Centre for
Health Service Economics
& Organisation

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Working Paper No. 4, August 2012

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Published by:
Centre for Health Service Economics & Organisation (CHSEO)
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1. Introduction

Health policy reform in the past decade has been strongly influenced by the view that commissioning should be flexible and reflect the distinctive needs of local populations. For example, the proposals to create a large number of Primary Care Trusts a decade ago and Clinical Commissioning Groups in 2011 were implemented despite criticism for creating too many organisations. The proposal that patients might choose their PCT was also opposed because of the importance attached to providing local populations with appropriate services, which in turn requires small contiguous populations. In reality, however, commissioning for out of hospital services continues to show only limited geographic variation.

At the same time, increasing efforts have been applied to redefining care for patients with specific medical or social characteristics that might lead to social exclusion (Social Exclusion Task Force, 2010). Whilst this focus is justifiable, it remains the case that healthcare is delivered to geographic areas so efficiency gains are available to commissioners who provide services that reflect this geographic grouping of patients with certain needs and characteristics.

If commissioners and practitioners are to respond to local patient need, they must understand both how their needs differ from others and why these differences have arisen. Understanding distinct needs enables the services to be appropriately selected (allocative efficiency) whilst understanding how these differences arise may inform changes to policy and practice that influence the pattern of demand for hospital care so that the local health system can adjust to a more efficient structure. This is of particular concern for deprived areas where need is greater and more complex, evidence exists that patients' requirements of the health system is different and additional resources have created opportunities to address historic differentials in mortality and morbidity rates.

This study uses hospital admissions as a lens to understand how general practice in deprived areas might better meet the needs of its patients. The method of admission (emergency or elective) and the conditions for which patients are admitted provides evidence of why patients in deprived areas use hospital care differently and how general practice might be improved. Having reviewed the literature on the use of healthcare by patients from deprived areas, this study identifies the aggregate outlines how the total number of emergency and elective admissions varies by level of deprivation. The contribution of different conditions to the difference in the percentage of admissions that were emergencies is then discussed. Some conditions cause more emergency admissions in deprived areas simply because they are more prevalent. Others suggest that primary care is not effectively utilized and conditions are being diagnosed later in deprived areas. Finally, the question of whether patients in deprived areas use too much emergency care or too little elective is addressed for some conditions for which other research or data makes this possible.

1.1. Literature on deprivation and healthcare

Most of the literature on deprivation and hospital use focuses on whether utilisation of NHS care is equal for all patients with equal need (See for example Dixon et al., 2007; van Doorslaer et al., 2006; Goddard and Smith, 2001; Propper et al., 2005; Morris et al., 2005; Chaturvedi and Ben-Shlomo, 1995; O'Donnell, 2000). Although results vary between studies the consensus is that GP use is broadly equitable given need, whilst specialist treatment, particularly outpatient care, is disproportionately used in affluent areas.

The majority of studies of overall hospital utilisation do not distinguish between emergency and elective inpatient care either because their data does not allow it or because they choose to focus on elective care alone. Reid et al. (1999), however, examined both elective and emergency admissions for all conditions in a sample of GP practices in London. Higher emergency admissions rates were associated with a larger proportion of patients being unskilled, from a one parent family or unemployed. The same factors had a much weaker relationship with elective admissions. Some condition-specific evidence, which effectively controls for the varying nature of disease by deprivation, supports these findings (e.g. some cancers, Pollock and Vickers, 1998; Raine et al., 2010).

Differences in the use of hospital care that are not related to differences in need indicate variation in the effectiveness of primary care. This may partly be caused by variation in quality, but factors influencing candidacy and permeability are also likely to contribute.

Studies into differences in the quality of primary care using QOF scores have varying results, but suggest that quality might be slightly poorer in deprived areas (Hippisley-Cox et al., 2004; Wright et al., 2006; Ashworth et al., 2007; Ashworth et al. 2008, McLean et al 2006, Sigfrid et al., 2006; Sutton and McLean, 2006).

Dixon-Woods et al. (2006) reviewed the literature on access to healthcare and developed concepts to describe the barriers to access caused by both supply and demand side factors at different stages of the care process. The first is candidacy, which "describes the ways in which people's eligibility for medical attention and intervention is jointly negotiated between individuals and health services". The patient needs to view their need as suitable for healthcare in order for them to visit the GP initially, but candidacy then depends on the interactions between the patient and health professionals. The patient formulates and articulates the problem whilst the doctor should aid the patient to do so effectively and then judge whether they should "allow or inhibit continued progression of candidacy". To do this, doctors assess the possible risks and reach a view as to whether the patient would benefit from each available treatment.

A second concept, permeability, relates to the ease of using services and is greater where fewer qualifications and fewer resources are required to access care, such as in the case of A&E departments. Practical resources include transport and the ability to be available at the appropriate time, which may require flexible work arrangements or childcare. Appointment systems may reduce permeability, particularly where the patient has limited choice of times. Patients' choice of care provider is also influenced by how comfortable they feel with the "organisational values of the service" so a lack of 'cultural alignment' can reduce permeability.

Even where appropriate candidacy is achieved in a permeable system, interventions may be prevented by patients resisting offers of referral or treatment.

Candidacy and permeability can be restricted by financial costs, patient characteristics, doctors' criteria for treatment and the way in which the patient relates to the doctor. Financial costs of transport or making time to attend an appointment. Rigid working patterns may particularly increase costs for patients from deprived areas and thresholds for the level of costs that is tolerable are likely to be lower. These costs particularly restrict "optional services related to health promotion and health prevention."

Patients' knowledge, competencies and viewpoints also influence their access to care. Patients in deprived areas may not be aware of some services, precluding their use. Poor literacy skills may hinder use of appointments systems, an inability to articulate the issue may make it harder for doctors to reach a correct diagnosis, and shortfalls in confidence or persistence can prevent patients from demanding better care. Patients' views on health and

care providers may change the way they respond to symptoms. “Lack of a positive conceptualisation of health, the normalisation of symptoms…, and fear of being “blamed” by health professionals” can reduce the importance of early symptoms.

Doctors’ views of which patients benefit sufficiently from interventions and perceptions of “social deservingness” may disadvantage patients from deprived areas. Doctors are less likely to offer interventions to patients with risk factors such as smoking, obesity and co-morbidities that can harm outcomes and are particularly prevalent in deprived areas. Much of this resistance is clinically justified, but it is possible that doctors are overly risk averse. Some GPs also appear to take into account whether the patient is economically active or has dependents, which would also disadvantage many in deprived areas.

Finally, the nature of the interaction between patients and doctors can also act as a barrier. Patients may be reluctant to visit a GP because they feel uncomfortable relating to someone in a different social position or because they feel “alienated from the cultural values” of service providers.

This study builds on the literature by using Hospital Episode Statistics (HES) from 2008/09 to provide details about how the NHS secondary care received by a patient varies depending on their level of deprivation. Unlike survey data, this dataset does not enable systematic adjustment for need, but it does provide a comprehensive picture of healthcare use. The degree to which differences in use are explained by differences in need or differences in the effectiveness of primary care, are explored through analysis of primary diagnoses.

2. Deprived areas

2.1. Definition

The following analysis uses a variant of the Index of Multiple Deprivation (IMD) as the measure of deprivation and Lower Layer Super Output Area (LSOA) as the geographical area at which deprivation is defined. LSOAs are very small geographical areas that have an average population of only 1,500 people. There are about 220 LSOAs in an average PCT. The IMD 2007 is calculated using data on seven domains (see Noble et al., 2008 for details). This study uses a variant of the IMD, (the Non-Health IMD or NHIMD) which excludes the health domain to avoid circularity (i.e. hospital use influencing deprivation as well as the other way around). Using the NHIMD instead of the IMD changes the decile of 17 per cent of LSOAs. However, it has a minimal impact on the most deprived LSOAs; 94 per cent of the LSOAs in decile 10 of the NHIMD are also in the same decile of the IMD.

