Addressing the inverse care law in cardiac services

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Abstract

**Background** Wide variation in rates of angiography and revascularization exist that are not explained by the level of need for these services. The National Service Framework for Coronary Heart Disease has set out a number of standards with the aim of increasing the number of revascularizations and reducing inequalities in access to care. In this study we aimed to investigate inequity in angiography and revascularization rates between the four Primary Care Group (PCG) areas in Camden and Islington Health Authority and to put in place measures to address the problems identified.

**Methods** Routinely available data were collected on all residents within Camden and Islington Health Authority undergoing angiography, angioplasty (PTCA) or coronary artery bypass grafting (CABG) between 1997 and 2001. These were used to calculate intervention rates per million population for each of the three procedures within each PCG. Semi-structured interviews were carried out with a sample of clinicians to explore their views on the provision of revascularization services within the Health Authority.

**Results** Angiography and revascularization rates varied widely between the four PCGs. In 2001 there was a two-fold difference for angiography and CABG and a 3.5-fold difference for PTCA. The variations were not explained by a measure of the level of need for these services. The highest rates were in the area with the lowest standardized mortality ratio for coronary heart disease. The interviews identified a number of possible explanations for the variations that related to differences in clinical behaviour at the consultant level and barriers in access to interventional cardiology and cardiac services. Following this research, a further interventional cardiologist appointment is planned, joint protocols of care are being established and barriers to access are being addressed.

**Conclusions** The new strategic health authorities should make it a priority to assess inequity in the provision of services within their areas, investigate the possible causes and support the primary care trusts to implement plans to address them.

**Keywords:** revascularization rates, inequity, National Service Framework, coronary heart disease

Introduction

The National Service Framework for Coronary Heart Disease (CHD) sets out a number of standards with the aim of increasing the number of revascularizations and reducing inequalities in access to care.1 The immediate priority, which was to be achieved by April 2002, was to increase the total number of revascularization procedures by 3000, eventually leading to a national rate equivalent to at least 750 coronary artery bypass grafts (CABGs) and 750 percutaneous transluminal coronary angioplasties (PTCAs) per million population (no date given). These standards have been set as a result of evidence highlighting that the United Kingdom has a low rate of coronary revascularization compared with other countries2,3 with a high rate of coronary heart disease and long waiting times. Also, the wide variations in rates that have been reported4 are not wholly explained by variations in measures of need,5–7 or other population characteristics,8 indicating inequitable access to care. Furthermore, data are not routinely made available at a sub-health authority level, so the potential exists for inequality to remain undetected.

These variations may result from variation in demand, such as differences in peoples' expectations and their response to illness;6,8 however, the most likely explanation relates to supply factors, i.e. the availability of coronary revascularization services and differences in clinical judgement and practice. A number of studies have shown that proximity to a tertiary cardiology centre affects utilization rates.6,7 Areas nearer centres have higher rates. This could be the result of differences in referral procedures and patients' access to interventional cardiologists.12 It is likely that differences in clinical judgement and practice exist as a result of the lack of standardized protocols of care. There could be differences in general practitioners' (GPs') referral procedures, thresholds for investigation by cardiologists and decision to...
revascularize by cardiologists and cardiac surgeons. There is scope therefore for inappropriate investigation and treatment that could lead to variations in rates. Some patients may receive care when there is no, or limited, benefit (overuse) and other patients may be denied care when there is a need (underuse). A recent study conducted in the United Kingdom determined the appropriateness of a cohort of patients undergoing angiography, PTCA and CABG using appropriateness ratings derived by an expert panel. It found substantial underuse of coronary revascularization procedures.13,14

At the time of this study, Camden and Islington Health Authority in Inner London served a population of approximately 370,000 and consisted of four PCGs; North Camden, South Camden, North Islington and South Islington. (Since April 2002 the new North Central London Strategic Health Authority has been created. The four PCGs in Camden and Islington have been amalgamated to form two primary care trusts.) The majority of angiograms and PTCA’s on Camden and Islington residents during the period of this study were conducted at the Royal Free Hospital (RFH) and the University College London Hospitals (UCLH). The majority of CABG’s were undertaken at the cardiothoracic unit at UCLH and a small number at the RFH (60–70 per annum, since planned to cease). A smaller group of patients were referred to the Royal Hospitals Trust outside the Health Authority’s boundaries. There is one other teaching hospital in the Health Authority, the Whittington Hospital, which is situated in North Islington and whose cardiologists have limited access to angiography facilities at UCLH.

