	0.4	4	1.6	6	2.4	5	2.0	7	2.8	1.5 to 4.1
	61–75	158	7	4.4	4	2.5	9	5.7	8	5.1	13	8.2	2.2 to 14.3
	30–75	623	9	1.4	9	1.4	23	3.7	15	2.4	29	4.7	1.5 to 7.8
Population standardised age-adjusted rate										3.2		4.2	2.5 to 5.9
Female	30–45	287	1	0.3	3	1.0	17	5.9	4	1.4	17	5.9	1.9 to 9.9
	46–60	430	11	2.6	15	3.5	49	11	26	6.0	51	11.9	7.3 to 16.4
	61–75	213	7	3.3	9	4.2	22	10	16	7.5	25	11.7	6.1 to 17.4
	30–75	930	19	2.0	27	2.9	88	9.5	46	4.9	93	10.0	6.2 to 13.8
Population standardised age-adjusted rate										7.0		8.7	6.9 to 10.6

Odds ratio between men and women aged 30–45 for Angina (history and/or Rose): 1.5 (0.5 to 4.1); p value 0.417**. Odds ratio between men and women aged 46–60 for Angina (history and/or Rose): 4.6 (2.1 to 9.9); p value 0.002**. Odds ratio between men and women aged 61–75 for Angina (history and/or Rose): 1.5 (0.6 to 3.6); p value 0.329**. Odds ratio between men and women aged 30–75 for angina (history and/or Rose): 2.28 (1.23 to 4.22); p value 0.015**. The prevalence of angina between general practices varied from 0–12.5% in men and 0–20.3% in women. There was little overlap between the practices that had the highest levels in men and women.

ICC—whole sample 0.016; ICC men—0.023; ICC women—0.018.

*95% CIs for sample prevalences estimated using survey:proportion to adjust for possible clustering between practices.

†Using survey:logit to adjust for possible clustering between practices.

Standard error for age standardised rate (ASR) using the formula:$SE(ASR) = \frac{\sqrt{((N_i^2 r_i(1r_i)/n_i))}}{N_i}$ where N_i is the number in age group i in Goa census data, r_i is the rate in age group i in the sample, and n_i is the number in the age group i in the sample. The 95% CI is then ASR±1.96SE(ASR).

in the former group and a strong association with angina (OR=20, 95% CI=7.8 to 53) in the latter group.

Pattern of responses to the Rose Angina Questionnaire

Given the unexpected elevated prevalence of angina in women as well as its direct association with psychological symptoms but inverse association with serum cholesterol, we compared men and women on distribution of responses with individual questions of the Rose Angina Questionnaire. The only significant differences between men and women were as follows. Women with RQP were more likely than men to indicate the typical angina area for the pain (question 2—women 90%, men 50%, χ^2=9.34, p=0.002). There was however a trend for these women to be less likely than men to agree that the pain subsided on rest (question 6—women 82%, men 100%, χ^2=2.87, p=0.09). There were no differences in the pattern of responses between men and women with RQD.

DISCUSSION

Main findings

Ten per cent of women and almost 5% of men aged 30 to 75 attending general practices in Goa have angina. Women aged 46–60 were at greater risk than men. After adjusting for demographic confounders, the odds of angina in women of all ages were twice that in men. Psychological distress was strongly associated with angina in both men and women. Additionally, hypertension with psychological distress was strongly associated with angina in men. Borderline and high total cholesterol levels in women were associated with a lower prevalence of angina.

