

The Socioeconomic and Community Influences on 'Potentially Avoidable' Emergency Admissions to Hospital for the Older People of London

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PhD



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Abstract

This PhD thesis explores the relationship between ‘potentially avoidable’ emergency admissions to hospital and socio-economic and community care influences for the older population of London.

The thesis first explores how socioeconomic conditions are associated with ‘potentially avoidable’ hospital admissions ratios (SARs) for the older population at a local level. I bring in a new index of social fragmentation for older people, specifically designed to reflect potential increased need for older people. I show how a high amount unpaid care is important in explaining variations in admissions, but, unsurprisingly, it is strongly correlated with morbidity. I therefore create an index of high demand, incorporating these variables. Using multiple regressions I show how deprivation and a high demand for care predominate in explaining variation in ‘potentially avoidable’ emergency admissions for the older population of London. It then continues to show multiple admissions, or frequent admissions, where patients have more than one admission to hospital in any year from last admissions is also closely associated to the effects of deprivation, but not to a high demand for care, suggesting service factors from Primary Care Trusts (PCTs) and Local Authorities (LAs) may be in operation.

I then explore the interactions between PCT and LA social services care funding and service provision at the scale of PCTs and local ward level socio-economic conditions, in relation to SARs using multilevel analysis. This demonstrates how PCT funding and social services spending on older people reduce the effects of deprivation at PCT level, however significant positive effects of deprivation remain both within and between wards. It shows how there are cross level effects of

deprivation and PCT funding in operation with *frequent* 'potentially avoidable' emergency admissions for the older population of London.

The final results chapter focuses on the question of 'potentially avoidable' admission at a finer scale (individuals) within a district of London. Multilevel modelling is applied to explore the relationships of individual risks of avoidable admission with the patient's GP practice characteristics and quality of care provided by the patients' GP surgery, whether the patient receives homecare and the socio-economic condition of the area the patient resides in. The thesis concludes with a discussion of the overall findings concerning factors that seem to be driving potentially avoidable admissions for older people and the implications for policy.

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CHAPTER 1 Introduction to ‘potentially avoidable’ emergency admissions to hospital

The English National Health Service (NHS) Plan (Department of Health 2000b) defines ‘potentially avoidable’ emergency admissions as “hospitalisation which should not be necessary if adequate primary care is in place”. Conditions that are considered ‘potentially avoidable’ include asthma (a condition that affects the airways), diabetes (where the amount of glucose in the blood is too high because the body cannot use it properly), heart failure (an inability for the heart to pump blood around the body properly because of weakening of the heart), ear, nose and throat infections and renal/kidney infections. Despite efforts to reduce admissions for ‘potentially avoidable’ emergency admissions they are still problematic, and cost the NHS over a £1 billion annually, accounting for 15 per cent of all emergency admissions (Audit Commission, 2007). Primary care is considered key for these conditions, where early diagnosis and good management of existing conditions can help reduce the need for hospitalisation.

The older population (age 65 and over) are the highest users of hospital services, accounting for 40 per cent of all emergency admissions to hospital and two thirds of hospital bed usage (Department of Health, 2000b). The numbers of older people reaching extreme old age (over the age of 85) is increasing, in 2001 there were 1.1 million people over the age of 85 (Office of National Statistics, 2002). Older people have specific health and social care needs related to ageing. In 1998/99 40 per cent of the NHS budget was spent on caring for the older population (over 65) at a cost of

£10 billion, whilst Social services spent a further £5.2 billion accounting for 50 per cent of their budget (NHS Executive, 2001).

Reducing 'potentially avoidable' emergency admissions for the older population is not merely about cost implications, but is about equity of health care provision and use. At the time of writing, a weighted capitation formula is used to determine the needs of each Primary Care Trust (PCT)/Local Authority (LA) to enable them to commission similar levels of health services and social services care provision for populations in similar need. Yet many studies have shown there are still inequalities in healthcare usage (Marmot, 2010; Bindman *et al.*, 1995; Fellows, 2005; Saxena *et al.*, 2006). The need to integrate social services and health care services to meet the need of the older population has been increasingly recognised in recent year (NHS Executive, 2001). Despite this few studies examine the association of social services care in conjunction with primary care on 'potentially avoidable' emergency admissions for the older population, something this thesis redresses.