In response to the National Service Framework standards Camden and Islington Health Authority set up a study with the aim of investigating inequity in angiography and revascularization rates between their four original PCG areas and to put in place measures to address the problems identified.

Methods

Data on admissions for all patients with a diagnosis of CHD were available from the Health Authority’s Admitted Patient Care Commissioning Data Set for the six years 1997–2001 for each PCG. Total numbers of patients undergoing angiography (OPCS codes K63 and K65), PTCA (K49) and CABG (K40–K46) were derived from these data and combined with population estimates for 1997–2001 (projected from 1991 Census data) to estimate crude intervention rates per million total population for each PCG area population. Intervention rates were calculated from a PCG’s resident population rather than the population registered with PCG’s constituent GPs, given the difficulty of establishing denominators for intervention rates for these registered populations.

The proportion of CHD patients referred to hospital who went on to have an angiography and then revascularization were calculated and compared. The rates were also directly standardized for age and sex and compared with crude rates to assess whether the age–sex structure of the population would explain any variations found. The standardized mortality ratios (SMRs) for CHD (ICD9 410–414; 1997–1999, aged 75 years or less) were compared with the crude angiography and revascularization rates to assess the relationship between interventions and levels of need in each PCG area.

A number of semi-structured interviews were also undertaken. The lead consultants in CHD from each acute Trust, plus two other cardiologists and one consultant involved in CHD planning (five cardiologists and one cardiac surgeon) were interviewed by one of us (S.L.). The topic guide for the interview included questions on the management of patients with CHD (specifically the decision criteria used to refer for angiography, PTCA and CABG, and the management of waiting lists), barriers in access to revascularization services, and views on the current provision of services within the Health Authority and how it could be improved. The interviews were taped and the main themes of the six tapes were then extracted and summarized by the interviewer in a written report. The Medical Audit Advisory Group was contacted for a list of GPs with an interest in CHD, and two GPs from each of the four PCGs were selected for interview by a public health trainee. The interview guide was similar to the one for consultants, except the focus in the section on the management of patients with CHD was on the GPs’ decision criteria used to refer patients to hospital. Interviews were taped and analysed as above. Interviews were conducted in March and April 2001.

Results

Variation in rates

The crude rate of angiography in Camden and Islington as a whole remained at around 2000 per million population between 1997 and 2001; however, there was considerable variation between the rates of the four PCGs with, on average, a two-fold variation between the highest and lowest rate. In 2001 the highest rate of angiography (2710 per million) was in South Camden and the lowest (1621 per million) was in North Islington (Table 1). Variation between the rates for CABG was highest in 1999, when there was a three-fold difference, and that for PTCA was highest in 1998, with a 12-fold difference (Table 1). These variations in rates had reduced by 2001 to a two-fold variation for CABG and a 3.5-fold variation for PTCA. The combined revascularization rate largely mirrored the variation in the rates of angiography (Figure). In 2001 the combined rate was 647 per million population for the Health Authority. The highest rate was in North Camden (752 per million) and the lowest in North Islington (495 per million) (Table 1).

There were substantial variations in the balance of revascularizations employed by PCG area. In 2001 the PTCA rate was 40 per cent of the revascularization rate for the whole area. In North Camden, however, the PTCA rates were substantially higher than the average in Camden and Islington, making up 59 per cent of all revascularizations performed in North Camden (Table 1).
In contrast, in South Camden the PTCA rate was only 21 per cent of the total revascularization rate for the PCG. There were also wide variations in the proportion of patients progressing to revascularization in each PCG area. In 2001 North Camden had the highest proportion of patients admitted to hospital with CHD progressing to revascularization (12 per cent) compared with only 7 per cent of North Islington patients (Table 2). Similarly, progression from angiogram to revascularization is highest in North Camden (41 per cent) and lowest in South Islington and South Camden (27 per cent).

The age–sex structure of the population and level of need for revascularization did not explain the variations in rates found. Crude rates and age–sex-standardized rates were very similar (Table 3). The only routine data available on need were the SMRs
for CHD. The PCG with the highest combined revascularization rate in 2001 (752 per million population) had the lowest SMR for CHD (112) and the PCG with the lowest combined revascularization rate (495 per million population) had the highest SMR for CHD (134).