Table 4 Univariate association of demographic factors with prevalence of angina

	Women				Men			
	N	Percentage	OR	95% CI	N	Percentage	OR	95% CI
Age								
Mean			1				1.00	
Mean+1			1.04	0.99 to 1.09			1.02	0.98 to 1.07
Marital status								
Married	50	9.5	1.00		22	4.5	1.00	
Single, never married	2	7.4	0.76	0.17 to 3.50	0	0.0	–	–
Widowed	23	11.0	1.17	0.32 to 4.37	2	13.3	3.27	0.73 to 14.70
Divorced	1	20.0	2.39	0.63 to 9.07	0	0.0	–	–
Occupation								
Employed and full-time education	6	4.3	1.00		13	3.5	1.00	
Unemployed	4	22.2	6.38	0.46 to 89.10	3	8.1	2.42	0.52 to 11.25
Retired/looking after family	66	10.8	2.70	0.82 to 8.93	8	6.1	1.77	0.62 to 5.03
Accommodation								
Owns home	67	9.5	1.00		19	4.0	1.00	
Other	9	14.5	1.62	0.96 to 2.74	5	8.1	2.11	1.34 to 3.34
Living alone								
No	69	9.4	1.00		24	4.6		
Yes	7	19.4	2.32	1.15 to 4.70	0	0.0	–	–
Satisfaction with accommodation								
Satisfied	68	10.5	1.00		20	4.1	1.00	
Neutral	6	6.1	0.56	0.22 to 1.43	3	7.1	1.82	0.78 to 4.20
Dissatisfied	2	8.7	0.81	0.23 to 2.93	1	20.0	5.90	2.09 to 16.62
Born in Goa								
No	7	9.6	1.00		5	9.3	1.00	
Yes	69	9.9	1.04	0.36 to 3.02	19	3.9	0.40	0.18 to 0.88
Religion								
Hindu	13	7.0	1.00		8	3.9	1.00	
Roman Catholic	59	10.4	1.53	0.81 to 2.88	15	4.8	1.25	0.62 to 2.54
Other	4	28.6	**5.29**	**1.86 to 15.05**	1	4.6	1.18	0.06 to 21.96
Literacy								
Literate	50	9.4	1.00		23	4.9	1.00	
Non-literate	26	10.9	1.18	0.62 to 2.25	1	1.5	0.31	0.03 to 3.33
Highest qualification								
None	26	11.7	1.00		1	1.8	1.00	
Up to Standard 4	23	13.1	1.15	0.67 to 1.95	5	5.1	2.98	0.33 to 27.01
Up to Standard 10	21	7.7	0.63	0.22 to 1.79	12	4.6	2.67	0.22 to 32.83
Up to Standard 12	3	6.4	0.52	0.12 to 2.22	4	12.1	7.72	0.72 to 82.72
Professional qualification	3	6.0	0.48	0.10 to 2.30	2	2.3	1.33	0.08 to 21.02
Annual family income (Rs)								
<10000	9	17.0	1.00		0	0.0	–	–
10000–50000	45	10.6	0.58	0.20 to 1.68	12	4.6	1.00	
50000–100000	22	8.9	0.48	0.14 to 1.59	9	5.0	1.09	0.49 to 2.46
>100000	0	0.0	–	–	3	4.3	0.93	0.28 to 3.09

Bold figures indicate factors significant at the 0.1 level. N=of those 76 women and 24 men with angina. Analyses were done only on those with complete data available=1308 (769 women, 539 men). Stata survey logistic regression commands were used to adjust for clustering within practices.

Table 5 Univariate association of coronary heart disease risk factors with prevalence of angina