Analysis of the most deprived geographical areas does not equate exactly to analysis of the most deprived people, so in considering the 10 per cent most deprived LSOAs we are looking at the people who live in the 10 per cent most deprived areas, but almost certainly not the 10 per cent most deprived individuals in the country. Deprived and socially excluded people sometimes live close to one another and sometimes live interspersed with less deprived people. For example, many homeless people choose to live in areas that are generally affluent. These people would not necessarily be picked up as deprived in our sample. This problem is, however, reduced as far as possible by using very small areas, thereby providing greater homogeneity within LSOAs.

Apart from the section on maternity, this analysis includes all episodes in 2008/09 where the admission method is classified as ‘elective’ or ‘emergency’. It excludes those where the admission method is ‘babies’ or ‘other’. These form a very small proportion of all care for

everyone other than women aged 16-44, who have significant numbers of 'other' episodes relating to maternity.

2.2. Characteristics of deprived areas

25 per cent of the LSOAs in decile 10 of the NHIMD (the most deprived) are in the North West. London, Yorkshire and the Humber and the West Midlands contain a further 51 per cent of the most deprived areas (17.7, 16.9 and 16.3 per cent respectively). According to the Office for National Statistics' classifications, almost 99 per cent of the LSOAs in decile 10 are urban. The comparative figure for the whole of England is 81 per cent. As noted in section 2.1, this does not imply that there are few deprived people living in rural areas, only that they are living in more mixed communities. Urban areas and therefore deprived areas are more likely to be nearer to hospitals.

The population in decile 10 is younger: 11.3 percentage points more of the adult population are under 30 compared to decile 1 and 14.5 percentage points fewer are over 44. Although this paper is not concerned with paediatric care, it is interesting to note that there are more children in deprived areas because this affects the way communities interact with the healthcare system.

The more deprived deciles have larger Black, Asian and Mixed Ethnicity populations than the less deprived deciles. 22.0 per cent of the population in decile 10 are ethnic minorities compared to only 3.5 percent in decile 1.

3. Use of secondary care in deprived areas: the aggregate view

Figure 1 gives an overview of the utilisation of NHS secondary care across areas with different levels of deprivation in England. Utilisation of all forms of care is higher in the most deprived areas with the exception of elective admissions, which is roughly similar across the deciles. A&E attendance has the steepest gradient, particularly at the most deprived end of the distribution.

Figure 1

Overall, there were 31 admissions per 100 population in decile 10 and 22 admissions per 100 population in decile 1. The additional admissions were almost entirely emergency, as decile 10 generated 48 per cent more emergency admissions, but only 2 per cent more elective admissions. The proportion of admissions that were classified as emergency was therefore much larger in the most deprived decile than in the least (50 per cent compared with 34).

Finding 1	Deprived areas generated more emergency admissions than affluent areas, but a similar volume of elective admissions. The proportion of admissions that were emergencies was therefore larger in deprived areas (48.4 percent) than in the rest of the country (38.1 percent).

4. Why is the ratio of emergency to elective admissions higher in deprived areas than in more affluent areas?

The percentage of admissions that were emergencies provides a useful single measure with which to analyse emergency and elective admissions simultaneously. A high percentage is undesirable because emergency care is often more expensive and less effective than elective care. Not adjusting for case-mix, emergency spells cost 10 per cent more than elective spells[1] despite fewer procedures being carried out. This is partly because large fluctuations in demand necessitate lower bed occupancy rates (Bagust et al., 1999). Poorer outcomes from emergency admission include higher 28-day emergency readmission and post-operative mortality rates in some cases (Primatesta and Goldacre, 1996).

It is important to understand what is causing the patterns of use in deprived areas in order to respond appropriately. Section 4.1 describes how variation between different patient groups in the use of care can be caused by differences in need or differences in the effectiveness of primary care (determined by the quality of care and barriers to accessing care). Different emergency/elective admission ratios are appropriate for different conditions so the mix of conditions is an important factor influencing the percentage of admissions in each decile that are emergencies. Other aspects of need, such as comorbidities and risk factors, are also relevant. Within most conditions, it is reasonable to expect more effective primary care to reduce the emergency/elective admission ratio as community and elective treatment and case management prevent conditions from escalating to a level requiring emergency admission.

The best way to ascertain the role of need and primary care effectiveness in determining the observed patterns of hospital use is to identify the prevalence of each condition in each decile. The number of emergency and elective admissions can then be compared with the number of patients with the condition to show how the propensity for emergency and elective admission varies within and between conditions.

Unfortunately, this level of prevalence data is not available. Therefore we use HES data to estimate the contributions of differences in need and primary care effectiveness to the observed difference in emergency admissions across the ten deciles.

4.1. Quantifying the contribution of differences in case-mix and the effectiveness of primary care

The percentage of admissions that were emergencies differs between deciles 10 and *j* and this difference can be divided into a "needs" component, reflecting patient diseases, and an "effectiveness of primary care" component. The "needs" component (referred to as the case-mix, or CM difference) consists of the influence on emergency admissions of inter-decile variation in case-mix – the prevalence of each condition relative to that of every other condition. This is identified using $c_{i,j}$ – the number of admissions for condition *i* in decile *j* as a percentage of all admissions for all conditions in the same decile. The "effectiveness of primary care" component is that which is not explained by case-mix, which we refer to as the non-case-mix, or NCM difference.

To perform this partition we begin by describing the difference in emergency admissions between deciles 10 (the most deprived) and decile *j.*

Difference in emergency admissions between deciles 10 and decile *j*:

$$\sum_{i=1}^{I}\left(\left(m_{i,10}\times c_{i,10}\right)-\left(m_{i,j}\times c_{i,j}\right)\right) \quad (1)$$

where $c_{i,j}$ is the proportion of all admissions for condition *i* in decile *j*, and $m_{i,j}$ is the proportion of admissions for condition *i* in decile *j* that are treated as an emergency (compared to an elective) admission.

Equation (1) can be rewritten as a sum of two components, reflecting differences in case-mix and emergency admission rates[2]:

$$\underbrace{\sum_{i=1}^{I}\left(m_{i,j}\left(c_{i,10}-c_{i,j}\right)\right)}_{CM_j}+\underbrace{\sum_{i=1}^{I}\left(c_{i,10}\left(m_{i,10}-m_{i,j}\right)\right)}_{NCM_j} \quad (2)$$

The first part of equation 2 is the CM difference, because it shows the difference between actual admissions in decile *j* and those that would have occurred if decile *j* had the same case-mix as decile 10. The second part of equation 2 is the NCM difference, because it shows the difference between the actual admissions in decile 10 and those that would have occurred in decile 10 if they had the same proportion of emergency admissions as decile *j*. This second factor is potentially more interesting, because it is an indication of primary care behaviour.

Splitting equation 2 into these separate components provides:

$$CM_j=\sum_{i=1}^{I}\left(m_{i,j}\left(c_{i,10}-c_{i,j}\right)\right) \quad (3)$$

and

$$NCM_j=\sum_{i=1}^{I}\left(m_{i,j}\left(c_{i,10}-c_{i,j}\right)\right) \quad (4)$$

These values can be calculated using data from the HES database.

Conditions (*i*) are defined at the ICD10 block level, of which 186 were used. Figure 2 shows $a = (m_{i,10} \times c_{i,10})$, $b = (m_{i,10} \times c_{i,j})$ and $c = (m_{i,j} \times c_{i,j})$ for all deciles j. The NCM difference is represented by the difference between lines *a* and *b*, with the CM difference the gap between *b* and *c*.

Figure 2

Figure 2 shows that 57 percent of the 14.9 percentage point difference in the proportion of emergency admissions between deciles 1 and 10 can be explained by a difference in case-mix.

Using HES data to separate the "need" and "effectiveness of primary care" components carries two main problems. Firstly, the CM difference is not completely independent of the effectiveness of primary care because effective primary care can reduce the likelihood of hospital admission (our proxy for prevalence) for some conditions. A large number of admissions for a condition in decile 10 may be caused by high prevalence, a larger proportion of cases being allowed to escalate to the stage where hospital admission is required, or a combination of the two.

Secondly, the definition of conditions in the calculation affects the value of the estimate. Greater aggregation is likely to increase variation in the method of admission (emergency or elective) within condition groups. This would increase the estimated size of the NCM difference and decrease the size of the CM difference (as $m_{i,j}$'s vary more and $c_{i,j}$'s vary less).

