

# Is access to specialist assessment of chest pain equitable by age, gender, ethnicity and socioeconomic status? An enhanced ecological analysis

Neha Sekhri,<sup>1</sup> Adam Timmis,<sup>1</sup> Harry Hemingway,<sup>2</sup> Niamh Walsh,<sup>3</sup> Sandra Eldridge,<sup>3</sup> Cornelia Junghans,<sup>2</sup> Gene Feder<sup>3</sup>

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<sup>1</sup>Cardiac Directorate, Barts and the London NHS Trust, London, UK

<sup>2</sup>Department of Epidemiology and Public Health, University College London Medical School, London, UK

<sup>3</sup>Centre for Health Sciences, Barts and the London, Queen Mary's School of Medicine and Dentistry, University of London, London, UK

## Correspondence to

Professor Adam Timmis;  
[adamtimmis@mac.com](mailto:adamtimmis@mac.com)

## ABSTRACT

**Objectives:** To determine whether access to rapid access chest pain clinics of people with recent onset symptoms is equitable by age, socioeconomic status, ethnicity and gender, according to need.

**Design:** Retrospective cohort study with ecological analysis.

**Setting:** Patients referred from primary care to five rapid access chest pain clinics in secondary care, across England.

**Participants:** Of 8647 patients aged  $\geq 35$  years referred to chest pain clinics with new-onset stable chest pain but no known cardiac history, 7570 with documented census ward codes, age, gender and ethnicity comprised the study group. Patients excluded were those with missing date of birth, gender or ethnicity ( $n=782$ ) and those with missing census ward codes ( $n=295$ ).

**Outcome measures:** Effects of age, gender, ethnicity and socioeconomic status on clinic attendance were calculated as attendance rate ratios, with number of attendances as the outcome and resident population-years as the exposure in each stratum, using Poisson regression. Attendance rate ratios were then compared with coronary heart disease (CHD) mortality ratios to determine whether attendance was equitable according to need.

**Results:** Adjusted attendance rate ratios for patients aged  $>65$  years were similar to younger patients (1.1, 95% CI 1.05 to 1.16), despite population CHD mortality rate ratios nearly 15 times higher in the older age group. Women had lower attendance rate ratios (0.81, 95% CI 0.77 to 0.84) and also lower population CHD mortality rate ratios compared with men. South Asians had higher attendance rates (1.67, 95% CI 1.57 to 1.77) compared with whites and had a higher standardised CHD mortality ratio of 1.46 (95% CI 1.41 to 1.51). Although univariable analysis showed that the most deprived patients (quintile 5) had an attendance rate twice that of less deprived quintiles, the adjusted analysis showed their attendance to be 13% lower (0.87, 95% CI 0.81 to 0.94) despite a higher population CHD mortality rate.

**Conclusion:** There is evidence of underutilisation of chest pain clinics by older people and those from lower socioeconomic status. More robust and patient

## ARTICLE SUMMARY

### Article focus

- Is access to chest pain clinics of people with recent onset symptoms equitable according to local need and consistent with national policy.

### Key messages

- Need for evaluation in chest pain clinics will vary according to the variable incidence of heart disease in different age, gender, socioeconomic and ethnic groups.
- There is evidence of underutilisation of chest pain clinics by older people and those from lower socioeconomic status.

### Strengths and limitations of this study

- Large, diverse and unselected patient population with uniformly collected patient-level data, allowing robust comparisons between demographic and clinical groups.
- Ecological fallacy with respect to age and sex has been avoided by applying an enhanced ecological analysis.
- Need to use census wards, not postcodes, as the smallest geographical areas for which mortality and demographic data were available.
- Ethnicity was not based on self-ascription.

focused administrative pathways need to be developed to detect inequity, correction of which has the potential to substantially reduce coronary mortality.

