Presentation of stable angina pectoris among women and South Asian people

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Abstract

Background: There is speculation that women and South Asian people are more likely than men and white people to report atypical angina and that they are less likely to undergo invasive management of angina. We sought to determine whether atypical symptoms of angina pectoris in women and South Asians impacted clinically important outcomes and clinical management.

Methods: We prospectively identified 2189 South Asian people and 5605 white people with recent-onset chest pain at 6 chest-pain clinics in the United Kingdom. We documented hospital admissions for acute coronary syndromes, coronary deaths as well as coronary angiography and revascularization procedures.

Results: Atypical chest pain was reported by more women than men (56.5% vs 54.5%, \( p < 0.054 \)) and by more South Asian patients than white patients (59.9% vs 52.5%, \( p < 0.001 \)). Typical symptoms were associated with coronary death or acute coronary syndromes among women (hazard ratio \([HR]\) 2.30, 95% CI 1.70–3.11, \( p < 0.001 \)) but not among men (\( HR 1.23, 95\% CI 0.96–1.57, p = 0.10 \)). Typical symptoms were associated with coronary outcomes in both South Asian and white patients. Among those with typical symptoms, women (\( HR 0.76, 95\% CI 0.63–0.92, p = 0.004 \)) and South Asian patients (\( HR 0.52, 95\% CI 0.41–0.67, p < 0.001 \)) were less likely than men and white patients to receive angiography.

Interpretation: Compared to those with atypical chest pain, women and South Asian patients with typical pain had worse clinical outcomes. However, sex and ethnic background did not explain differences in the use of invasive procedures.

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The description of symptoms, articulated by patients and recorded by doctors, remains a cornerstone of diagnosis. History-taking is central to the diagnosis of chronic stable angina pectoris, yet “textbook” descriptions have been largely derived and validated among white men. A meta-analysis that included almost 25 000 people from 31 countries found that the prevalence of typical symptoms of stable angina pectoris is as high or higher in women compared with men. In addition, the prevalence of typical symptoms is higher among people of South Asian descent than among white people. Despite these findings, it is widely perceived that women, South Asian people and other ethnic minorities with suspected ischemia are more likely than white men to report atypical features of pain. This has been attributed to vasospastic and microvascular angina in women and to the higher prevalence of diabetes mellitus among South Asian people.

We sought to determine whether the description of angina pain as typical or atypical is associated with coronary outcomes. We also investigated whether differences in how patients report their symptoms is related to the clinical management of angina.

Methods

Population
We recruited 11 082 consecutive patients with recent onset chest pain from 6 rapid-access chest-pain clinics in the United Kingdom from Jan. 2, 1996, to Dec. 31, 2002. These ambulatory care clinics are run by cardiology teams and accept same-day referrals from family physicians of patients with recent-onset chest pain suspected to be stable angina pectoris. These clinics do not accept referrals of patients who have previously been suspected to have coronary disease, who have received a diagnosis of coronary disease, or who received a diagnosis of acute coronary syndromes on the day of the visit.
Data about baseline patient characteristics and pain descriptions were electronically recorded by the cardiologists using identical databases, details of which have been reported previously.20 We included only patients with suspected incident angina in our analyses, similar to an earlier study.21 If a patient’s first language was not English, or if a patient did not attend the clinic with an English-speaking family member or friend, a trained health advocate assisted the patient during the visit. The selection of patients is shown in Figure 1.

Ethical approval was obtained from a multiregional ethics committee (Multi-centre Research Ethics Committee/02/04/095). The National Patient Information Advisory committee (Multi-centre Research Ethics Committee) gave us permission to link anonymized data sets without obtaining individual patient consent.

Baseline characteristics
Cardiologists recorded ethnic background as Asian, white, black or other. In a validation study that included 34 consecutive patients, we found that the cardiologist’s assessment of ethnic background was consistent with how 88% of patients self-identified on the 2001 census (kappa statistic 0.77). For the purpose of our study, we defined South Asian as people who self-identified as Bangladeshi, Indian, Pakistani or Sri Lankan. Cardiologists recorded data about smoking status, history of hypertension or diabetes and medication use. Exercise electrocardiography was performed if it was deemed appropriate by the cardiologist.