	Women				Men			
	N	Percentage	OR	95% CI	N	Percentage	OR	95% CI
Waist–hip ratio								
Healthy: men <0.95, women <0.8	11	15.3	1.00		9	3.2	1.00	
Other: men ≥0.95, women ≥0.8	65	9.3	0.57	0.28 to 1.14	15	5.8	1.87	0.80 to 4.34
BP >140/90/history hypertension								
No	43	8.6	1.00		8	2.3	1.00	
Yes	33	12.3	1.49	0.67 to 3.32	16	8.7	**4.09**	**1.45 to 11.59**
BG >125 or history of diabetes mellitus								
No	47	8.6	1.00		12	3.4	1.00	
Yes	29	13.1	1.60	0.82 to 3.12	12	6.4	1.94	0.38 to 10.03
Total cholesterol								
Optimal <200	43	12.2	1.00		14	4.3	1.00	
Borderline/high risk ≥201	33	11.7	0.62	0.3 to 1.28	10	5.1	1.07	0.42 to 2.72
High-density lipoprotein								
Optimal >60 md/dl	24	9.5	1.00		4	3.1	1.00	
Borderline 40–59 mg/dl	42	10.3	1.11	0.63 to 1.94	15	5.2	1.7	0.30 to 9.81
High risk <40 mg/dl	10	9.2	0.97	0.58 to 1.61	5	4.1	1.31	0.38 to 4.59
Low-density lipoprotein								
Optimal <130 mg/dl	48	11.5	1.00		15	4.1	1.00	
Borderline/high risk >130 mg/dl	28	11	**0.67**	**0.47 to 0.95**	9	4.7	1.3	0.41 to 4.05
Triglycerides								
Optimal <150 mg/dl	54	9.2	1.00		15	4.6	1.00	
Borderline/high risk >150 mg/dl	22	9.13	1.37	0.73 to 2.6	9	5.06	0.93	0.44 to 2
Family history of coronary heart disease								
No	40	8.2	1.00		14	3.8	1.00	
Yes	36	13.0	1.68	0.83 to 3.40	10	6.0	1.63	0.6 to 4.41
Use tobacco now								
No	76	10.1	–	–	20	4.4	1.00	
Yes	0	0.0	–	–	4	4.6	1.03	0.26 to 4.08
Alcohol								
Not teetotal	13	11.3	1.00		12	4.1	1.00	
Teetotal	63	9.6	0.84	0.29 to 2.45	12	4.9	1.21	0.47 to 3.13
Physical activity								
No	37	11.7	1.00		17	5.8	1.00	
Regular	39	8.6	0.71	0.34 to 1.50	7	2.8	0.47	0.18 to 1.24
K10 symptoms anxiety/depression								
Low or no risk	40	7.2	1.00		13	2.8	1.00	
Medium or high risk	36	16.7	2.58	1.02 to 6.58	11	14.3	5.76	1.84 to 18.05

Bold figures indicate factors significant at the 0.1 level; N=of those 76 women and 24 men with angina. Analyses were done only on those with complete data available=1308 (769 women, 539 men). Stata survey logistic regression commands were used to adjust for clustering within practices.
BG, blood glucose.

CHD in India

The burden of CHD is rising in India with an estimated prevalence of 3–4% in rural areas and 8–10% in urban areas,[26] representing a twofold and sixfold rise in rural and urban areas, respectively, over the past four decades. India has the largest number of people with diabetes in the world with a rise in type II diabetes from less than 3% in 1970 to 12% in 2000.[27] This increase in morbidity from diabetes and CHD may be due to the changes in lifestyle and diet that come with economic prosperity. Goa is the richest state in India and has the highest CHD mortalities in the country.[1] Further research on whether case finding by the general practitioner in Goa, India could enhance early detection and effective management of the condition is nescssary.

Angina in Indian women

CHD is the commonest cause of death in women across all countries throughout the world.[28] Although men are more likely to suffer non-fatal myocardial infarctions,[29] population research indicates that the prevalence of chronic stable angina in some countries may be similar in men and women.[30 31] Recent evidence from a systematic review, however, suggests that the prevalence of angina showed a small female excess of 20%.[32] This female excess was found across countries with widely differing myocardial infarction mortalities in women. Moreover, it was found to be higher in non-Caucasian ethnic groups than in Caucasians. The female excess of angina in our study, however, exceeds that which has previously observed.

General practice data from 98 general practitioners in Sydney estimated an angina prevalence rate of 6.5% in men and 3.5% in women.[33] Recent data from the UK derived from 8970 practices and 55.5 million people reported CHD prevalence rates of 3.7% with wide variation between practices (0–34.6%).[34] There were no data on angina in this study. Moreover, there are no published statistics from Indian general practice.