## BACKGROUND

Equitable access to healthcare is a widely accepted goal for health services internationally and a key principle of the NHS.<sup>1</sup> The concept, however, is complex<sup>2</sup> involving not only service availability and also service utilisation according to the needs of different groups within catchment populations. Most studies of equity have been within specialist services with few analysing equity of entry

into those services at an early stage of presentation. Those studies that are available are mostly 'qualitative' in nature.<sup>3 4</sup>

Rapid access chest pain clinics, based in hospitals within the UK, provide a gateway for a range of tertiary investigations and treatments through referral from primary care. Recent guidelines have emphasised the potential consequences of missing the opportunity to diagnose coronary heart disease (CHD) and provide effective intervention, but equitable access to this service by age, socioeconomic status, ethnicity and gender is crucial, yet has not been studied to date.<sup>5</sup> Equity of access cannot be measured by simple comparison of proportions of user groups with proportions of the same groups in catchment populations because this takes no account of clinical need and can lead to false conclusions and wrong policy decisions.<sup>6</sup> Need for evaluation in chest pain clinics will vary according to the variable incidence of heart disease in different age, gender, socioeconomic and ethnic groups. An additional factor requiring consideration is the distance that potential users of a service have to travel, as there is evidence from the USA<sup>7</sup> and the UK<sup>8 9</sup> that this is independently associated with service utilisation. The present study, using an enhanced ecological analysis,<sup>10</sup> is the first to incorporate all these factors in determining whether access to chest pain clinics of people with recent onset symptoms is equitable according to local need and consistent with national policy.

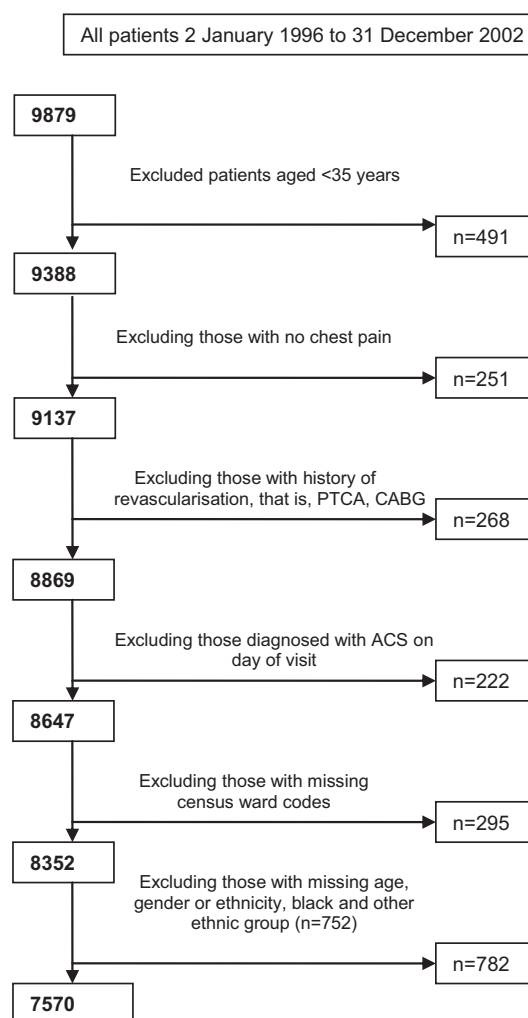
## METHODS CHEST Pain Clinic Population

We collected data on consecutive patients referred to five rapid access chest pain clinics from 1 January 1996 to 31 December 2002 with new onset of chest pain. We excluded patients younger than 35 years, patients without chest pain, patients with previously diagnosed coronary artery disease, patients diagnosed with acute coronary syndrome, patients with incomplete data on age, gender and ethnicity, and patients not traced by central registries—the Office for National Statistics (ONS)<sup>11</sup> or the Secondary Uses Service<sup>12</sup> (figure 1).

### Data collection

Data on age, sex and ethnicity (white, Asian, black or other) were systematically recorded on a customised database<sup>13</sup> at the time of the clinic visit. Other data sources for this study are summarised in table 1.