Descriptors of chest pain
While obtaining the patient’s history, cardiologists recorded a descriptor for each of the following 4 components of chest pain: character (aching, constricting, stabbing, nondescript), site (central, left-sided, right-sided, submammary, epigastric, other), duration (seconds, < 5 minutes, 5–15 minutes, 15–30 minutes, hours or variable) and precipitating factors (none, exercise, exercise and rest, stress, eating, other). Based on the Diamond–Forrester classification,1 we considered typical pain to be that which the patient described as having a constricting quality, being located centrally or on the left-side of the chest, lasting between a few seconds and 15 minutes, and being provoked by exercise. We used a “symptom score” to classify the patient’s description of pain as typical (3 or more characteristics of typical pain) or atypical (2 or fewer characteristics). The cardiologist made an overall assessment of the patient’s symptoms as typical or atypical (“cardiologist summary”). At the end of the consultation, the cardiologist diagnosed the cause of the patient’s chest pain as either angina or noncardiac chest pain.

Outcomes and follow-up
Using unique National Health Service numbers, we were able to monitor mortality among patients by use of data from the Office for National Statistics. We were able to monitor hospital admissions, coronary angiography and revascularisation by use of the national Hospital Episode Statistics, supplied by the National Health Service Wide Clearing System. Successful matching was achieved for 99.5% of the cohort. Causes of death and admission to hospital were coded according to the International Classification of Diseases, 10th revision (ICD-10). Our primary outcome, used in all reports from this data set,17,12 was death from coronary artery disease (ICD-10 codes I20-I25) as well as hospital admission because of an acute coronary syndrome (acute myocardial infarction, ICD-10 codes I21-I23) and unstable angina (ICD-10 codes I20.0–120.9, 124.0, I24.8, I24.9). The management outcomes were receipt of coronary angiography as a confirmatory diagnostic test and subsequent coronary revascularization (either percutaneous coronary intervention or coronary artery bypass surgery, whichever was first) within 3 years of a clinic visit.

Figure 1: Selection of patients for inclusion in the study.
**Statistical analysis**

To examine baseline clinical and chest-pain characteristics, we recorded age as a continuous variable (median, interquartile range) and compared these characteristics using the Student's *t* test. Proportions were compared using the $\chi^2$ statistic.

To examine the probability of receiving a diagnosis of angina according to exercise electrocardiography results, cardiologist summary or symptom score, we used likelihood ratios with 95% confidence intervals (CI). When calculating likelihood ratios, we excluded patients who had a positive exercise electrocardiography result (182 South Asian patients, 668 white patients) to remove the potential influence of a positive result on formulating a diagnosis of angina.

To examine the prognostic validity of cardiologist summaries and symptom scores for coronary outcomes, we performed adjusted Cox proportional hazards regression by sex and ethnic background. A hazard ratio less than 1 represents a better prognosis. We compared hazard ratios between sex and ethnic background using a test of interaction. We performed adjusted Cox proportional hazards regression by sex and ethnic background to assess the relation between typicality of chest pain and coronary outcomes, and receipt of coronary angiography and revascularization. In these analyses, a hazard ratio less than 1 represents a lower likelihood of receiving the procedure. We adjusted for age (as a continuous variable), sex or ethnic background, diabetes, smoking, hypertension, revascularization (percutaneous or bypass surgery), result of exercise electrocardiography (positive or negative), and use of antianginal medications ($\beta$-blocker, calcium antagonist, oral nitrate, nicorandil) or secondary prevention medication (acetylsalicylic acid, statin, angiotensin-converting enzyme [ACE] inhibitor).

**Results**

In total, we included 7794 people: 2676 white women, 2929 white men, 980 South Asian women and 1209 South Asian men.
### Table 1: Baseline clinical and chest-pain characteristics of patients included in the study (part 1 of 2)