This study explores the association of spatial proximity to hospital beds, socioeconomic conditions, unpaid care provision, primary care spending and provision and social services care spending and provision with 'potentially avoidable' emergency admissions and multiple 'potentially avoidable' admissions for the older population of London between the financial years (April to March) 2001/02 to 2004/05. It explores the associations at a variety of levels using a number of different statistical techniques to build a picture of how a whole healthcare system operates in relation to 'potentially avoidable' emergency admissions to hospital for the older population.

Chapter 2 explores the literature around ‘potentially avoidable’ emergency admissions, beginning with what ‘potentially avoidable’ are and why are important. The particular healthcare needs of older people are explored. It will be seen there is a wealth of literature surrounding health inequalities and how they are defined. The complex issue of access to healthcare is explored, showing how there are many differences in defining access, and how it is a multifaceted concept. The literature surrounding ‘potentially avoidable’ emergency admissions is explored, showing that it is a worldwide problem.

How socioeconomic conditions are related to avoidable admissions is explored in depth, showing that ‘potentially avoidable’ emergency admissions are strongly associated with deprivation. It also shows how, for older people, living alone and long-term illness is particularly associated with ‘potentially avoidable’ emergency admissions to hospital along with deprivation.

The literature surrounding service provision from GPs is then explored, particularly in relation to hospital admissions. How the new Qualities of Outcomes Framework (QOF), designed to assess the provision and quality of care provided by GP practices, is now being used in research as a measure of GP care is also explored in detail along with other studies surrounding GP care provision. Studies of the effectiveness of social services care provision have been largely ignored, particularly in relation to hospital admissions; however what literature exists is explored.

Chapter 3 explores the methods behind this study. It shows how the geographic scale of the data chosen is important as well as the data itself. This study uses a combination of statistical techniques to give a descriptive explanation of the data at

each level. It then goes on to explain the different regression techniques used. The choices behind some of the data chosen are explained. It also explains how two new indices, a social fragmentation index and a morbidity index were developed specific to the needs of the older population. It explains how unique individuals were developed from pseudo-anonymous individual data, and how these were tested for robustness.

For a study of the socioeconomic conditions, spatial proximity to hospital beds, provision of unpaid care and 'potentially avoidable' emergency admissions for the older population of London at ward level, multiple regressions were performed (reported in chapter 4). For PCTs, service level data are introduced for primary care provision and Social services provision at PCT level. Multilevel models are then used to explore the effects of service funding and provision of care from LAs and PCTs on 'potentially avoidable' emergency admissions for the older population of London after controlling for the effects of socioeconomic conditions with and between PCTs (reported in chapter 5). Finally (in Chapter 6) multilevel models on a data set specially constructed for this research are used to explore the relationship of local GP practice service provision and the provision of individual level homecare and meal on wheels for individual patients with individual's experience of 'potentially avoidable' emergency admissions, among the older population within the PCT of Barking GP practices. Each chapter explores similar relationships in relation to older people who have *frequent* (i.e. multiple admissions for the same person) 'potentially avoidable' emergency admissions.

Chapter 4 explores whether inequalities in healthcare usage, in particular 'potentially avoidable' emergency admissions for the older population of London and multiple

admissions, exist for the older population in relation to socioeconomic conditions. It explores whether patients are more likely to be admitted to hospital for a 'potentially avoidable' condition if they live close to an available supply of hospital beds. It also makes an original contribution by including aspects of unpaid care by members of the public and the relationship with 'potentially avoidable' emergency admissions for the older population of London; an area under explored, yet important for meeting the healthcare requirements of the older population.