In order to minimise the association between the effectiveness of primary care and the estimated CM difference, conditions should be defined so that their classification is independent of treatment received. For example, the condition assigned to a patient should not change if a preventable complication is allowed to develop. Complications are likely to increase the probability of emergency admission relative to elective, but this is related to primary care and should therefore form part of the NCM difference. Conversely, to maximise the association between the effectiveness of primary care and the NCM difference, conditions that start and develop differently, independently of the care received and in a manner that influences the probability of emergency admission relative to elective, should be classified separately.

Conditions are defined in HES by the ICD10 code recorded as the primary diagnosis. The WHO groups these codes into blocks, and then chapters. The analysis above uses 186 blocks. Using the more granular classification of 3-digit ICD10 codes (of which 1230 were used) increases the value of $b = (c_{i,10} \times m_{i,j})$ for all deciles. As a result CM difference increases to account for 71 percent of the total difference between deciles 1 and 10 in the proportion of admissions that were emergencies.

It is not clear which definition of conditions is better for our purposes because greater aggregation and greater granularity can both lead to biased results. Greater granularity increases the risk that patients' conditions will be altered by complications that are allowed to develop because of less effective care. This falsely increases the estimated CM difference. On the other hand, greater aggregation increases the risk that conditions with relevant differences are grouped together, falsely decreasing the estimated CM difference.

Finding 2	Depending on the classification system used to define conditions, 57 or 71 percent of the difference between deciles 1 and 10 in the percentage of admissions that were emergencies can be explained by differences in case-mix. The rest is caused by differences in the ways patients were admitted for the same condition.

It is possible to calculate the importance of individual conditions in the CM components by dividing the condition's contribution $(m_{i,j}(c_{i,10} - c_{i,j})$ by the total difference. The contribution of each condition to the NCM difference can be calculated in a similar way.

Tables I and II show the conditions that contribute most to the CM and NCM components.

Table I

Table II

The main contributors to the CM difference (table I) were respiratory and mental conditions as well as conditions relating to pregnancy and the use of drugs and alcohol. Undiagnosed symptoms (chapter R) and injuries (chapter S) were also important in explaining the CM difference.

The main contributors to the NCM difference (table II) were malignant cancers and conditions of the urinary and digestive systems, heart and joints. ICD10 codes relating to undiagnosed symptoms (namely, those in chapter R and Z00-Z13) also contribute significantly to the NCM difference.

Observing the degree to which the NCM difference is composed of large inter-decile differences in the emergency/elective admission ratio for a few conditions, or small differences for many conditions provides evidence about the extent to which the NCM difference has condition-specific, rather than systematic, causes. The ten conditions that contributed most to the CM difference accounted for 95 percent of the total CM difference, whereas the ten largest contributors to the NCM difference accounted for only 48 percent of the NCM difference. The NCM difference therefore appears to be composed of small contributions from many conditions and is therefore likely to have systematic causes.

Figure 3

Figure 3 shows that the proportion of admissions that were emergencies was larger in decile 1 than in decile 10 for only 18 percent of conditions. The proportion of admissions that were emergencies was at least five percentage points larger in decile 10 than in decile 1 for 46 percent of conditions.

Finding 3	The conditions that contributed most to the CM difference were conditions relating to the use of drugs and alcohol use, complications in pregnancy as well and mental health conditions.
Finding 4	The conditions that contributed most to the NCM difference were diseases of the digestive, urinary and respiratory systems as well as cancers.
Finding 5	The proportion of admissions that were emergencies was larger in deprived areas than in affluent areas for most conditions, suggesting that the NCM difference has systematic, rather than condition-specific, causes.

The following sections provide further details about the conditions that contribute most to the CM and NCM differences. The nature of these conditions suggest that high prevalence of some conditions and less effective primary care (partly relating to late diagnosis and treatment) both contribute to the greater dependence on emergency hospital care in deprived areas.

4.2. High prevalence of diseases that cause predominantly emergency admissions

Table I shows that respiratory disease, maternity complications (ICD10 chapter O), the use of alcohol and drugs (for example T36-T50) and mental health problems (chapter F) contribute most to the CM difference. The proportion of admissions that were emergencies

varied little by deprivation for all of these conditions with the exception of respiratory diseases, which also contribute significantly to the NCM difference.

This section explores which conditions contribute to the CM difference at a more detailed level. Rates of admission relating to maternity are compared with birth rates to ascertain whether the patterns of use in deprived areas are caused by higher birth rates or higher complication rates.

Conditions may be more prevalent in deprived areas because risk factors are particularly common or the condition causes financial problems that result in the patient moving into a deprived area (for example, some mental health problems). Alternatively, the large volume of admissions may be caused by a failure to prevent hospitalisation.

In so far as the large number of emergency admissions for these conditions in deprived areas are caused by high prevalence, the policy response should mostly target public health issues. The NHS may also be able to exploit scale economies in geographical areas of high prevalence to provide more cost-effective primary care.

This section provides further information about the patterns of hospital use for these conditions by deprivation and outlines the relevant literature.

4.2.1. Respiratory conditions

Respiratory conditions feature among the main contributors to both the CM and NCM differences because the number of elective admissions was similar across all levels of deprivation whilst patients from deprived areas had more emergency admissions than those from more affluent areas. The ICD codes within the “chronic lower respiratory diseases” block that contributed most to the CM difference were “other chronic obstructive pulmonary disease” (J44) and asthma (J45). There were 4.1 more admissions per 1,000 population with the primary diagnosis of J44 in decile 10 than in decile 1, of which 99 percent were emergencies. There were fewer elective admissions for asthma in decile 10 than in decile 1 so emergency admissions constituted 103 percent of the additional 1.0 admissions per 1,000 population with this primary diagnosis.

Hospital admissions for symptoms involving the circulatory and respiratory systems follow a similar pattern to those for respiratory disease. The codes within the R00-R09 block that contribute most to the CM difference are “pain in the throat and chest” (RO7) and “abnormalities of breathing” (R06). Emergency admissions form 97 percent of the additional 5.6 admissions per 1,000 population for throat and chest pain in decile 10 (compared to decile 1) and 95 percent of the additional 0.9 admissions per 1,000 population for breathing abnormalities.

4.2.2. Conditions relating to maternity

“Other maternal disorders predominantly related to pregnancy” (O20-O29) and “pregnancy with abortive outcome” (O00-O08) contributed 10.4 and 6.2 percent of the CM difference respectively, reflecting the higher rates of complication observed in the literature. The main diagnoses within these blocks are “haemorrhage in early pregnancy” (O20, 4.3 percent), “maternal care for other conditions predominantly related to pregnancy (O26, 2.9 percent), “excessive vomiting in pregnancy” (O21, 2.6 percent), “spontaneous abortion” (miscarriage, O03, 2.3 percent) and “medical abortion” (O04, 1.0 percent).

Figure 4

Figure 4 shows the number of births[3] and antenatal admissions not related to delivery event[4] (HRG N12) for women aged 16-44 by deprivation decile[5]. Younger women in decile 10 had 17 percent more antenatal admissions per birth than those in decile 1 and older women had 35 percent more admissions per birth.

These findings are supported by evidence that deprivation is associated with lower birth weight (Wilcox et al., 1995; Spencer et al. (1999), higher rates of perinatal and infant mortality, intrauterine growth restriction and preterm birth (Kramer et al., 2000; Gray et al., 2008). These are partly caused by higher prevalence of risk factors such as smoking, in deprived areas (Bonellie, 2001).

4.2.3. Alcohol and drugs

"Poisoning by drugs, medicaments and biological substances" accounts for 14 percent of the CM difference in the percentage of admissions that were emergencies. This group of diagnosis codes does not relate to the use of alcohol. Significant costs are likely to be imposed by the longer term mental health issues that drugs can cause. These are grouped within F10-F19, (mental and behavioural disorders due to psychoactive substance use) which accounts for 7 percent of the CM difference.