| Characteristic          | Women; no. (%) of patients* | South Asian n = 980 | White n = 2676 | p value | Men; no. (%) of patients* | South Asian n = 1209 | White n = 2929 | p value |
|-------------------------|------------------------------|----------------------|----------------|---------|---------------------------|----------------------|----------------|---------|
| **Age, yr. median**     |                              | 50.6 (42–58)         | 57.6 (49–67)   | < 0.001 | 49.8 (41–59)              | 54.7 (45–65)         | < 0.001         |         |
| **Risk factor**         |                              |                      |                |         |                           |                      |                 |         |
| Smoker                  |                              | 35 (3.6)             | 683 (25.5)     | < 0.001 | 320 (26.3)                | 924 (31.6)           | 0.001           |         |
| Diabetes                |                              | 209 (21.3)           | 165 (6.1)      | < 0.001 | 219 (18.1)                | 207 (7.1)            | 0.001           |         |
| Hypertension            |                              | 367 (37.5)           | 1017 (38.0)    | 0.759   | 365 (30.2)                | 875 (29.9)           | 0.84            |         |
| **Medication**          |                              |                      |                |         |                           |                      |                 |         |
| **Secondary prevention**|                              |                      |                |         |                           |                      |                 |         |
| ASA                     |                              | 232 (23.7)           | 843 (31.5)     | < 0.001 | 328 (27.1)                | 1028 (35.1)          | < 0.001         |         |
| Statin                  |                              | 61 (6.2)             | 371 (13.9)     | < 0.001 | 117 (9.7)                 | 445 (15.2)           | < 0.001         |         |
| ACE inhibitor           |                              | 62 (6.3)             | 171 (6.4)      | 0.94    | 83 (6.9)                  | 213 (7.3)            | 0.64            |         |
| **Antianginals**        |                              |                      |                |         |                           |                      |                 |         |
| β-blocker               |                              | 155 (15.8)           | 557 (20.8)     | 0.001   | 214 (17.7)                | 701 (23.9)           | < 0.001         |         |
| Calcium antagonist      |                              | 99 (10.1)            | 474 (17.7)     | < 0.001 | 102 (8.4)                 | 537 (18.3)           | < 0.001         |         |
| Oral nitrate            |                              | 67 (6.8)             | 229 (8.6)      | 0.09    | 94 (7.8)                  | 300 (10.2)           | 0.014           |         |
| Nicorandil              |                              | 3 (0.3)              | 38 (1.4)       | 0.005   | 9 (0.7)                   | 60 (2.1)             | 0.003           |         |
| **Patient description of pain** |                  |                      |                |         |                           |                      |                 |         |
| **Site**                |                              |                      |                |         |                           |                      |                 |         |
| Central                 |                              | 402 (41.0)           | 1592 (59.5)    |         | 450 (37.2)                | 1728 (59.0)          |         |         |
| Left sided              |                              | 404 (41.2)           | 583 (21.8)     |         | 560 (46.3)                | 804 (27.5)           |         |         |
| Right sided             |                              | 40 (4.1)             | 56 (2.0)       |         | 50 (4.2)                  | 86 (2.9)             |         |         |
| Submammary              |                              | 64 (6.5)             | 223 (8.3)      |         | 103 (8.5)                 | 149 (5.1)            |         |         |
| Epigastric              |                              | 69 (7.0)             | 218 (8.2)      |         | 44 (3.61)                 | 158 (5.4)            |         |         |
| Other                   |                              | 1 (0.1)              | 7 (0.3)        | < 0.001 | 2 (0.2)                   | 4 (0.1)              | < 0.001         |         |
| **Precipitating factor**|                              |                      |                |         |                           |                      |                 |         |
| Nothing                 |                              | 603 (61.5)           | 1399 (52.3)    | < 0.001 | 765 (63.3)                | 1524 (52.0)          |         |         |
| Exercise                |                              | 173 (17.7)           | 752 (28.1)     |         | 216 (17.9)                | 958 (32.7)           |         |         |
| Exercise and rest       |                              | 142 (14.5)           | 340 (12.7)     |         | 164 (13.6)                | 288 (9.8)            |         |         |
| Stress                  |                              | 29 (3.0)             | 121 (4.5)      |         | 27 (2.2)                  | 94 (3.2)             |         |         |
| Eating                  |                              | 32 (3.3)             | 60 (2.2)       |         | 34 (2.8)                  | 60 (2.1)             |         |         |
| Other                   |                              | 1 (0.1)              | 4 (0.2)        | < 0.001 | 3 (0.3)                   | 5 (0.2)              | < 0.001         |         |
| **Character**           |                              |                      |                |         |                           |                      |                 |         |
| Aching                  |                              | 325 (33.2)           | 1059 (39.6)    |         | 407 (33.7)                | 1110 (37.6)          |         |         |
| Constricting            |                              | 230 (23.5)           | 762 (28.5)     |         | 295 (24.4)                | 884 (30.2)           |         |         |
| Stabbing                |                              | 269 (27.5)           | 558 (20.9)     |         | 303 (25.1)                | 623 (21.3)           |         |         |
| Nondescript             |                              | 156 (15.9)           | 297 (11.1)     | < 0.001 | 204 (16.9)                | 322 (11.0)           | < 0.001         |         |
| **Duration**            |                              |                      |                |         |                           |                      |                 |         |
| Seconds                 |                              | 39 (4.0)             | 147 (5.5)      |         | 69 (5.7)                  | 236 (8.1)            |         |         |
| < 5 min                 |                              | 156 (15.9)           | 513 (19.2)     |         | 230 (19.1)                | 627 (21.4)           |         |         |
| 5–15 min                |                              | 226 (23.1)           | 699 (26.0)     |         | 269 (22.5)                | 733 (25.0)           |         |         |
| 15–30 min               |                              | 123 (12.6)           | 259 (9.7)      |         | 129 (10.7)                | 282 (9.6)            |         |         |
| Hours or variable       |                              | 436 (44.5)           | 1058 (39.5)    | 0.001   | 512 (42.0)                | 1051 (35.9)          | < 0.001         |         |