In men, angina was associated with psychological distress and high blood pressure. In women, it was also related to higher levels of psychological distress but raised cholesterol levels were associated with a reduced risk of angina. This might suggest an atypical picture of cardiac pain which may be psychological in origin.[33] However, at least two findings go against this possibility. First, there was an even stronger association between psychological distress and angina in men, and second, there were no important differences between men and women in their

Table 6 Multivariable models of associations of Coronary heart disease risk factors for men and women separately adjusted for age

Final multivariable model in women

		OR	95% CI	p Value
Total cholesterol	Optimal <200	1.00		
	Borderline/high risk≥200	0.49	0.28 to 0.89	0.018
Family history of coronary heart disease				
	No	1.00		
	Yes	1.53	1.05 to 2.24	0.026
K10 risk of mental illness				
	Low or no risk	1.00		
	Medium or High risk	2.18	1.01 to 4.69	0.047

Final multivariable model in men

		OR	95% CI	p Value
K10 symptoms of anxiety and/or depression				
	No	1.00		
	Yes	5.65	2.25 to 14.16	<0.001
BP>140/90/history hypertension				
	No	1.00		
	Yes	3.82	1.57 to 9.30	0.003

N=76 women and 24 men with angina. Analyses were done only on those with complete data available=1308 (769 women, 539 men). Stata survey logistic regression commands were used to adjust for clustering within practices.

responses to the Rose Angina Questionnaire. Men and women classified with the Rose Angina Questionnaire (RQP and RQD) had very similar responses to the key angina questions. However, it is difficult to explain the lower prevalence of angina in women with borderline or high cholesterol levels. This study was a cross-sectional study and not designed to explain mechanisms of angina occurrence, and hence this finding requires further investigation.

Psychological distress

Emotional distress was associated with angina in both sexes. In men, the combination of psychological distress and an elevated blood pressure increased the risk of angina. Depression and anxiety disorders affect heart rhythms, increase blood pressure and alter blood clotting due to increased platelet aggregation.[35] They can also lead to elevated insulin and cholesterol levels. Furthermore, depression or anxiety leads to chronically elevated levels of stress hormones, such as cortisol and epinephrine[36] so that the body's metabolism is diverted away from the type of tissue repair needed in heart disease. Alteration in the ratio between sympathetic and parasympathetic tone makes people with depression more susceptible to arrhythmias by lowering the threshold for ventricular fibrillation.[37 38]

Recent data from 755 Australian women aged 23–97 suggested that lifetime depression is strongly associated with angina and somewhat less so with cigarette smoking but not at all with some of the other risk factors such as weight, cholesterol levels, hypertension, inactivity and diabetes.[39]

Depression often goes undiagnosed and untreated. People with heart diseases, their families and friends, and even the family doctors and cardiologists may misinterpret symptoms of palpitation, chest pain and breathlessness as accompaniments to heart disease rather than signs of depression and vice versa. General practitioners need to recognise symptoms of depression, enquire about their duration and severity, diagnose the disorder and recognise this as possibly being closely associated with CHD.

Strengths and limitations of the study

We could not find any other studies that assessed the prevalence of angina and CHD risk factors among general practice attendees in India. We chose a sample of private practices that served rural and urban communities with a range of socio-economic conditions in Goa and achieved 100% participation. The study practices opted to take part in this study and hence may not be represent private Goan general practice. There were demographic differences between the sexes. Women were more likely to be widowed, to have lower educational achievements and to be engaged in household-related occupations. This was with the exception of family income and religious denomination, in keeping with the socio-demographic difference generally observed between the sexes in this population under investigation.[25] Our analysis adjusted for the demographic variables that confounded the association between angina and sex.

Our estimate of the prevalence of angina was limited to a past history of the disease or existing angina based on the Rose Angina Questionnaire. We did not use other diagnostic criteria such as electrocardiography (ECG), as the accuracy of the Minnesota Code of ECG findings in epidemiological research has recently been contested.[40] The Rose Angina Questionnaire remains the best known standardised instrument for assessing angina, and the RQP has been found to be an accurate assessment of angina in people from South Asia.[14] We used a validated psychological assessment instrument.

The study was limited by its cross-section nature, and hence our multivariable analysis was not able to ascertain a causal relationship between angina and the significant clinical and biochemical markers. Nevertheless, the elevated rates of angina in women remain an important finding. Further longitudinal population data are required to ascertain risk factors of angina in this population.

CONCLUSIONS

Angina is twice as common in women as men attending general practitioners in Goa and is especially higher in women aged 45–60 years. Moderate to high risk of depressive and anxiety symptoms was strongly associated with angina. General practitioner must be aware of the extent of angina and the higher prevalence in women among people attending general practices.