The clinician assessing the patient in the rapid access chest pain clinic ascribed 'Asian', 'white', 'black' or 'other' ethnic identity during the consultation, choosing between those four categories. There were no explicit criteria for ascribing ethnicity; the category 'Asian' being used for patients of Indian, Pakistani, Sri Lankan and Bangladeshi origin, referred to as 'south Asian' in this paper. A validation study on 34 consecutive patients found the clinician's assessment of ethnicity to be consistent with 88% of patients who self-identified on the 2001 census ( $\kappa$  statistic 0.77).<sup>14</sup>



**Figure 1** RACPC study population to determine utilisation by age, gender, ethnicity and deprivation. ACS, acute coronary syndrome; CABG, coronary artery bypass surgery; PTCA, percutaneous transluminal coronary angioplasty.

### Derivation of socioeconomic status

We used the Townsend index of deprivation (calculated with census 2001 variables) based on the proportion of the census ward population unemployed, with no car, not owner-occupiers and living in overcrowded housing (2001 Townsend Index, South West Public Health Observatory, 2004). Deprivation quintiles for Townsend score were calculated, and quintiles 1–4 were grouped together and are described as less deprived and quintile 5 as most deprived. We have described our choice of relevant wards in the section on the denominator population.

### Distance of census ward to rapid access chest pain clinic

For each patient attending the rapid access chest pain clinic (RACPC), distance to the clinic was calculated from their residence postcode (recorded at attendance) to the respective clinic. Distance of each residential census ward from the RACPC was then calculated by averaging the distance of all the included patients from a ward who visited that particular clinic. For wards with no attendees, the distance from the geographic centre of

Table 1 Baseline characteristics of the whole cohort and stratified by age, gender, ethnicity and deprivation

	Whole (N=7570)	Age <65 years (N=5553)	Age ≥65 years (N=2017)	Men (N=3999)	Women (N=3571)	S Asian (N=2150)	White (N=5420)	Less deprived* (N=2737)	Most deprived* (N=4833)
<b>Demographics</b>									
Age (mean±SD)	56±12	51±8	72±5	56±12	57±12	52±11	58±12	59±12	55±12
Women	3571 (47)	2595 (47)	976 (48)	—	—	975 (45)	2596 (48)	1246 (46)	2325 (48)
South Asian	2150 (28)	1832 (33)	318 (16)	1175 (29)	975 (27)	—	—	188 (7)	1962 (41)
Most deprived	4833 (64)	3721 (67)	1112 (55)	2508 (63)	2325 (65)	1962 (91)	2871 (53)	—	—
<b>Risk factors</b>									
Diabetes	850 (11)	575 (10)	275 (14)	466 (12)	384 (11)	458 (21)	392 (7)	215 (8)	635 (13)
Current smoker	1806 (24)	1538 (28)	268 (13)	1130 (28)	676 (19)	332 (15)	1474 (27)	535 (20)	1271 (26)
Hypertension	2707 (36)	1750 (32)	957 (48)	1302 (33)	1405 (39)	769 (36)	1938 (36)	989 (36)	1718 (36)
Abnormal ECG	1417 (19)	729 (13)	688 (34)	837 (21)	580 (16)	319 (15)	1098 (20)	610 (23)	807 (17)
<b>Diagnosis</b>									
Angina	2280 (31)	1201 (22)	1079 (55)	1345 (34)	935 (27)	494 (23)	1786 (34)	932 (35)	1348 (28)
Non-cardiac chest pain	5109 (69)	4225 (78)	884 (45)	2569 (66)	2540 (73)	1625 (77)	3484 (66)	1701 (65)	3408 (72)
CHD death/ACS	541 (7)	327 (6)	214 (11)	327 (8)	214 (6)	167 (8)	374 (7)	154 (6)	387 (8)

Data are expressed in n (%), except age.

\*Less deprived group contains wards in deprivation quintiles 1–4. Most deprived contains wards in deprivation quintile 5. CHD, coronary heart disease.

the ward to the clinic was calculated. The median distance for the clinics was 4.4 km (IQR 2.7–7.7 km).

### Denominator population for the chest pain clinics

In order to analyse equity of access to these clinics, we identified a denominator population based on the catchment areas of the relevant hospitals. We obtained data on denominator populations from the 2001 census. For our stratified method of analysis, we used electoral wards, the smallest geographical units for which individual data were available. The catchment area for each clinic was defined by the primary care trusts (PCTs) holding major contracts with the relevant hospitals.