Continued
Asian men. The mean follow-up was 3.05 (standard deviation [SD] 1.84) years. Compared with white women and men, South Asian women and men were younger. Fewer South Asian patients were smokers compared with white patients. There was a higher prevalence of diabetes mellitus among South Asian patients compared with white patients (Table 1). The mean follow-up was 3.05 (SD 1.84) years. Compared with white women and men, South Asian women and men were younger. Fewer South Asian patients were smokers compared with white patients. There was a higher prevalence of diabetes mellitus among South Asian patients compared with white patients (Table 1). There was no interaction between sex and ethnic background (likelihood ratio $p = 0.002$). When we examined the adjusted Cox regression hazard ratios, we found that atypical pain had a similar prognostic value for coronary outcomes across sex and ethnic background (Table 3). There was no interaction between sex and ethnic background (likelihood ratio for interaction: typical pain $p = 0.34$; atypical pain $p = 0.76$).

### Symptoms and diagnosis

Neither sex nor ethnic background modified the association between exercise electrocardiography results and receiving a diagnosis of angina. There were high likelihood ratios across both sex and ethnic background (Figure 2). After excluding patients with a positive exercise electrocardiography result, cardiologist summaries and typical symptom scores both remained predictive of a diagnosis of angina (Figure 2). Likewise, likelihood ratios were lower for symptom scores compared with cardiologist summaries, but they remained well above 1.0.

### Symptoms and prognosis

We found that typical pain symptoms were associated with coronary outcomes in all patients (Table 2). Using cardiologist summaries, typical pain symptoms were more strongly associated with coronary outcome among women (hazard ratio [HR] 3.74, 95% CI 2.80–5.01) than among men (HR 1.51 95% CI 1.16–1.97, $p = 0.001$). This was also true for symptom scores (women HR 2.30, 95% CI 1.70–3.11; men HR 1.23, 95% CI 0.96–1.57, $p = 0.002$).

Among patients with typical symptoms, women were more likely than men to have coronary outcomes (cardiologist summaries HR 1.49, 95% CI 1.09–2.04; symptom scores HR 1.39 95% CI 1.06–1.84) (Table 3). South Asian people with typical pain were as likely as white people with typical pain to experience a coronary outcome for cardiologist summaries (HR 1.27, 95% CI 0.89–1.81) and more likely with symptom scores (HR 1.41, 95% CI 1.04–1.91). Women with atypical pain were less likely than men with atypical pain to experience a coronary outcome (Figure 3) unadjusted log rank test $p = 0.001$). Among South Asian people with atypical pain, the symptom score was associated with coronary outcomes (Figure 3, unadjusted log rank test $p = 0.30$). When we examined the adjusted Cox regression hazard ratios, we found that atypical pain had a similar prognostic value for coronary outcomes across sex and ethnic background (Table 3). There was no interaction between sex and ethnic background (likelihood ratio for interaction: typical pain $p = 0.34$; atypical pain $p = 0.76$).