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Contributors IN and MK designed and led the study. IN had full access to the data and is responsible for the integrity and the accuracy of the data analysis. DN was responsible for the overall management of recruitment and follow-up of the study participants. EK was responsible for the statistical analyses. GD and RV were responsible for the organisation, training of data collectors and running of the study in Goa. All authors contributed to the final draft of the paper.

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REFERENCES

1. **Gupta R,** Misra A, Pais P, *et al*. Correlation of regional cardiovascular disease mortality in India with lifestyle and nutritional factors. *Int J Cardiol* 2005;**108**:291—300.
2. **Ramachandran A,** Snehalatha C, Latha E, *et al*. Clustering of cardiovascular risk factors in urban Asian Indians. *Diabet Care* 1998;**21**:967—71.
3. **Mohan V,** Deepa R, Rani SS, *et al*. The Chennai Urban Population Study. Prevalence of coronary artery disease and its relationship to lipids in a selected population in South India: The Chennai Urban Population Study (CUPS No. 5). *J Am Coll Cardiol* 2001;**38**:682—7.
4. **Ahmad N,** Bhopal R. Is coronary heart disease rising in India? A systematic review based on ECG defined coronary heart disease. *Heart* 2005;**91**:719—25.
5. **Bhopal R.** What is the risk of coronary heart disease in South Asians? A review of UK research. *J Public Health* 2000;**22**:375—85.
6. **Bhopal R,** Unwin N, White H, *et al*. Heterogeneity of coronary heart disease risk factors in Indian, Pakistanis, Bangladeshi and European origin populations: cross sectional study. *Br Med J* 1999;**319**:215—20.
7. **Williams R,** Bhopal R, Hunt K. The health of a Punjabi ethnic minority in Glasgow: a comparison with the general population. *J Epidemiol Community Health* 1993;**47**:96—102.
8. **Nazroo JY.** *The health of Britain's ethnic minorities*. London: Policy Studies Institute, 1997.
9. **Singh RB,** Sharma JP, Rastogi V. Prevalence of coronary artery diseases and coronary risk factors in rural and urban populations of north India. *Eur Heart J* 1997;**18**:1728—35.
10. **Gopinath N,** Chadha SL, Jain P, *et al*. An epidemiological study of coronary heart diseases in different ethnic groups in Delhi urban population. *J Assoc Phys India* 1995;**43**:30—3.
11. **Brugha R,** Zwi A. Improving the quality of private sector delivery of public health services. *Health Pol Plann* 1998;**13**:107—20.
12. **Zwi A,** Brugha A, Smith E. Private health care in developing countries. *BMJ* 2001;**323**:463—4.
13. **Rose G.** The diagnosis of ischaemic heart pain and intermittent claudication in field surveys. *Bull World Health Organ* 1962;**27**:645—58.
14. **Sorlie PD,** Cooper L, Schreiner PJ, *et al*. Repeatability and validity of the Rose questionnaire for angina pectoris in Artherosclerosis Risk in Communities Study. *J Clin Epidemiol* 1996;**49**:719—25.
15. **Oei HH,** Vliegenthart R, Deckers JW, *et al*. The association of Rose Questionnaire angina pectoris and coronary clacification in a general population: the Rotterdam Coronary Calcification Study. *Ann Epidemiol* 2004;**14**:431—6.
16. **Fischbacher C,** Bhopal R, Unwin N, *et al*. The performance of the Rose angina questionnaire in south Asians and European origin populations: a comparative study in Newcastle UK. *Int J Epidemiol* 2001;**30**:1009—16.
17. Health Survey of England. 1992. http://www.dh.gov.uk/en/Publicationsandstatistics/PublishedSurvey/HealthSurveyForEngland/Healthsurveybackground/DH_4000522
18. **Qureshi N,** Bethea J, Modell B, *et al*. Collecting genetic information in primary care: evaluating a new family history tool. *Fam Pract* 2005;**22**:663—9.