Chapter 5 then explores whether the provision, quality and use of primary community care and social care, along with socioeconomic conditions are important in explaining variations in 'potentially avoidable' emergency admissions at an ecological level. This allows the exploration of a whole healthcare system, exploring whether resource allocation, driven by formulae used to allocate funding to PCTs/LAs, and so reduce inequalities in healthcare use, may be effective in relation to reducing 'potentially avoidable' emergency admissions for the older population of London and *frequent* 'potentially avoidable' emergency admissions for the older population of London. It also explores whether characteristics of GP practices (number GPs per 1,000 population or whether a single-handed practice) and quality of care (QOF), along with the amounts of care provided by social services are associated with *all* and *frequent* 'potentially avoidable' emergency admissions for the older population of London.

Chapter 6 then explores individual level 'potentially avoidable' emergency admissions for the older population of one PCT (Barking & Dagenham). It explores whether characteristics of individual GP practices, such as the number of patients per GP, whether GP practices are single handed and the quality of care provided, are

important in explaining variations in 'potentially avoidable' emergency admissions between GP practices, along with socioeconomic conditions. It explores whether the receipt of homecare and meals on wheels by individuals may be a useful predictor of admission to hospital for 'potentially avoidable' conditions.

The overall study also explores whether the scale of analysis influences conclusions about what drives 'potentially avoidable' emergency admission. It explores whether the geographic level 'potentially avoidable' admissions are studied at affect results, such as whether there are differences between overall PCT level or GP practice provision of care. It also explores whether information on 'individuals' can tell us more about health care service delivery.

The conclusion discusses the findings of the results and the original contributions to the field made by this research. It demonstrates how the analysis has developed our understanding of the fine scale, as well as broad scale variation in 'potentially avoidable' admissions. It also discusses the kinds of conclusions that can be drawn from the results concerning the extent to which 'potentially avoidable' admissions are apparently avoidable given typical levels of current health and social care provision in London, and whether efforts to concentrate service resources in the areas of greatest need appear to have any effect on 'potentially avoidable' admission. The discussion also highlights the value of measures of population 'demand' or 'need' for hospital care that are validated through this analysis.

CHAPTER 2 Literature Review for Potentially Avoidable Admissions

2.1 INTRODUCTION

With an increasingly ageing and aged population, there is concern over current and future healthcare provision and usage for the older population throughout the developing world. Despite efforts to reduce ‘potentially avoidable’ emergency admissions, admission rates remain stagnant or in some areas are rising, particularly amongst the older population. The older population are the heaviest users of hospital services and this usage increases with increasing age (Dunnell, 2001). One particular concern is the reduction of ‘potentially avoidable’ emergency admissions, where monitoring of patients by their GP and timely intervention can prevent unnecessary admissions to hospital (Department of Health, 2000b). There is often confusion over the use of the term ‘potentially avoidable’ emergency hospital admissions, with it being used interchangeably to describe hospital admissions that may be deemed ‘unnecessary’ or ‘inappropriate’, however it is in fact a distinct category of admission. This chapter sets out to explain how the term ‘potentially avoidable’ emergency admissions came about, what conditions are included, how they differ from ‘inappropriate’ admissions and why they are deemed important in trying to establish an equitable healthcare system.

Healthcare resources in the UK are distributed under the National Health Service (NHS) and access to healthcare in the UK is primarily through GP services, which are provided free. Despite this free access, inequalities in health and healthcare

provision persist. Healthcare inequalities and varying healthcare 'need' is not a new idea. A number of initiatives have been put in place to try to reduce healthcare disparities. That is not to say that every health care problem is treated no matter the cost, but that equal 'need' should be treated similarly.

The older population is increasing and becoming more aged, a trend that is set to continue. This has led to greater demands for healthcare amongst the older population. The older population represented two thirds of hospital admissions in the year 2000 (Department of Health, 2000b). How access to healthcare is measured is complex and multifaceted and a number of models of access have been suggested over time (discussed further later on). However access to healthcare services is not the only factor influencing hospital admission rates; this chapter explores how socioeconomic factors, social care provision and the distribution of nursing homes can all have an effect on hospital admission rates for the older population.