### Symptoms and clinical management

Revascularization rates were higher among patients who reported typical symptoms than among those who reported atypical symptoms (women, adjusted HR for revascularization 3.86, 95% CI 2.35–6.35; South Asian patients, adjusted HR 3.16, 95% CI 1.93–5.19). However, the rate of revascular-

### Table 1: Baseline clinical and chest-pain characteristics of patients included in the study (part 2 of 2)

| Characteristic | Women; no. (%) of patients* | Men; no. (%) of patients* |
|---------------|-----------------------------|---------------------------|
|               | South Asian | White | $p$ value | South Asian | White | $p$ value |
| **Symptom assessment** | | | | | | |
| Exercise electrocardiography | | | | | | |
| Positive result | 56 (12.8) | 200 (13.2) | 0.50 | 126 (17.3) | 468 (24.0) | 0.001 |
| Cardiologist summary | | | | | | |
| Typical | 163 (16.6) | 647 (24.2) | < 0.001 | 193 (16.0) | 834 (28.5) | < 0.001 |
| Atypical | 817 (83.4) | 2044 (75.8) | | 1016 (84.0) | 2095 (71.5) | |
| Symptom score | | | | | | |
| Typical | 386 (39.4) | 1243 (46.5) | <0.001 | 492 (40.7) | 1509 (51.5) | < 0.001 |
| Atypical | 594 (60.6) | 1433 (53.6) | | 717 (59.3) | 1420 (48.5) | |

Note: ACE = angiotensin-converting enzyme, ASA = acetylsalicylic acid.
*Unless stated otherwise.
Table 2: Type of chest pain (typical v. atypical) as a predictor of coronary outcome, * by sex and ethnic background

| Method of assessment | Typical pain | Atypical pain | Coronary death or acute coronary syndromes; adjusted† HR (95% CI) | p value‡ |
|----------------------|--------------|---------------|---------------------------------------------------------------|---------|
|                      | No. of patients with a coronary outcome | Total no. of patients | No. of patients with a coronary outcome | Total no. of patients |                                      |         |
| **Cardiologist summary** |              |               |                                                        |         |
| Women§                | 141          | 874           | 102                                                   | 3259    | 3.74 (2.80–5.01) | <0.001 |
| Men¶                 | 168          | 1088          | 168                                                   | 3460    | 1.51 (1.16–1.97) |         |
| **Symptom score**    |              |               |                                                        |         |
| Women§                | 170          | 1796          | 73                                                    | 2337    | 2.30 (1.70–3.11) | 0.002  |
| Men¶                 | 214          | 2070          | 122                                                   | 2478    | 1.23 (0.96–1.57) |         |
| **Cardiologist summary** |              |               |                                                        |         |
| South Asian patients** | 64          | 356           | 100                                                   | 1833    | 1.97 (1.38–2.81) | 0.35   |
| White patients**     | 223          | 1481          | 151                                                   | 4124    | 2.41 (1.91–3.05) |         |
| **Symptom score**    |              |               |                                                        |         |
| South Asian patients** | 97          | 878           | 67                                                    | 1311    | 1.58 (1.14–2.18) | 0.90   |
| White patients**     | 261          | 2663          | 113                                                   | 2942    | 1.62 (1.29–2.05) |         |

Note: CI = confidence interval, HR = hazard ratio.
*Coronary outcomes include death because of coronary artery disease or acute coronary syndromes, and hospital admissions with unstable angina.
†Adjusted for age, sex, ethnic background, diabetes, hypertension, smoking and revascularization.
‡p value for the difference between 2 hazard ratios.**
§Includes both white and Asian women.
¶Includes both white and Asian men.
**Includes both men and women.

Table 3: Differences in the receipt of angiography and revascularization and in prognosis, by type of chest pain (typical v. atypical)

| Group | Coronary angiography* | Revascularization* | Coronary death or acute coronary syndrome† |
|-------|-----------------------|--------------------|-------------------------------------------|
| **Women (v. men)** |              |               |                                           |         |
| Typical | 0.68 (0.56–0.84) | 0.33 (0.24–0.46) | 1.49 (1.09–2.04) |
| Cardiologist summary | 0.76 (0.63–0.92) | 0.40 (0.30–0.54) | 1.39 (1.06–1.84) |
| Symptom score | 0.90 (0.68–1.19) | 0.61 (0.39–0.98) | 0.83 (0.58–1.19) |
| Atypical | 0.87 (0.62–1.22) | 0.42 (0.23–0.78) | 0.80 (0.51–1.25) |
| **South Asian patients (v. white patients)** |              |               |                                           |         |
| Typical | 0.58 (0.45–0.75) | 0.52 (0.36–0.75) | 1.27 (0.89–1.81) |
| Cardiologist summary | 0.52 (0.41–0.67) | 0.53 (0.38–0.74) | 1.41 (1.04–1.91) |
| Symptom score | 0.55 (0.38–0.78) | 0.61 (0.35–1.05) | 1.38 (0.94–2.02) |
| Atypical | 0.59 (0.39–0.88) | 0.49 (0.24–1.00) | 1.19 (0.73–1.92) |