### Proxy for need

CHD death rates by census ward were used as a marker of need for specialist cardiac assessment. Data on deaths due to CHD (ICD 10 I20–I25) by age and gender for the years 2000–2003 were obtained from the health geography section of the ONS. Though PCT boundary changes took place in 2002, the mortality data were reconfigured by the ONS for the preceding years (2000 and 2001), to conform to PCT boundary changes in 2002, such that census ward areas were similar for the four years. Mortality data from 2000 were based on the ICD 9 code and for the subsequent years on the ICD 10 code with comparability ratios for ICD 10 I20–I25 between the two coding systems of 1.007 for men and 1.005 for women.<sup>15</sup> Therefore, recoding for mortality data from 2000 to ICD 10 code was not done. Mortality data by ethnicity are not available, as it is not recorded on death certificates. Therefore, standardised mortality ratios (SMRs) from a cross-sectional analysis of CHD mortality by country of birth in England and Wales<sup>16</sup> were used as proxy measure of need by ethnicity.

### Ethical approval

This was obtained from the multiregional ethics committee (MREC /02/04/095). Permission was given by the National Patient Information Advisory Group<sup>17</sup> to link anonymised data sets without individual patient consent.

### Statistical analysis

We performed all analyses with STATA V.8.0. All data were configured to census wards level.

### Configuration of data

First, the RACPC data on patients attending the index clinics were collapsed to census ward level by age group, gender and ethnicity. This resulted in data on number of attendances in eight units of analysis per census ward by cross-classification of age, gender and ethnicity (2 age groups (≥65, 35–64 years) × 2 gender (male, female) × 2 ethnicities (south Asian, white); a total of 1608 strata for the 201 census wards (201 census wards × 8). The 2001 census population data were then used to estimate resident population-years over the time covered by the attendances (6 years for wards served by Newham RACPC, 2.66 years for Oldchurch, 2.083 years for

Blackburn, 1.75 years for Burnley and 1.5 years for Kingston) at each clinic by ward, age, sex and ethnicity, thus resulting in a denominator population for each of the 1608 strata. Each patient attending the clinics and the denominator population were then ascribed their respective census ward deprivation scores.

Modelling to assess equity

We fitted two Poisson regression models. The first determined the effects of age, sex, ethnicity, socioeconomic status on attendance. The second model assessed the effect of these factors on mortality but did not include ethnicity because those data were not available from national statistics. We were able to assess equity in relation to ethnicity by comparing the SMRs for ethnic groups from a cross-sectional study. In each case, we controlled for distance and individual clinic. To estimate effects on attendance, we calculated rate ratios using univariate and multivariate models (including age, gender, deprivation, ethnicity, distance and clinic as predictors) with number of attendances as the outcome and resident population-years as the exposure in each stratum. We compared attendance rate ratios for age, gender and deprivation subgroups with CHD mortality ratios for these subgroups calculated in a similar way, and attendance rate ratios by ethnicity with the published SMR for south Asians. We performed all analyses with Stata V.8.

A sensitivity analysis was done by excluding Newham chest pain clinic, which contributed nearly 55% of the total cohort, has high deprivation index and a large proportion of south Asian patients, as such a cohort composition may not be generalisable across the UK.

RESULTS

Patients

The study group comprised 7570 patients, of whom 2017 (27%) were aged ≥65 years, 3571 (47%) were women, 2150 (28%) were of south Asian ethnicity and 4833 (64%) were in the most socioeconomically deprived quintile (table 1).

Attendance rate ratios

1. *Age.* Adjusted attendance rate ratios for patients aged >65 years were similar to younger patients (1.1, 95% CI 1.05 to 1.16), despite population CHD mortality rate ratios being nearly 15 times higher in the older age group.
2. *Gender.* Women had lower attendance rate ratios (0.81, 95% CI 0.77 to 0.84) and also lower population CHD mortality rate ratios compared with men.
3. *Ethnicity.* South Asians had higher attendance rates (1.67, 95% CI 1.57 to 1.77) compared with whites and a higher standardised CHD mortality ratio of 1.46 (95% CI 1.41 to 1.51), based on national data.
4. *Deprivation.* Although univariable analysis showed that the most deprived patients (quintile 5) had an attendance rate twice that of less deprived quintiles, the adjusted analysis showed their attendance rate to be 13% lower (0.87, 95% CI 0.81 to 0.94) despite a higher population CHD mortality rate.