2.1 HEALTHCARE NEEDS OF THE OLDER POPULATION

The 2001 UK census saw the over 60-age group out numbering the under 16 age group for the first time in history (Office of National Statistics, 2002). Perhaps more worrying is the increase in the extreme old – those over the age of 85, where the census showed there are now 1.1 million people over the age of 85 living in the UK (Office of National Statistics, 2002). It is estimated that between 1995 and 2025 the number of people over the age of 80 will increase by almost half, whilst the number of people over the age of 90 will double. An increasingly ageing and aged population may have profound consequences for healthcare in the UK, which inevitably has cost implications.

Older people are seen to use hospital services more than any other group. Hospitals in London are currently running at near full capacity. However the Tomlinson report (1992) suggested much of this is due to inappropriate use, and that almost a quarter of the hospitals should be closed (Abercrombie and Warde, 1994). In the UK the older population account for 40 per cent of all emergency admissions and two thirds of hospital patients (Department of Health, 2000b). Furthermore, in 1998/99 40 per cent of the NHS budget was spent on caring for the older population (over 65) at a cost of £10 billion, whilst Social services spent a further £5.2 billion accounting for 50 per cent of their budget (NHS Executive, 2001).

Extreme old age may lead to poorer health, frailty and increasing dependency on others for care as chronic degenerative diseases and increased disability set in. For many years the NHS adopted a 'one size fits all' approach to caring for the older population. Today it has been realised that older people need to be treated as individuals, with care packages tailored to individual needs (NHS Executive, 2001). *A National Service Framework for Older People* was introduced in the UK in 2001 emphasising the need to promote independence and good health in older age (NHS Executive, 2001). The role of the National Health Service in health promotion was emphasised in *Standard Eight: The promotion of health services and active life in older age* (NHS Executive, 2001, p107-113). The primary care setting is seen as the driving force in promoting good health and preventing admission to hospital.

The increasing number of extremely old people (i.e. those over 85), nationally and locally, could have a profound effect on health care needs for the older population, which inevitably leads to cost implications for the National Health Service (Department of Health, 2000b). Much of the NHS budget is spent on caring for the

needs of the older population (Department of Health, 2000b). There is growing pressure for the NHS to reduce costs, whilst ensuring health care needs of the elderly are met. They suggest funds could be diverted into providing a better Primary Care service. As such, the National Service Framework for Older People (NHS Executive, 2001) and the NHS Plan (Department of Health, 2000b) set out policy for the care of older people. Targets for performance management of services are emphasised, including reducing the numbers of so-called ‘potentially avoidable’ emergency hospital admissions.

2.2 DEFINING POTENTIALLY AVOIDABLE EMERGENCY ADMISSIONS

The terms ‘potentially avoidable’ emergency admissions and inappropriate admissions are often confused and used interchangeably, however they are in fact distinctly different. The NHS Plan (Department of Health, 2000b) defines ‘potentially avoidable’ emergency admissions as: ‘hospitalisation which should not be necessary if adequate primary care is in place.’ The term ‘potentially avoidable’ emergency admission emerged during the 1970s when as Ricketts *et al* (2001, p28) explain, there was an ‘emerging focus on small area analysis ... to assess the quality of care, not just of specific patients, but of populations’. There was a growing interest in the role of primary care in preventing hospitalisation. This interest was led by the US Institute of Medicine, who were particularly interested in identifying admissions due to specific medically diagnosed conditions that may serve as an early identifier of problems within primary care. A committee of leading clinicians and health service researchers was convened to investigate the problem and identify conditions where ‘their occurrence could be affected by timely ambulatory

healthcare' (Ricketts et al., 2001, p28). They were asked to nominate conditions that met three criteria:

'Where the existence of the problem would indicate a problem in preventative services or primary care system. These include diseases that could be eliminated by universal immunization including measles, mumps and rubella.