Admissions relating to the use of alcohol are easier to identify because HES classifies a set of conditions as 100% "alcohol related". Admissions are classified as alcohol related if any of the diagnoses (not just primary, as in the rest of this study) are on this list. There are 6.2 times as many admissions per head for these conditions in decile 10 than in decile 1. The majority (69 percent) of the additional admissions are for mental and behavioural disorders relating to alcohol. Alcoholic liver diseases and toxic effects of alcohol account for a further 14 and 12 percent of the difference respectively.

If there were the same number of alcohol related admissions in decile 10 as there were in decile 1 (still admitted by the same methods), the percentage of admissions that were emergencies would have been 1.5 percentage points smaller (46.9 percent).

HES classifies further diagnosis codes as alcohol related for a proportion of admissions. Reducing admissions for these conditions in a similar way would most likely further reduce the percentage of admissions that were emergencies.

These findings are unsurprising, given well-documented high rates of alcohol and drug abuse in deprived areas. The Marmot report (Marmot, 2010) shows how alcohol related admissions are more than twice as high in the most deprived quintile compared with the least deprived (p57) and there is a strong association between prevalence of problematic drug use and deprivation at Local Authority level (p60).

4.2.4. Mental health

Figure 5

Figure 5 shows the four mental health ICD10 blocks that have the greatest variation in the number of emergency admissions by deprivation. There were relatively few elective admissions for these conditions. People in deprived areas had between 2.1 and 7.2 times as many emergency admissions for these conditions as those in decile 1. The importance of drugs and alcohol use (predominantly alcohol, F10) is highlighted, particularly by the trends in F10-F29. Schizophrenia (F20) contributes 2.3 percent of the CM difference, whilst depressive episodes and bipolar affective disorder (F32 and F31) contribute 0.8 and 0.7

percent respectively. “Reaction to severe stress, and adjustment disorders” and “other anxiety disorders” (F43 and F41) contribute 0.4 percent of the CM difference each.

As well as necessitating more emergency admissions, the higher prevalence of mental illness may influence patients’ decisions and interactions with the healthcare system.

Finding 6	Compared with those in affluent areas, patients in deprived areas had more antenatal admissions per birth (17 and 35 percent for younger and older women respectively), more admissions relating to the use of drugs and alcohol (6.2 times as many for alcohol related conditions) and more admissions for mental health problems (particularly schizophrenia, depressive episodes and bipolar affective disorder).

The Marmot review also reports a steep social gradient in the rate of mental illness, with a two-fold variation between the highest and lowest quintiles for common mental health problems and a much steeper 9-fold variation for psychotic disorders (NCSR, 2009). The review argues that “while the particularly high rate of psychotic disorder in the lowest quintile may, to some extent, result from downward social drift, this is unlikely to account for the social gradient.” (Marmot, 2010 p. 54)

4.3. How much of the CM and NCM differences are avoidable?

A key question for NHS policy makers interested in reducing the burden on hospital care is how much of the extra volume of admissions being generated by deprived communities could be avoided if primary healthcare provision in these areas were more effective. “Ambulatory care sensitive conditions” (ACSCs) provide a useful tool for addressing this question. Purdy et al. (2009) define these conditions as those “for which hospital admission could be prevented by interventions in primary care” and provide lists of ICD 10 codes that carry broad consensus.

This section identifies how much of the CM and NCM differences are comprised of admissions with ACSC primary diagnoses. The most important ACSCs in this respect are identified, and variation in admission rates by level of deprivation is compared with evidence on prevalence to gain insight into the extent to which it is driven by differences in need and the extent to which it reflects less effective primary care.

The first list of codes, defined at the 4-digit ICD10 code level (referred to here as ACSC1) was identified by Dr Foster and the NHS Institute for Innovation and Improvement and is therefore commonly used in the NHS. The second (ACSC2) includes additional codes suggested by other researchers.

Among the ICD10 blocks in table II (NCM difference), ischaemic heart diseases (I20-I25), chronic lower respiratory diseases (J40-J47), circulatory and respiratory systems (R00-R09), non-infective enteritis and colitis (K50-K52) and episodic and paroxysmal disorders (G40-G47) contain ACSCs. The respiratory conditions in this list are also the main causes of CM difference. Table II also includes other ICD10 blocks that contain ACSCs, such as skin and subcutaneous tissue infections (L00-L08), influenza and pneumonia (J09-J18), other acute lower respiratory infections (J20-J22), diabetes mellitus (E10-E14) and episodic and paroxysmal disorders (G40-G47).

In total, there are 19 ACSCs that can be prevented by primary prevention (such as tetanus immunization), early diagnosis and treatment of acute conditions (such as ENT infections and epilepsy) or good control and management of chronic conditions (such as angina, asthma and COPD) (Caminal et al., 2004).

Analysis of the HES data supports findings in the literature that patients from deprived areas are admitted more often for ACSCs than those from more affluent areas (Roos et al., 2005; Agabiti et al., 2009; Bottle et al., 2008). In decile 10 there were 53 admissions per 1,000 population; twice as many as in decile 1. A larger proportion of these admissions were emergencies in decile 10 than in decile 1 (77 percent compared to 66 percent).

The large number of admissions for ACSCs in decile 10 accounts for a significant proportion of both the CM and NCM differences. Under the broader definition, ACSCs account for 22 percent of the NCM difference (8 percent using just ACSC1) and 50 percent of the CM difference (24 percent using just ACSC1).

Figure 6

Figure 7

Figures 6 and 7 show the main ACSCs that contribute to the difference between deciles 1 and 10 in the percentage of admissions that were emergencies. Asthma and COPD contribute moderately to the NCM difference and more substantially to the CM difference. People living in decile 10 had 2.8 times as many ACSC admissions per head for asthma as those in decile 1 and 4.5 times as many ACSC admissions for COPD. The differences in the percentage of admissions that were emergencies are significant, but less marked; 97 percent of both asthma and COPD admissions in decile 10 compared with 86 and 93 percent in decile 1 respectively.

In addition to the differences in admission methods, evidence from other studies suggests that differences in admission rates do not just relate to differences in prevalence of ACSCs. Basagana et al. (2004) used data from a cross-sectional study among 20-44 year olds in 32 study centres in Europe, Australia, New Zealand and the United States. They found that, for this age group, the prevalence of asthma was 50 per cent higher among social classes IV and V than in classes I and II. For the 16-44 age group, there were 150 per cent more emergency ACSC episodes in the most deprived quintile than in the least deprived.

Angina admissions contribute more than 12 percent of both the NCM and CM differences. There were 3.4 times as many emergency ACSC admissions per head for angina in decile 10 compared with decile 1, but only 10 percent more elective admissions. The percentage of admissions that were emergencies in decile 10 was 15 percentage points larger than in decile 1; 77 percent.

‘Dehydration and gastroenteritis’ (almost entirely the latter) and ENT infections’ (particularly tonsillitis and pharyngitis) explain 2.8 and 1.1 percent of the admissions method driven difference respectively. The difference in the percentage of admissions that were emergencies suggests that these conditions were not managed as effectively in deprived areas as in the rest of the country. This view is supported by other findings in the literature. A study in Scotland by Hannaford et al. (2005) found that the proportion of people reporting “severe sore throat/tonsillitis” was 25 per cent higher among people form Carstairs 7 areas (the most deprived) than among those from Carstairs 1 areas (the least deprived). However, HES data show that there were 105 per cent more emergency ACSC admissions for ENT infections in decile 10 than in decile 1.

The contribution of diabetes to the CM and NCM differences is caused partly by higher prevalence in deprived areas (Evans et al., 2000), but evidence controlling for need found that patients from poorer areas also had an excessive number of hospitalisations (Booth and Hux, 2003).

Although some of the variation in ACSC admission rates by level of deprivation is undoubtedly caused by variation in prevalence of these conditions, prevalence estimates and variation in the method of admission indicate that primary care is not working as effectively in deprived areas as in more affluent areas. This may be caused by any combination of poorer quality, poorer access and patient characteristics.

Finding 7	Ambulatory care sensitive conditions (ACSCs) account for 22 percent of the NCM difference and 50 percent of the CM difference.