*Adjusted for age, sex or ethnic background, diabetes, smoking, hypertension, use of secondary prevention or antianginal medications and exercise electrocardiography result.
†Adjusted for age, sex or ethnic background, diabetes, smoking, hypertension, use of secondary prevention medications, revascularization and exercise electrocardiography result.
larization is largely driven by the severity of angiographic
disease, which was not recorded in this study. Women with
typical pain were less likely than men with typical pain to
receive angiography and revascularization (typical symptom
score, adjusted HR for revascularization 0.40, 95% CI
0.30–0.54) (Table 3). South Asian people with typical or
atypical pain were less likely than white people to receive
angiography and revascularization (typical symptom score,
adjusted HR for angiography 0.52, 95% CI 0.41–0.67;
adjusted HR for revascularization 0.53, 95% CI 0.38–0.74).

**Interpretation**

We found that typical chest pain was about twice as likely to be
associated with adverse outcomes among women than among
men. Among those with typical chest pain, there was no differ-
ence in prognosis between South Asian and white patients.
Thus, women and South Asian patients with prognostically
important angina pectoris did not present atypically. Systematic
and potentially inequitable differences in management between
men and women and between ethnic groups cannot be ex-
plained by differences in presentation of symptoms. The central
diagnostic cannon of stable angina1 for the last 3 decades has
assessed pretest probability by use of symptoms, age and sex.
Our study demonstrates the validity of this approach for women
and extends this approach to include South Asian patients.

Much of the previous research about symptoms in women
has focused on suspected acute myocardial infarction rather
than stable angina. In women, typical symptoms are more
common than atypical symptoms in acute coronary syn-
dromes,24 although women tend to have more associated
symptoms such as nausea and dyspnea.25 In ambulatory set-
tings, women may rate their pain as more intense than men
and have more associated symptoms.6 In our study, women
who attended an ambulatory chest-pain clinic reported more
atypical symptoms of angina pectoris than men.

The classification of symptoms as typical or atypical was
predictive of the cardiologist’s diagnosis of angina in women
and men. However, there was prognostic separation between
women and men when the classification of symptoms was
used to predict outcomes. Thus, when comparing risk of coro-
nary death or admission with acute coronary syndrome, typi-
cal symptoms were a stronger predictor of coronary outcomes
in women than in men. Thus, the phenomenon described as
the “Yentl syndrome” (lower use of diagnostic and therapeu-
tic procedures for women and a decreased ability to identify
women at risk for acute coronary events) cannot be entirely
attributed to atypical symptoms.

We found that typical symptoms were predictive of a diag-
osis of angina for both white and South Asian patients. Fur-
thermore, typical symptoms were predictive of coronary out-
comes in South Asian patients when compared with atypical
presentations. Although South Asian patients attending the
chest-pain clinic reported more atypical symptoms than typi-
cal symptoms, the rate of subsequent adverse coronary out-
comes was similar among both white and South Asian
patients with atypical symptoms. Because both doctors and
patients may be aware that coronary heart disease mortality is
higher among South Asian people,26,27 our findings might be
explained by a lower threshold for referral of South Asian
patients with any chest pain symptoms. Indeed, a previous
survey found that South Asian patients with chest pain were
more willing than white patients to seek care.9 Reassuringly,
the prognosis was no worse for South Asian patients than for
white patients.