Interviews with consultants

All six consultants approached agreed to be interviewed. Patients presenting with CHD were managed differently at each of the three hospitals and protocols of care were not standardized between the hospitals. There was a range of views on the value of revascularization between cardiologists, even within one hospital. The decision to revascularize and the decision as to which procedure was the most appropriate were mainly based on symptoms and severity of disease, but it was also suggested that hospitals that had angiography facilities on site adopted a more aggressive approach to treatment than those without. Furthermore, it was suggested that a number of other factors come into play when deciding between PTCA and CABG, including patient preference, age, whether PTCA is technically feasible, whether there was easy access to PTCA on site, preference of the cardiologist and the length of the CABG waiting list (patients may receive a holding PTCA while waiting for a CABG).

A number of perceived barriers to access to care were identified. The major issues related to waiting lists, access to facilities by cardiologists and capacity constraints. The CABG waiting lists were long and it was suggested that they could be managed more efficiently. Emergency cases made up about one-third of all cases and because of their unpredictability they created difficulties for the management of elective waiting list cases. In one hospital (UCLH) each surgeon had his own waiting list for CABG with a transfer list for those patients referred from other hospitals. There were large discrepancies between these lists, so a patient could wait a long time for a particular surgeon, whereas another surgeon had a much shorter waiting time. Nevertheless, cardiologists referred cases to surgeons based on preference for the surgeon rather than length of waiting list. Waiting lists were sometimes frozen, preventing cardiologists putting any patients on them. Waiting times for PTCA were much shorter, with no waiting list at all at one hospital (UCLH).

Access to facilities by cardiologists at the hospital without onsite angiography (the Whittington) was perceived as a problem. The Whittington had access to single sessions per week for elective patients that rarely met the demand. Emergency cases had to go onto a transfer list and wait alongside all emergency referrals from other hospitals. The major reason given for this was capacity constraints at the main hospital. As acute or emergency cases constitute a significant proportion of the workload (and it was suggested that this proportion is increasing) it was not uncommon for there to be bed shortages, especially critical care beds. It was also suggested that the current infrastructure, mainly staff and beds, was not adequate to carry out the increasing number of procedures required.

Interviews with GPs

All eight of the GPs approached for an interview agreed to take part. They reported that their decision on where to refer CHD patients for treatment was largely made on the basis of geography. Patients were generally referred to the most convenient hospital. Referral decisions were not usually based on perceived differences in the quality of services provided; in fact, GPs were not particularly concerned about any such differences. Perhaps

<table>
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<tr>
<th>PCG</th>
<th>Total population</th>
<th>Admissions for patients with CHD</th>
<th>Angiography</th>
<th>PTCA</th>
<th>CABG</th>
<th>Admissions to CABG or PTCA (%)</th>
<th>Angiography to CABG or PTCA (%)</th>
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<tr>
<td>North Camden</td>
<td>113 006</td>
<td>720</td>
<td>208</td>
<td>50</td>
<td>35</td>
<td>12</td>
<td>41</td>
</tr>
<tr>
<td>South Camden</td>
<td>79 705</td>
<td>569</td>
<td>216</td>
<td>12</td>
<td>46</td>
<td>10</td>
<td>27</td>
</tr>
<tr>
<td>North Islington</td>
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<td>180</td>
<td>14</td>
<td>41</td>
<td>7</td>
<td>31</td>
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<tr>
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<td>473</td>
<td>158</td>
<td>19</td>
<td>24</td>
<td>9</td>
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<tr>
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<td>2501</td>
<td>762</td>
<td>95</td>
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<th>PCG</th>
<th>CABG</th>
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<tr>
<td></td>
<td>Crude rate</td>
<td>Standardized rate</td>
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<tr>
<td>North Camden</td>
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<td>291</td>
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<tr>
<td>South Camden</td>
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<td>574</td>
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<tr>
<td>North Islington</td>
<td>369</td>
<td>396</td>
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<tr>
<td>South Islington</td>
<td>348</td>
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this was because there was satisfaction with the level of services provided, compared with services to other groups of patients. Camden GPs did feel that waiting times for CABG were not acceptable, and some of both Camden and Islington GPs mentioned problems with delays in angiography, particularly following referral to the Whittington Hospital.

Discussion

The National Service Framework for CHD set out a number of standards of care for preventing and treating CHD. In terms of revascularization the aim was to increase the number of revascularizations and reduce inequalities in access to care. These standards reflect the role revascularization plays in both relieving symptoms and prolonging life in patients with established CHD.

Variations in angiography and revascularization rates between PCGs in one Health Authority have been found that are not explained by a measure of the level of need for revascularization. The PCG area that had the lowest SMR for coronary heart disease had the highest rates of angiography and revascularization. This study suggests that supply factors were the most likely cause of variation in rates between PCG areas. The evidence suggested that the variations were due, in part, to differences in clinical behaviour at the consultant level and barriers in access to interventional cardiology and cardiac services once the patient had been referred.