4.4. Delayed treatment

The presence of ICD10 blocks with no firm diagnosis (chapters R and Z) among the conditions that contribute most to both the CM and NCM differences suggests that patients in deprived areas may not be seeking care in the same was as those living in more affluent areas. An admission where the primary diagnosis is recorded as "signs and symptoms" indicates that no firm diagnosis has been made prior to, or during the inpatient spell and that the symptoms have been allowed to escalate to the point where they pose sufficient discomfort and risk to warrant admission. This being so, it is reasonable to expect that the management of conditions that originate with these symptoms is likely to begin at a later stage or be less effective, hence increasing the ratio of emergency to elective admissions.

The conditions that contribute most to the NCM difference appear to be linked to the symptoms that contribute most to the CM and NCM differences in this way. For example, the urinary tract infections that make up the majority of "other diseases of [the] urinary system" (N30-N39) and some digestive conditions (chapter K) may start with abdominal pain (R10) or haematuria (blood in the urine, R69). Compared to decile 1, there were 160 percent more emergency admissions per head for abdominal and pelvic pain (R10), but only 40 percent more elective admissions. Similarly there were 62 percent more emergency admissions per head for haematuria (R31), but 13 percent fewer elective admissions.

Perhaps unsurprisingly given the large number of emergency admissions for related symptoms, admissions for urinary tract infections (N39) follow a similar pattern; there were 67 more emergency admissions per head in decile 10 than in decile 1, but 21 percent fewer elective admissions.

Finding 8	Rates of emergency admission for undiagnosed symptoms were higher in decile 10 than in decile 1 indicating that symptoms are not being diagnosed early or managed properly. This is likely to be related to the differences in the method of admission that contribute to the NCM difference.

5. Are there too many emergency admissions or too few elective?

Whilst comparing the percentage of admissions that were emergencies provides evidence about the appropriateness of care, it is not clear whether better primary care in deprived areas would reduce the number of emergency admissions or increase the number of elective admissions. Prevalence or incidence data are necessary to calculate an estimated outcome.

Unfortunately reliable data of this kind is not available for most conditions, but the National Cancer Intelligence Network (NCIN) reports incidence rates at the small area level for most cancer sites. Other studies in the literature have addressed the question of whether patients in deprived areas receive sufficient elective treatment by controlling for need.

This section compares HES cancer admission data with NCIN incidence data, before highlighting evidence that patients in deprived areas may not be receiving the elective treatments for arthritis and cardiac conditions that their need suggests is appropriate. These are significant because all three conditions are among the main contributors to the NCM difference.

5.1. Cancer

Cancers compose 4.3 percent of the NCM difference, but it is not clear whether this is because patients in deprived areas are not receiving sufficient elective care or whether they are having more emergency admissions in addition to the appropriate elective treatment.

NCIN report average incidence over the decade 1994-2004 at the small area level (NCIN, 2009). Incidence of cancer is highest in deprived areas for the majority of cancers, including liver, lung and cervical. However, there are some for which this trend is reversed, such as female breast cancer, prostate cancer and male brain cancer. Across all sites they report that the ratio between the most deprived and the least deprived quintile was 1.2 to 1.

Table III compares hospital admissions per head for 15 cancers with the appropriate NCIN incidence data. The ratio of NHIMD quintile 5 values to quintile 1 values (Q5/Q1) is presented to show variation by deprivation.

Table III

The Q5/Q1 ratio is larger for emergency admissions than elective for all cancers except non-Hodgkin Lymphoma and brain cancer. Comparing chemotherapy episodes with emergency admissions presents a more mixed picture; the Q5/Q1 ratio was smaller for chemotherapy episodes than for emergency admissions for four sites, the same for one, and more for the remaining four sites.

The difference in incidence between quintiles 1 and 5 was greater than the difference in hospital admissions (emergency and elective) for 11 of the 15 sites. The Q5/Q1 ratios for incidence and emergency admissions were similar for the remaining sites.

Finding 10	Compared to more affluent areas, a larger proportion of cancer admissions in deprived areas were emergencies. Patients in deprived areas did not have sufficient emergency or elective admissions to match their higher incidence of cancer.

These findings broaden, if only crudely, findings in the literature, that colorectal, breast and lung cancer patients from deprived areas are more likely to be admitted as an emergency than those from more affluent areas (Raine et al., 2010).

The propensity for cancer patients to be admitted as emergencies is of particular concern because it makes treatment less effective and reduces the chances of survival (Porta et al., 1998; Jack et al., 2006). This may contribute to higher cancer mortality under this age of 75 in more deprived neighbourhoods (the Marmot review reports most deprived quintile: least

deprived quintile mortality ratios of about 1.6 to 1 for men and 1.4 to 1 for women; ONS data, p53).

Poorer management of cancer patients is likely to cause some of the extra emergency admissions (NHS Confederation and Macmillan, 2010) as well as lifestyle factors.

5.2. Arthritis

A larger proportion of admissions for hip and knee arthritis were emergencies in decile 10 than decile 1 (4.3 percent compared with 3.2 percent). The main treatment procedures associated with arthritis are hip and knee replacements. There is evidence in the literature that patients in deprived areas may not be receiving the number of replacements that their need warrants, which would explain, at least in part, why a larger proportion of their admissions were emergencies.

Figure 8

Figure 8 shows that there were fewer hip replacements for people over pension age in the most deprived decile than in the rest of the country. These figures do not control for the level of need, but this does not vary significantly with deprivation (see Hawker et al., 2002).

These procedures very rarely occur during emergency spells so this analysis focuses on elective admissions. Private procedures are not included in this dataset, but Williams et al. (2000) suggest that private procedures in the 1990s amounted to over 20 per cent of all hip replacements. Current rates are unknown but hypothetical rates of 10 per cent of total additional procedures added to deciles 1 to 4 would smooth the dip seen in figure 10.

Judge et al. (2010) found a similar under-provision of hip and knee replacements in deprived areas relative to the most affluent when the level of need was accounted for. This is observed despite patients being equally willing to consider surgery (Hawker et al., 2002). Furthermore, there is evidence that patients in deprived areas receive their hip replacements at a later stage than those in more affluent areas (Neuburger et al., 2012a). Consultants may be responding to poorer outcomes and more comorbidities among patients from deprived patients (Cookson and Laudicella, 2011; Neuburger et al., 2012b; Judge et al., 2012), but this does not necessarily justify a failure to operate because patients from deprived areas still benefit.

5.3. Cardiac conditions

Available evidence suggests that socio-economically deprived patients do not receive the investigation and revascularisation that their level of need warrants (Dixon et al., 2007). Furthermore, when they are referred for coronary artery bypass graft (CABG) surgery, they wait longer because they are significantly less likely to be classified as urgent (Pell et al., 2000).

Emergency admission for acute myocardial infarction (AMI) provides a good indication of the frequency of emergency cardiac events. Figure 9 compares the rates of emergency admissions for AMI with those of elective revascularisation procedures.

Figure 9

Rates of elective angioplasty and coronary artery bypass graft (CABG) surgery in deprived areas do not appear to be in line with rates of emergency admissions for acute myocardial infarction (AMI). This supports the findings in the literature and is likely to be caused by both lower rates of surgical intervention and poorer outcomes from surgery.

Finding 12	Rates of elective revascularisation lag behind rates of emergency AMI admissions.

6. Conclusions

It is of wide concern that emergency care is more commonly used relative to elective care in deprived areas: on average, emergency care is less beneficial to patients, and more costly to the NHS. This paper shows that about two-thirds of this greater use of emergency care reflects these distinct morbidities of deprived area patients. It documents the conditions that use emergency care intensively and are more prevalent in deprived areas, as well as the conditions that, for various reasons, have higher relative emergency use in deprived areas than elsewhere.

A key question for NHS policy makers interested in reducing the burden on hospital care is how much of the extra volume of admissions being generated by deprived communities could be avoided if primary healthcare provision in these areas were more effective. "Ambulatory care sensitive conditions" (ACSCs) provide a useful tool for addressing this question. The comparative ineffectiveness of primary care in deprived areas might explain the use of both emergency and elective care, and hence, their relative use. Overall, no less than one third of the higher relative use of emergency admissions in deprived areas may reflect the less effective working of primary care – as measured by ACSC admissions – in deprived areas.