Chest pain characteristics and the perception of pain have
been compared in different ethnic groups.10,11 Compared with
white people, South Asian people report a higher likelihood
of seeking care.9 In a prospective study based in an emer-
gency department, African-American patients were more
likely than white patients to attribute their symptoms to a
noncardiac source, but they were not more likely than white
patients to have atypical symptoms.28 When presenting for
coronary angiography, African-American patients have been
reported to complain more of shortness of breath more often
than white patients.29

Figure 3: Cumulative incidence of mortality because of coronary artery disease or acute coronary syndromes among men and women
(A) (p = 0.30 for typical symptoms, p = 0.001 for atypical symptoms) and among white and South Asian patients (p = 0.53 for typical
symptoms, p = 0.88 for atypical symptoms).
We found lower rates of coronary angiography and revascularization among women and South Asian patients compared with men and white patients. This could not be fully explained by the presence of typical or atypical symptoms despite the fact that women and South Asian patients with typical pain were less likely to undergo diagnostic and therapeutic invasive procedures. Studies of such inequalities in management among women have lacked details about pain symptoms. We have also shown that an atypical presentation of chest pain cannot explain undermanagement. It is also unlikely that differences in symptom severity explain this undermanagement because functional impact and tendency to seek care are greater among women and South Asian people with chest pain.30

In our study, a history of typical pain symptoms, based on predefined response categories to 4 questions (character, site, duration, precipitating factor) was associated with a diagnosis of angina and a worse prognosis for coronary outcomes among women and South Asian patients. Rather than using a more detailed risk score, a general practitioner could quickly determine the symptom score from the patient’s history and decide whether referral to a chest-pain clinic is necessary.31,32 Compared with the symptom score, the cardiologist summary was more strongly associated with a diagnosis of angina or risk of coronary outcomes, which may reflect the incorporation of risk factor information and clinical experience into the estimate of pretest disease likelihood. Although it was a weaker predictor of outcome, the symptom score was predictive. Thus, we encourage general practitioners to use a simple and quick patient history to determine appropriateness for referral to a cardiologist, potentially helping to overcome inequitable barriers to referral.33

**Strengths and limitations**

A major strength of our study is the detailed description of chest pain among a large number of people with recent-onset symptoms who had not had a previous investigation for angina and who had not had a previous myocardial infarction or revascularization. The duration of symptoms was less than 6 months for 87% of patients. Several limitations should be considered in interpreting our findings. First, the recorded patient history may have been biased by the knowledge of the exercise electrocardiography findings. For this reason, we excluded patients with an abnormal exercise electrocardiography results when assessing the diagnosis of angina. However, our finding of the prognostic importance of typical symptoms among women and South Asians would not have been affected by this bias. Second, the South Asian ethnic background encompasses people of different languages, religions and cultural groups, among whom the cardiovascular risk profile may differ.3 Further research is required to determine whether symptom validity differs between patients of Bangladeshi, Indian, Pakistani or Sri Lankan descent. Third, data were not available on the findings of angiography.

A potential limitation of our quantitative study is that the actual words used by patients, their meaning and context were not reported. We addressed this in a separate ethnographic qualitative study of 59 clinic consultations to understand how the chest pain classification and diagnosis were reached.34 We found that symptom history represents a complex negotiation between cardiologist and patient, with much ambiguity and re-telling. There was little evidence that this negotiation was patterned by sex or ethnic background. Importantly, none of the South Asian patients in our study relied on translators; the minority who needed help with English were accompanied by a family member. We relied on the prespecified coding in the database; it is likely that doctors may record in free text further relevant details of symptoms pertinent to the diagnosis of angina. We have demonstrated that electronic processing of this natural language might aid the identification of patients with angina.35

**Conclusion**

Women and South Asian people with typical chest pain were at increased risk of adverse coronary outcomes compared with those who presented with atypical pain. Women and South Asian people with clinically important angina pectoris did not present atypically, and differences in symptom description did not account for their lower rates of coronary angiography and revascularization compared with men and white patients. Thus, symptoms of chest pain are valid diagnostic and potentially relevant prognostic tools across sex and ethnic backgrounds. Further study should examine why South Asian patients and white women with the same prognosis as men receive poorer care.

This article has been peer reviewed.

**Competing interests:** None declared.

**Contributors:** M. Justin Zaman and Cornelia Junghans conceived the study idea. M. Justin Zaman performed the statistical analyses, wrote the first draft of the manuscript and is the guarantor. Ruoling Chen and Neha Sekhri were involved in writing the discussion and interpretation. Adam D. Timmis designed the database, organized the cohort and was involved in writing the discussion and interpretation. Harry Hemingway contributed to the first draft and the analyses, and he was involved in the discussion and interpretation. All authors participated in the discussion and interpretation of the final results, contributed to the final paper and approved the final version submitted for publication.

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