In terms of clinical judgement, there was little evidence to suggest that GPs' referral behaviour perpetuated the variations in rates found. However, GPs did tend to refer to the most convenient hospital. Once referred, there was evidence to suggest that differences in clinical behaviour at the consultant level did appear to influence the rates. The relatively lower number of patients proceeding to revascularization in North Islington and substantially higher in North Camden (particularly for PTCA) could have been related to beliefs in the effectiveness of intervention in heart disease. The interviews suggested that there were varying views amongst the cardiologists in North Islington about the importance of revascularization in CHD.

In terms of perceived barriers in access to care, evidence suggested that the variations in revascularization rates could also be related to blocks occurring in patient pathways to care once referred to hospital. The major issues related to waiting lists, access to facilities by cardiologists and capacity constraints that appeared to vary in severity between the PCGs. The interviews suggested that access appeared to be worst for the PCGs with the lowest angiography and revascularization rate. Access and capacity constraints may also have influenced the proportion of patients undergoing PTCA versus CABG. North Camden had a very high PTCA rate compared with the other PCGs and the data suggest that this was due in part to easier access to PTCA.

The results of this study indicate that GP referral to a particular hospital is largely a function of where the patient lives. Once referred, the study suggests that the chance of a patient being revascularized, and the choice of procedure, was influenced mainly by the availability of services but also partly by the clinical beliefs of the consultant in charge.

Strengths and weaknesses of the study

The data available in the study have a number of limitations. The shortcomings of routine hospital data are well known. However, there was no evidence to suggest that the procedures were miscoded systematically such that any particular PCG's results were biased, nor that data from any particular PCG area were missing to a greater extent than others. Postcode completeness was similar for each Trust. This study does not include data from private institutions. We wrote to all the likely places of referral for private angiography and revascularization during the course of this study and have received replies from approximately half. The data we have received so far suggest that the private sector contribution has been small and would not affect the results in any substantial way. Furthermore, the wealthiest part of the health authority is North Camden and therefore it is possible (the clinicians confirmed this) that access to private angiography and revascularization is likely to exacerbate any inequality seen.

SMRs for CHD were the only available data on need for revascularization services, which do not necessarily take into account the differences in clinical characteristics of patients between the four PCGs. Such clinical characteristics may also explain some of the differences in the variations found.

We interviewed eight local GPs with an interest in cardiology services, and six consultants, some of whom were the clinical leads for CHD in each of the hospitals. However, there are likely to be varying opinions amongst GPs and consultants, and this limits the generalizability of these qualitative data.

Implications for clinicians and policy-makers

The National Service Framework has set the targets for increasing the number of revascularizations and reducing inequalities. Since these were set there has been an increase in resources, including for revascularization. However, if these resources are used inappropriately they could increase the revascularization rate but also increase inequity. The Health Authority therefore undertook some work to ensure joint protocols were agreed, and supported the planned appointment of an interventional cardiologist jointly between the Whittington and UCLH. A UK study assessed the effect a new appointment and increased financial investment had on rates and found that rates increased and access became more equitable, particularly for angiography. Our study pointed to a number of problems with waiting list management and UCLH has since addressed many of those. The capacity problems have been alleviated by the recent opportune purchase of The Heart Hospital. The recent new money for revascularization has meant waiting times have fallen substantially and more procedures have been conducted. Angiography and revascularization rates have begun to rise rapidly in 2002, in line with local strategy. It will be important to monitor the rising rates in Camden and Islington, especially the degree to which the inequities are addressed.
This study has found important inequities in access to revascularization within a single health authority. If this can occur in a single health authority it seems likely that across the country there will be much larger and more marked inequities, given the historic variations in funding of services and the capacity available. One national survey\(^6\) and a more recent study of PCG revascularization rates in London\(^6\) confirm this.

The study has also demonstrated that Tudor Hart’s\(^{17}\) inverse care law is alive and well. Substantial proactive work is required to ensure that health care provision acts to alleviate rather than exacerbate inequalities in wealth and health. In the future it will be the job of Primary Care Trusts to monitor these variations in their local populations, especially when there is more than one local provider. Strategic health authorities must be required to have an overview such that the broader pattern of investment and inequities can be addressed. We hope that the analysis undertaken and the action we have embarked on will provide useful information for others.

**Acknowledgements**

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**References**


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