[1] Date source: reference costs 2008/09.

[2] To recover (1) from (2) note that $\sum_{i=1}^{I}\left(m_{i,j}c_{i,10}\right)$ appears with appropriate signs in the two terms in (2), and hence cancels.

[3] The number of births is estimated from a composite of several HRGs: N06 - Normal Delivery w cc, N07 - Normal Delivery w/o cc, N08 - Assisted Delivery w cc, N09 - Assisted Delivery w/o cc, N10 - Caesarean Section w cc, N11 - Caesarean Section w/o cc.

[4] HRG N12, which covers over 400 diagnosis and procedure codes including "late vomiting of pregnancy", "diagnostic amniocentesis" and "maternal care for high head at term".

[5] Only episodes with method of admission "other" are included because these represent all of the episodes and other episodes are more likely to contain errors.

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Tables and figures

Figure 1: Emergency and Elective inpatient admissions, A&E attendances and outpatient appointments per head of population by deprivation decile, patients of all ages

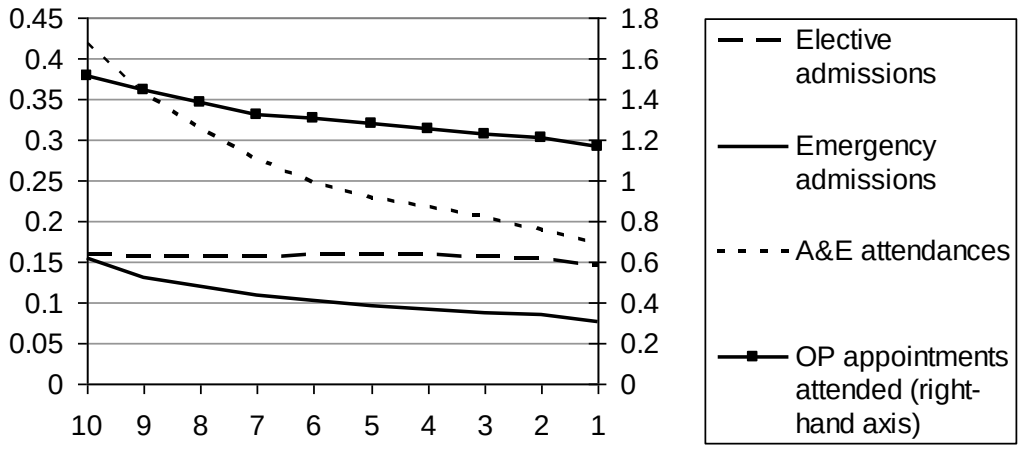

Figure 2: Emergency admissions as a percentage of total, with and without case mix adjustment

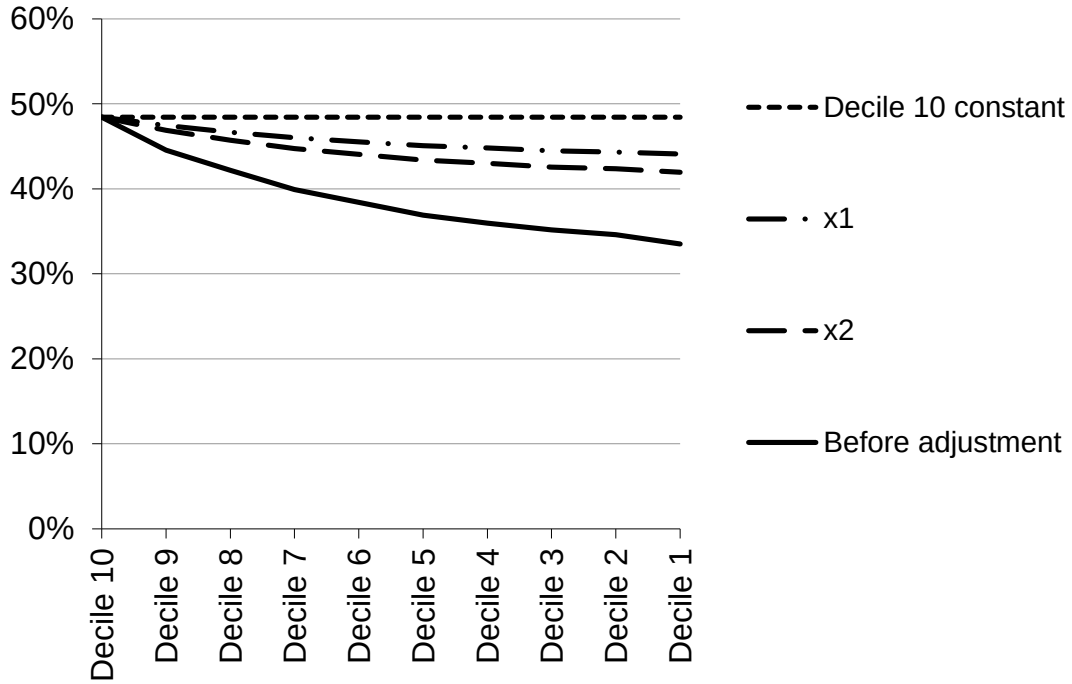

Figure 3: Histogram of the % of admissions that were emergencies in decile 10 minus the % of admissions that were emergencies in decile 1 by ICD10 block

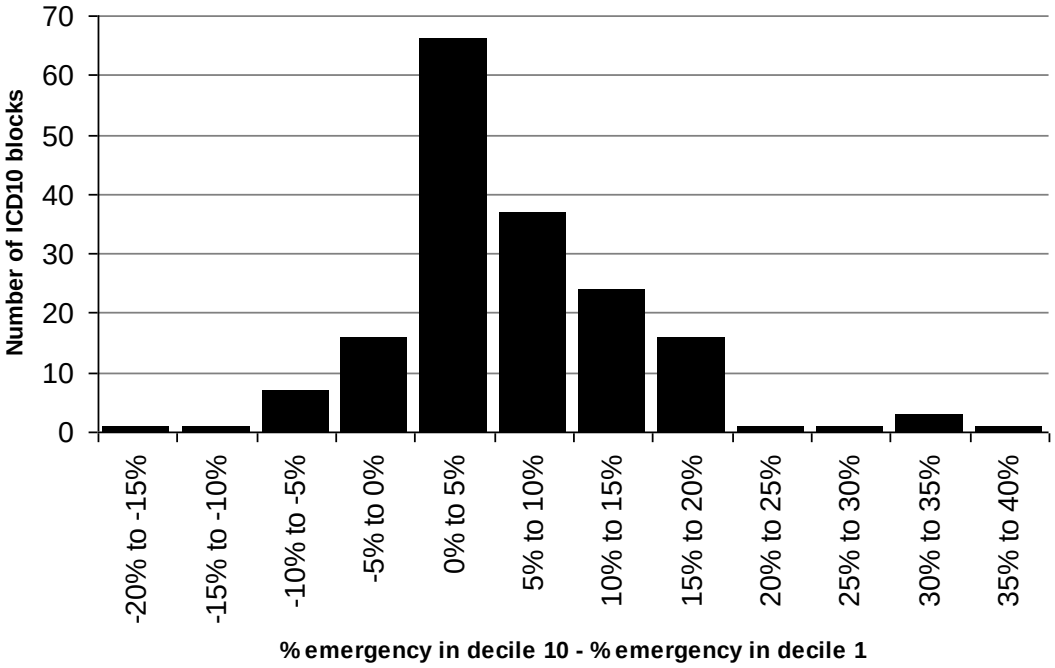

Figure 4: Births and antenatal admissions not relating to delivery event per 10,000 women