19. **WHO Expert Consultation.** Appropriate body-mass index for Asian populations and its implication for policy and intervention strategies. *Lancet* 2004;**363**:157—63.
20. **Kessler R,** Andrews G, Hiripi E, *et al*. Short screening scales to monitor population prevalence and trends in non specific psychological distress. *Psychol Med* 2002;**32**:959—76.
21. **Patel V,** Araya R, Chowdhury M, *et al*. Detecting common mental disorders in primary care in India: a comparison of five screening questionnaires. *Psychol Med* 2008;**38**:221—8.
22. **StataCorp.** *Stata statistical software: release 9*. College Station, TX: StataCorp LP, 2005.
23. **Rao J,** Scott A. The analysis of categorical data from complex sample surveys: chi-squared tests for goodness of fit and independence in two-way tables. *J Am Stat Assoc* 1981;**76**:221—230.
24. **Rao J,** Scott A. On chi-squared tests for multiway contingency tables with cell proportions estimated from survey data. *Ann Stat* 1984;**12**:46—60.
25. **Census of India.** *Registrar general of births and deaths. ministry of home affairs*. Government of India, 1991.
26. **Reddy KS,** Shah B, Varghese C, *et al*. Responding to the threat of chronic diseases in India. *Lancet* 2005;**366**:1744—9.
27. **Ramachandran A.** Epidemiology of diabetes in India—three decades of research. *J Assoc Phys India* 2005;**21**:1414—31.
28. **Mackay J,** Mensah G. *Atlas of heart diseases and stroke*. 1st edn. World Health Organization, 2004.
29. **Tunstall- Pedoe H,** Kuulasmaa K, Mahonen M, *et al*. Contribution of trends in survival and coronary event rates to change coronary heart diasese mortality: 10 year results from 37 WHO MONICA project populations. Monitoring trends and determinants on cardiovascular disease. *Lancet* 1999;**353**:1547—57.
30. **Murabito JM,** Evans JC, Larson MG, *et al*. Prognosis after the inset of cornonary heart diseases. An investigation of differences in outcome between the sexes according to initial coronary disease presentation. *Circulation* 1993;**88**:2548—55.
31. **Hemingway H,** McCallum A, Shipley M, *et al*. Incidence and prognostic implications of stable angina among women and men. *JAMA* 2006;**295**:1404—11.
32. **AIHW Australian GP Statistics and Classification centre.** SAND abstract No 98 from the BEACH Program: management of hypertension and angina in general practice patients, 2007. Sydney: AGPSCC, University of Sydney. ISSN 1444-9072.
33. **Saxena S,** Car J, Eldred D, *et al*. Practice size, caseload, deprivation and quality of care of patients with coronary heart disease, hypertension and stroke in primary care: national cross-sectional study. *BMC Health Serv Res* 2007;**7**:96. doi: 10.1186/1472-6963-7-96.
34. **Alexander P,** Prabhu S, Krishnamoorthy E, *et al*. Mental disorders in patients with non cardiac chest pain. *Acta Psychiatr Scand* 1994;**89**:291—3.
35. **Musselmann D,** Tomer A, Manatunga A, *et al*. Exageerated platelet reactivity in major depression. *Am J Psychiatry* 1996;**153**:1313—17.
36. **Cowen P.** Cortisol, serotonin and depression: all stressed out? *Br J Psychiatry* 2002;**180**:99—100.
37. **O'Connor C,** Gurbel P, Serebruany V. Depression and 18 months prognosis after myocardial infarction. *Am Heart J* 2000;**140**:S63—9.
38. **Kilkis B,** Burgess M, Abidskov J. Influence of sympathetic tome on ventricular fibrillation thresholds during experimental coronary occlusion. *Am J Cardiol* 1975;**36**:45—9.
39. **Jacka F,** Pasco J, McConnell S, *et al*. Self-reported depression and cardiovascular risk factors in a community sample of women. *Psychosomatics* 2007;**48**:54—9.
40. **Jensen MSA,** Thomsen JL, Jensen SE, *et al*. Prognosis of electrocardiographic abnormalities detected by screening. *fremlagt ved PhD Day* 2007. Århus.