Where, for diseases that cannot be prevented, the stage of the condition could be avoided by timely intervention. These include many complications of diabetes, hypertension, or advanced stages of certain cancers for which screening tests are common.

Where the incidence of the disease, when elevated above 'normal' rates, reflects more complex deficiencies within the health care system. Low birth weight is an example of this kind of marker' (Ricketts et al., 2001, p28).

A further goal was to identify areas that were 'underserved' by primary health care providers or required increased ambulatory services such as clinics. Eventually Rutstein and team chose a number of conditions including:

- Pneumonia
- Ulcers/Ruptured Appendix
- Heart Failure/Hypertension
- Diabetes
- Hypokalemia
- Immunizable Conditions
- Cellulitis
- Gangrene
- Epilepsy
- Asthma/Chronic Obstructive Pulmonary Disease (COPD)

Ear Nose and Throat (ENT) Infections (Ricketts et al., 2001).

These conditions have been accepted as ‘potentially avoidable’ emergency conditions in many countries outside of the USA, including New Zealand and Australia. The Department of Health in the UK has chosen to use a scaled down version of ‘potentially avoidable’ emergency admissions including:

ENT Infections

Heart Failure

Kidney/ Urinary Tract Infections

Asthma

Diabetes (NHS Executive, 1998).

Originally the Department of Health also included epilepsy in the conditions used, however soon dropped this. No explanation had been given for this decision, however it is possibly because admissions for epilepsy in the UK are very few. There is also no explanation in the literature as to why the NHS chooses to exclude many other of the definitions included in Rutstein’s analysis. The justifications for the conditions chosen are that early detection by General Practitioners (GPs) of ENT infections and kidney/urinary tract infections can prevent emergency hospital admissions and good management and early intervention for heart failure, asthma and diabetes can equally prevent hospital admission (Lewis and Dixon, 2004; NHS Executive, 1999).

However, as Coast *et al* (1996) note, a ‘potentially avoidable’ emergency admission does not mean that a patient has no requirement for hospital care at the present time, or in the future, but that timely intervention at primary care level may in fact prevent the need for admission. Equally these admissions are distinguishable from inappropriate admissions, where in fact a more appropriate alternative may exist even if unavailable. Noticeably ‘potentially avoidable’ conditions are medically orientated and defined by diagnosis. They do not take into account the severity of illness as inappropriate admissions do.

‘Potentially avoidable’ emergency admissions to hospital are classified by diagnosis, whereas inappropriate admissions are based on ideas about severity and functional definitions of health. Unlike some inappropriate admissions to hospital, it should be possible to avoid emergency admission to hospital for ‘potentially avoidable’ conditions given timely intervention within primary care for the majority of patients, and as such it is considered a failure of primary care to adequately monitor existing medical conditions or diagnose new conditions early enough to prevent admission.

Hospitalization for ‘potentially avoidable’ conditions has implications upon the patients’ overall health, access to healthcare services, cost implications and hospital bed availability. As the Agency for Healthcare Research and Quality (2003, p6) states, “[t]he personal cost of disparities [in health care] can lead to statistically significant morbidity, disability, and lost productivity at the individual level.” Caplan *et al* (2005) note, hospitalisation for the older person is associated with higher rates of morbidity and mortality and can lead to functional decline. For instance, increased bowel and urinary problems and confusion have been associated with hospital admissions for the older person (Caplan *et al.*, 1998). Conditions that are left

untreated or poorly treated can deteriorate further, leading to further complications. For example, as the Agency for Healthcare Research and Quality (2003, p6) note, “end-stage renal disease may result from longstanding poorly controlled diabetes. This highly morbid and highly costly condition could ‘potentially’ be avoided with access to indicated services and effective management of diabetes.”