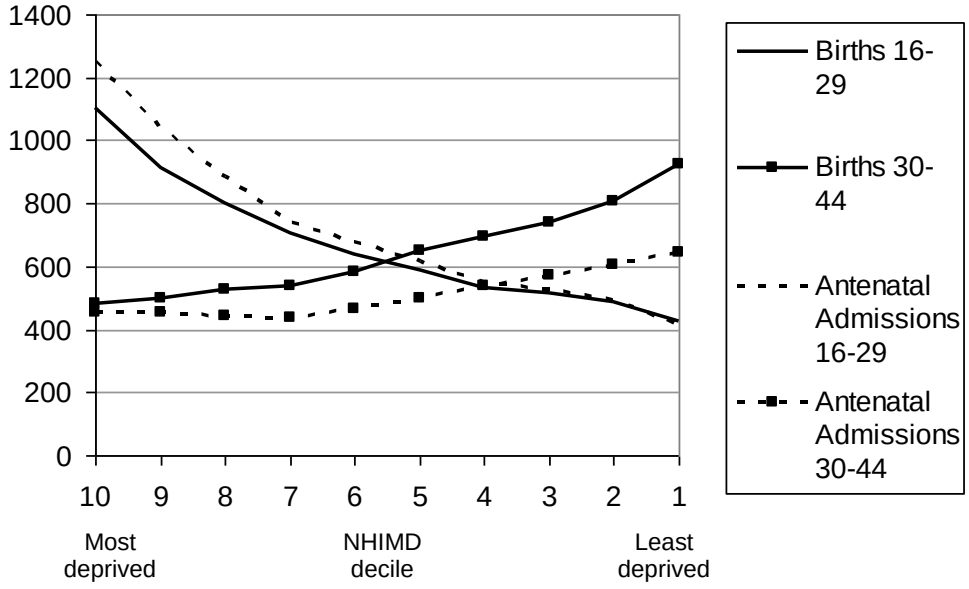

Figure 5: Admissions per 10,000 population for four mental health ICD10 blocks

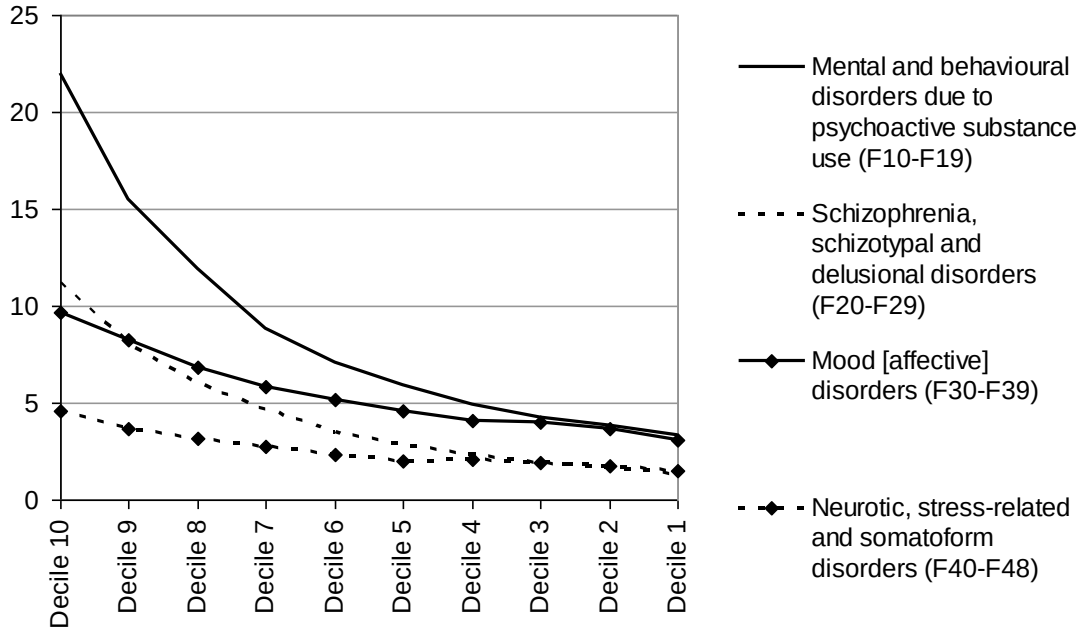

Figure 6: Contribution of main ACSCs to NCM difference in the percentage of admissions that were emergencies

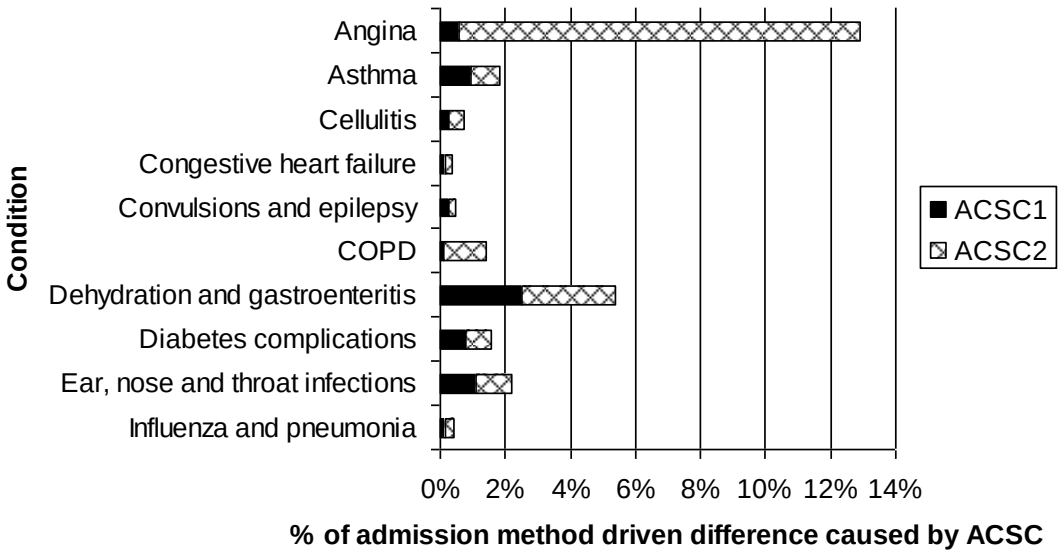

Figure 7: Contribution of main ACSCs to CM difference in the percentage of admissions that were emergencies

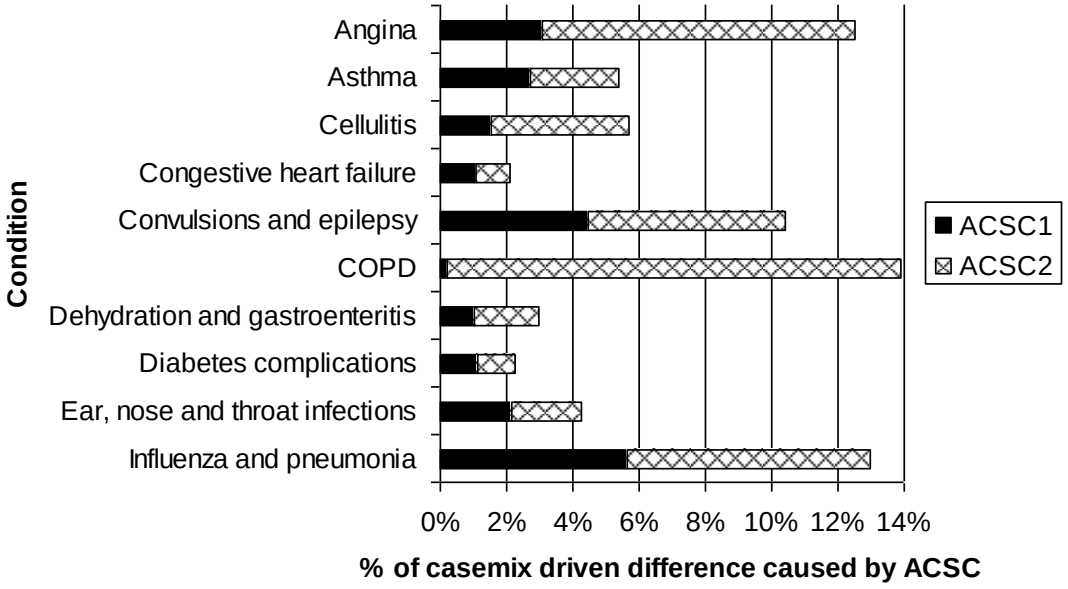

Figure 8: Elective hip replacement procedures per 1,000 pension-aged population (women over 59 and men over 64) by deprivation decile (OPCS 4=W371)