The sensitivity analysis, with exclusion of the Newham clinic, showed similar attendance rate ratios in all groups of interest (table 2).

DISCUSSION

This study is the first to evaluate equity of access to chest pain clinics taking into account the potential need for care among key groups defined by age, gender, ethnicity

Table 2 Clinic attendance RRs and population CHD mortality RRs and CHD SMR

Variable	Baseline comparator	Univariable attendance, RR (95% CI)	Multivariable attendance, RR (95% CI)*	Univariable CHD mortality RR (95% CI)	Multivariable CHD mortality RR (95% CI)*
Age (years)					
≥65	35–64	1.01 (0.96 to 1.06)	1.10 (1.05 to 1.16)	15.25 (14.47 to 16.08)	15.79 (14.97 to 16.65)
Gender					
Females	Males	0.82 (0.78 to 0.86)	0.81 (0.77 to 0.84)	0.74 (0.71 to 0.76)	0.61 (0.59 to 0.63)
Deprivation‡					
Most deprived	Less deprived	2.04 (1.95 to 2.14)	0.87 (0.81 to 0.94)	1.26 (1.21 to 1.31)	1.25 (1.19 to 1.30)
Distance (km)		0.85 (0.84 to 0.86)	0.93 (0.92 to 0.94)	1.00 (0.99 to 1.01)	0.99 (0.98 to 1.00)
Clinic					
Oldchurch		0.57 (0.54 to 0.60)	0.58 (0.54 to 0.63)	1.28 (1.20 to 1.36)	1.10 (1.02 to 1.17)
Blackburn	Newham	0.29 (0.27 to 0.32)	0.35 (0.32 to 0.39)	1.24 (1.16 to 1.33)	1.19 (1.10 to 1.28)
Burnley		0.25 (0.22 to 0.27)	0.30 (0.26 to 0.34)	1.28 (1.19 to 1.37)	1.22 (1.13 to 1.31)
Kingston		0.22 (0.20 to 0.24)	0.22 (0.19 to 0.25)	0.81 (0.76 to 0.87)	0.88 (0.80 to 0.96)
Ethnicity					CHD SMR (95% CI)‡
South Asian	White	2.54 (2.41 to 2.68)	1.67 (1.57 to 1.77)	–	1.46 (1.41 to 1.51)

\*Attendance and CHD mortality RRs adjusted for age, gender and deprivation, distance and clinic.

†Less deprived group contains wards in deprivation quintiles 1–4. Most deprived group contains wards in deprivation quintile 5.

‡SMR from a cross-sectional analysis of CHD mortality by country of birth in England and Wales.<sup>16</sup>

CHD, coronary heart disease; RR, rate ratio; SMR, standardised mortality rate.



and deprivation. The strongest evidence of inequitable access was for older people, although the discrepancy between clinic attendance and CHD mortality for patients from the most deprived wards may also reflect reduced utilisation compared with patients in less deprived wards. We found no evidence of inequitable access for women and south Asian patients.

Inequitable access to specialist care is understudied yet is a potentially important cause of adverse patient outcomes, particularly in high-risk patients with recent onset chest pain. Inequity was most evident for patients aged  $\geq 65$  years, for whom attendance rate ratios pointed to significant underutilisation compared with younger age groups because proxy of need, defined by ward-level coronary mortality, was so much higher. The causes of this underutilisation cannot be determined from our data but are likely to be complex, including the unwillingness of some older patients to 'bother' their doctors and comorbidities that may complicate decisions about specialist chest pain referral.<sup>18</sup> Nevertheless, inequity for older people is not confined to specialist referral, and there is considerable evidence of suboptimal pharmacotherapy and underuse of coronary investigations elsewhere on the management pathway, in both primary and secondary care.<sup>19–21</sup> Inequity in older people needs to be further explored to help develop health policies and eradicate ageism in service provision, according to the aims of the national service framework for older people.<sup>22</sup>