In the UK, the Audit Commission (2006) suggests, up to two thirds of admissions to hospital are related to chronic conditions and many could be treated within the primary care setting. In the UK, ambulatory sensitive conditions, of which ‘potentially avoidable’ emergency admissions are a subset, cost the NHS in excess of £1 billion a year, and account for 15 per cent of all emergency admissions (Audit Commission, 2007). However this is not just a UK problem. Sheerin *et al*’s (2006, p1) study of ‘avoidable’ admissions in New Zealand, which has a substantially smaller population (4 million to the UKs 60 million) found “[the] total estimated costs of ‘avoidable’ hospitalisations in 2003 were NZ\$96.6 million [around £40million], accounting for an estimated 94,462 bed days”. Wanlass (2002) suggests that with effective clinical governance (i.e. improvement in healthcare delivery), if the worst 25 per cent of health authorities were to increase their performance to the level of the next 25 per cent of health authorities, then within 5 years there could be a reduction in ‘potentially avoidable’ emergency admissions of 120,000 admissions, saving an estimated £220 million at 2001 prices.

Within hospitals, ‘potentially ‘avoidable’ admissions have the effect of reducing the number of beds available to planned admissions and thus inhibiting waiting list reductions (Department of Health, 2000b). This effect is particularly serious when there are knock-on effects in terms of ‘bed blocking’. Bed blocking occurs where

there is no longer a clinical need for the patient to remain in hospital, but they are unable to return to their homes due to problems in discharge and aftercare arrangements, a problem more common amongst older patients.

Of particular concern are 'frequent' hospital admissions, i.e. more than 1 hospital admission in any one year. A recent report by the Department of Health, *Our Health, Our Care, Our Say: A New Direction for Community Services White Paper* (Department of Health, 2006b) suggests that there are 15 million people in England and Wales with long term conditions, accounting for 50 per cent of GP consultations and up to 75 per cent of hospital bed usage. A team of statisticians at the independent research agency *Dr Fosters* have estimated that more than 1 million emergency admissions are accounted for by 'frequent' admissions at a cost of £2.3 million (Dr Foster Intelligence, 2006). Some of these admissions will be for conditions not included in the definition of 'potentially avoidable' conditions within the UK such as Chronic Obstructive Airways Disease, however many of these admissions will be for 'potentially avoidable' emergency admissions such as for heart failure. Dr Foster Intelligence (2006) estimate that costs for treating these frequent admissions could rise by up to 40 per cent over the next 20 years.

Fellows (2005) study of 'frequent' users of hospital services in PCTs in London found that 'frequent users' were on average disproportionately older, with the over 85 age group being the highest 'frequent' users. Most of these 'frequent' admissions were for chronic heart and respiratory disorders. It would seem however that primary care is failing to prevent many admissions for these conditions, with admission rates for 'potentially avoidable' conditions increasing (Bindman *et al.*, 1995; Fellows, 2005).

A number of reasons for this increase in ‘potentially avoidable’ emergency admissions have been put forward, including problems with accessing primary care and local area conditions. ‘Potentially avoidable’ emergency admissions are often used as an indicator of access to and quality of primary health care, enabling measurement of whether care is being delivered to areas of greatest ‘need’. The National Health Service (NHS) was introduced in 1948 with a specific aim of allowing equal treatment of patients regardless of ability to pay, and thus reducing inequalities in access to healthcare, yet, over 60 years later, inequalities are still in existence.

2.3 INEQUALITIES IN HEALTHCARE

The concept of equity is largely based on the idea of social justice. Social justice, as Smith (1996, p26) explains “is taken to embrace both fairness and equity in the distribution of a wide range of attributes”. This distribution of attributes goes beyond the spatial or general distributions but incorporates how these come about. For instance, where it is assumed that people may have equal talents, for some, these talents cannot be fully realized due to barriers relating to their natural and social environments. If they are nurtured then it is purely down to chance and good fortune (Rawls, 1971, p72). As Smith (2000, p140) states “[T]he injustice of such a system [that allows chance and good fortune to be the deciding factor in whether a talent is nurtured] is that it permits access to positions of advantage and distributive shares to be influenced by factors which are arbitrary from a moral point of view”. As elaborated below, in the NHS ‘need’ for health care is often taken as the theoretical criterion for determining distribution of access to care.