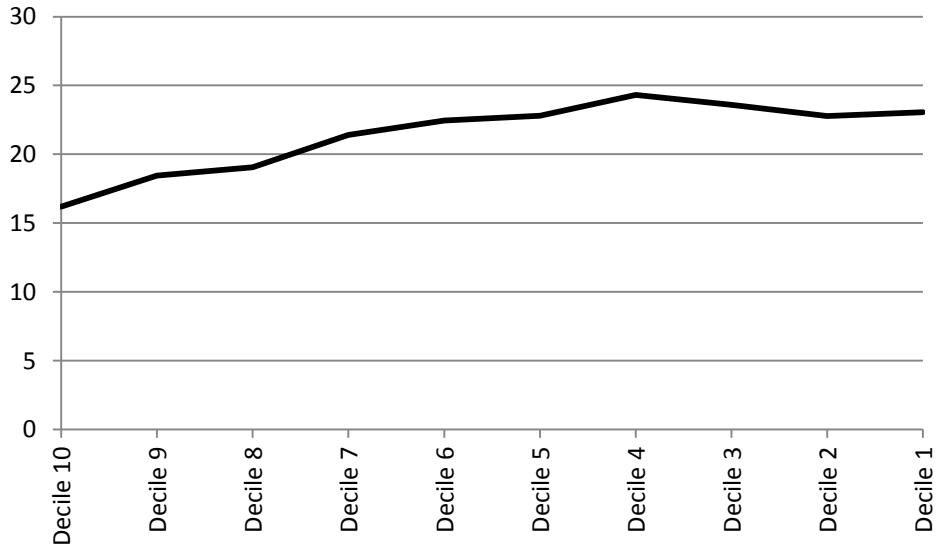

Figure 9: Rates of emergency AMI admission and elective revascularisation procedures

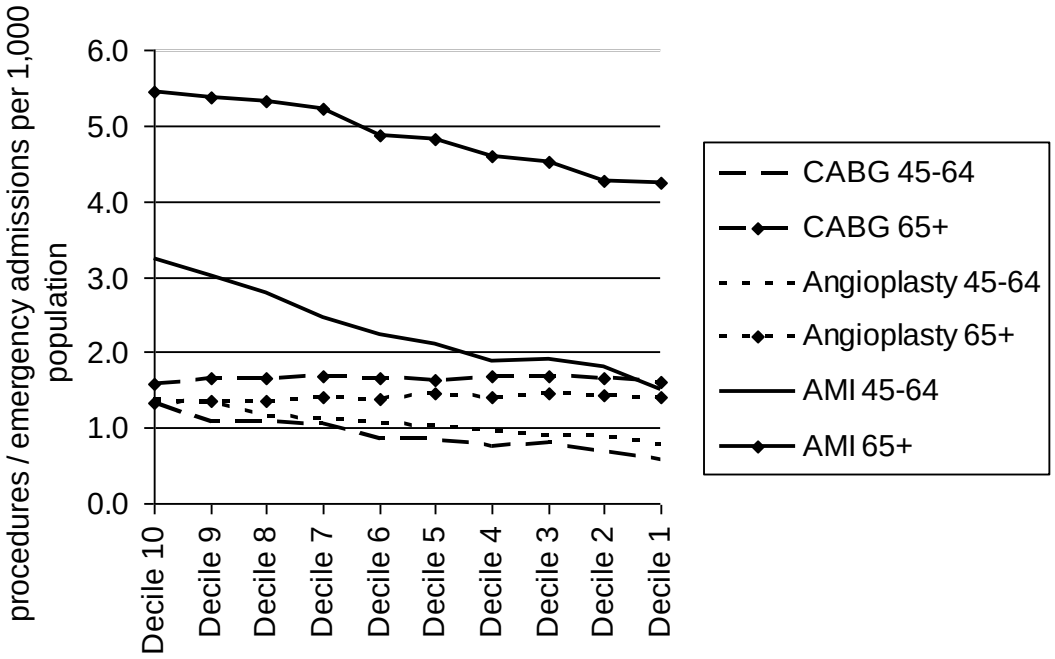

Table I: Main diagnosis codes contributing to the CM difference

ICD10 codes	ICD10 block description	% of CM difference
J40-J47	Chronic lower respiratory diseases	15.59%
R00-R09	Symptoms and signs involving the circulatory and respiratory systems	14.48%
T36-T50	Poisoning by drugs, medicaments and biological substances	13.63%
O20-O29	Other maternal disorders predominantly related to pregnancy	10.43%
R10-R19	Symptoms and signs involving the digestive system and abdomen	7.99%
R50-R69	General symptoms and signs	7.84%
S00-S09	Injuries to the head	7.42%
F10-F19	Mental and behavioural disorders due to psychoactive substance use	7.03%
O00-O08	Pregnancy with abortive outcome	6.22%
L00-L08	Infections of the skin and subcutaneous tissue	4.40%
J09-J18	Influenza and pneumonia	3.81%
F20-F29	Schizophrenia, schizotypal and delusional disorders	3.27%
S60-S69	Injuries to the wrist and hand	2.46%
J20-J22	Other acute lower respiratory infections	2.33%
E10-E14	Diabetes mellitus	2.24%
F30-F39	Mood [affective] disorders	1.63%
R40-R46	Symptoms and signs involving cognition, perception, emotional state and behaviour	1.62%

Table II: Main diagnosis codes contributing to the NCM difference

ICD10 codes	ICD10 block description	% of NCM difference
R10-R19	Symptoms and signs involving the digestive system and abdomen	10.44%
N30-N39	Other diseases of urinary system	4.63%
I20-I25	Ischaemic heart diseases	4.57%
C00-C97	Malignant neoplasms	4.33%
K55-K63	Other diseases of intestines	4.28%
Z00-Z13	Persons encountering health services for examination and investigation	4.28%
J40-J47	Chronic lower respiratory diseases	4.08%
R50-R69	General symptoms and signs	3.97%
R00-R09	Symptoms and signs involving the circulatory and respiratory systems	3.69%
I30-I52	Other forms of heart disease	3.49%
K50-K52	Noninfective enteritis and colitis	3.48%
M40-M54	Dorsopathies	3.44%
M60-M79	Soft tissue disorders	3.26%
K20-K31	Diseases of oesophagus, stomach and duodenum	3.18%
N80-N98	Noninflammatory disorders of female genital tract	3.11%
M00-M25	Arthropathies	2.89%
G40-G47	Episodic and paroxysmal disorders	2.74%
K80-K87	Disorders of gallbladder, biliary tract and pancreas	2.56%
D55-D59	Haemolytic anaemias	1.80%
E70-E90	Metabolic disorders	1.69%
N40-N51	Diseases of male genital organs	1.65%

Table III: Cancer incidence, emergency and elective admissions and chemotherapy episodes by cancer area

Cancer site	ICD10 codes	Incidence Q5/Q1	Emergency admissions ph Q5/Q1	Elective admissions ph Q5/Q1	Closest chemotherapy HRG3.5 code	Chemotherapy episodes Q5/Q1
Bronchus and lung	C34	2.5	1.9	1.6	D98 Respiratory	1.7
Head and Neck	C02-13, 32, 73	2.1	2	1.5	C98 Mouth, head, neck or ear	1.7
Stomach	C16	1.8	1.5	1.1		
Oesophagus	C15	1.4	1.2	0.9		
Colorectal	C18-20	(male) 1.1	1	0.8	F98 Digestive	1
Cervix	C53	1.9	2.4	1.6	M98 Female reproductive	
Ovary	C56	1	0.8	0.7		1
Pancreas	C25	1.2	0.9	0.7	G98 Hepato-Biliary and Pancreatic	0.9
Blood (Non-Hodgkin Lymphoma)	C82-85	(male) 0.9 (female) 1	0.8	0.8	S98 Haematology	1
Kidney	C64	1.2	1	0.8		
Bladder	C67	1.2	1	0.8	L98 Urinary tract or male reproductive	
Prostrate	C61	0.8	0.8	0.6		1
Brain	C71	(male) 0.8	0.8	0.9	A98 Nervous	0.9
Skin (melignant melanoma)	C43	0.5	0.6	0.4	J98 Skin, breast or burn	
Breast	C50	0.8	0.9	0.8		1

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