People living in the most deprived wards were 13% less likely to attend their local chest pain clinic compared with people living in less deprived wards. The inequitable access to specialist chest pain services associated with deprivation was reflected in the high population CHD mortality rates for deprived wards, an observation consistent with that of Lawlor and colleagues.<sup>23</sup> Again, we can only speculate on potential causes for this inequity, but socioeconomic variations in responses to chest pain identified in qualitative primary care studies<sup>3 4 24</sup> may account for some of the barriers in the uptake of healthcare by the most deprived.

Our study provided no evidence of inequitable access to specialist care for women with chest pain, significantly lower attendance rates at the chest pain clinics being consistent with lower catchment area population CHD mortality rates compared with men. This is reassuring but not a cause for complacency given the comparable rates of angina for men and women and the comparable prognoses.<sup>25</sup> This puts into perspective our finding of lower rates of chest pain clinic referral for women compared with men and the evidence that further down the management pathway many women with coronary disease are treated less intensively than men.<sup>26</sup>

South Asian patients had the highest chest pain clinic attendance rates in our study, consistent with the increased coronary risk for people born in India, Pakistan and Bangladesh.<sup>16</sup> Our finding of equitable access is consistent with reports that the health-seeking behaviour of south Asians is similar to Europeans.<sup>27</sup> Nevertheless,

our previous work has provided evidence of inequitable care further down the treatment pathway as reflected by lower rates of coronary revascularisation among south Asians after referral for the procedure.<sup>28</sup> Again, we were unable to identify causes for this, but it is a reminder that cultural gaps and communication difficulties persist<sup>29</sup> with the potential to disadvantage south Asians with CHD.

### Strengths and limitations

The strength of our study was its large, diverse and unselected patient population with uniformly collected patient-level data, allowing robust comparisons between demographic and clinical groups. By using census ward coronary mortality rates as an approximation of need for chest pain clinic referral (rates of incident angina would have been more appropriate but are unavailable), we have gone beyond a simple comparison of attendance rates for demographic subgroups. We have attempted to avoid ecological fallacy with respect to age and sex by applying an enhanced ecological analysis in which we divided populations within area units into demographic strata and then applied our analysis to these strata, similar to the method used by Lancaster *et al*<sup>10</sup> in modelling lung cancer data. A potential limitation was our need to use census wards, not postcodes, as the smallest geographical areas for which mortality and demographic data were available from the ONS. This is particularly relevant for the precision of the census-based Townsend deprivation score, which is averaged across wards and prone, therefore, to ecological fallacy. Although ethnicity was not based on self-ascription, the small validation substudy was reassuring. Our need to use SMRs to determine mortality by ethnicity was driven by the absence of ethnicity recording on death certificates and its unavailability therefore at individual or ward level.

What are the implications of this research? Differences in chest pain clinic attendance rates across demographic groups may not necessarily reflect inequity, but where such differences are observed, they require investigation, particularly when high-risk groups are affected, because their resolution provides a ready means of improving population healthcare. Thus, if inequity is a factor in the under-referral of older people to chest pain clinics, it is important since, of all the groups we evaluated, it is older people who are at greatest risk of CHD death and who might have the most to gain from specialist referral.<sup>30</sup> A similar argument applies to people who are in the most socioeconomically deprived groups.<sup>31</sup>

### CONCLUSIONS

There is evidence of underutilisation of chest pain clinics by older people and those from lower socioeconomic status. These are high-risk groups who are prone to inequitable management elsewhere on the healthcare pathway. More robust and patient focused administrative pathways need to be developed to detect inequity, correction of which has the potential to substantially reduce coronary mortality.

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**Competing interests** None.

**Patient consent** Permission was given by the National Patient Information Advisory Group<sup>17</sup> to link anonymised data sets without individual patient consent.

**Ethics approval** Ethics approval was provided by the multiregional ethics committee (MREC /02/04/095).

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data sharing statement** We would be happy to share anonymised data on request.

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