The concept of social justice being based on a moral obligation may seem directly at odds with an essentially capitalist society, where wealth and the right to purchase goods are earned. An alternative ideology might assume that access to healthcare should be *earned*, and therefore those who do not earn that right do not *deserve* to have access to healthcare. As Barry (1965, p107) notes, “desert is attributed on the basis of actions, efforts and results produced”, i.e. where a person is seen to achieve something they *deserve* a reward, however, if a person has undertaken a misdeed they are said to *deserve* punishment. This would imply that, as Powell (1990, p32) suggests, social justice might not be based on need at all, since merit and ‘contribution to the common good’ may be equally important in achieving social justice.

Within the market model of social policy a degree of inequality is seen as essential within society in order to encourage initiative, reward effort and hence increase efficiency. Therefore individuals should “accumulate reward through individual effort” (Clapham *et al.*, 1990, p25) and hence *deserve* a reward. If the State is providing healthcare there may be little incentive for some to show initiative and earn the right to healthcare. However, if the right to healthcare is not earned, then social exclusion can occur, so in practice a ‘safety net’ of provision might have to be made.

In contrast, the social democratic model of social policy sees inclusion in society as a basic right of all people, and that provision of welfare and healthcare should equally be a universal right to offset “the negative consequences of a market economy” (Clapham *et al.*, 1990, p25). This is closer to the model adopted in the British NHS. If external forces are responsible for some people’s greater need then “since these

‘actions’ are non-voluntary, attaching sanctions to them will not affect behaviour” (Barry, 1965, p109). Further, ensuring those areas of greatest need obtain the greatest amount of healthcare may have positive effects on people’s behaviour, and encourage people to take action to improve their own health. As (Barry, 1965, p111) suggests, “given that desirable behaviour deserves good treatment and undesirable behaviour bad treatment, giving people what they deserve will often come in practice to the same thing as giving people what is necessary to encourage desirable behaviour and discourage undesirable behaviour”. By improving the health of those that require healthcare the most, labour productivity may increase, whilst reliance on, and costs to the state may decrease, therefore benefiting all society, surely a desirable outcome (Clapham *et al.*, 1990,p25; World Bank, 1993).

The implication of the social democratic model for this study is that it is probably equitable to provide more care to those who are exposed to greater social and physical environmental risks for health and who as a result are in worse health and more likely to ‘need’ health services. It may also be more difficult to provide the care they ‘need’ outside the hospital setting (for example if the severity and complexity of their health problems is particularly challenging for community care, or if their home circumstances make care in a community setting more difficult. This leads to a concern to establish the extent to which aspects of poverty and social deprivation are associated with patterns of service use, including potentially avoidable conditions. The association between poverty and poor health has been demonstrated on a number of occasions (Sells and Blum, 1996; Singh and Yu, 1996; Smith, 1996). Inequalities in health cannot be attributed solely to inequalities in income, but is more complex, related to the concept of social justice and moral

obligations. As (Rawls, 1999, p76) explains, that there are four primary social goods that each member of society is ‘entitled’ to achieve social justice, and as such equity in health, including *rights, liberties, opportunities, income and wealth*. There will be some members of society who do not have the *opportunity, income or wealth* to access healthcare independently of State provision (through no fault of their own), but do, under the principles of primary social goods, have a *right* to healthcare, which in turn can help them achieve *liberty*. This idea of social justice can be related to health to assume that there is a moral obligation to ensure there is equal access to healthcare for all regardless of socioeconomic status or place of residence.

Concerns for social justice in health are growing, and there is a requirement to avoid the ‘inverse care law’ (Tudor-Hart, 1971), where ‘the availability of good medical care tends to vary inversely with the need for it in the population served’. It is desirable that those that *require* the *greatest* amounts of care should be those that *receive* the *greatest* amounts of care (territorial or social justice). Sometimes the opposite is found to be true, and those that *require* the *greatest* amounts of care in fact *receive* the *least* (inverse care), resulting in health inequalities (Tudor-Hart, 1971, p405). Figure 2.1 illustrates this, showing how for territorial justice, the amount of care provided increases as the need for care increases, whereas with the inverse care situation the opposite is true, and the amount of care provided reduces with need.

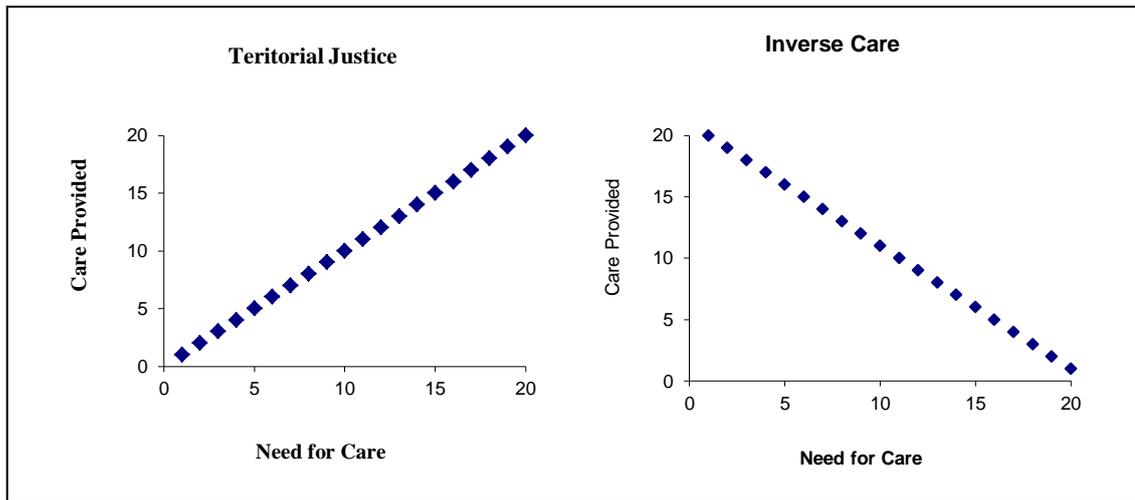


Figure 2.1: Hypothetical Example of the Inverse Care Law

Source: Reproduced from Jones and Moon (1987)

The desire for equity in health does not assume that everyone should be able to reach the same level of health, but that everyone should have an equal opportunity to reach their individual optimum health (Bommier and Stecklov, 2002). As Exworthy *et al* (2003, p1906) explain, “[h]ealth inequalities are the systematic, structural differences in health status between and within social groups within the population.” Access to healthcare is considered a basic human right that everyone is entitled to regardless of income or wealth (Dworkin, 1977; Williams, 1993). The introduction of the NHS in 1948 sort to ensure every person in the United Kingdom had equal access to healthcare services (Bevan, 1952). It was thought that by providing healthcare that was free at the point of access, health inequalities as identified in the Beveridge Report (1942) would diminish. Despite these ideals, subsequent reports show that inequalities in healthcare use and the health of the population remain and continue to grow (Black, 1980; Marmot, 2010).

The ‘*Black Report*’ (Black, Department of Health and Social Security, 1980) (often referred to as such with reference to the Chair of the committee which produced it)

was commissioned by the Department of Health and Social Security (now the Department of Health) to explore the extent of health inequalities in the UK since the introduction of the welfare state (including the NHS) in the 1940s. Marmot (2001, p1165) explains ‘although the problems of inequalities in health were well known to researchers, the Black Report summarized the evidence, gave it focus, reached conclusions and hence brought it to the public attention.’ The *Black Report* was to become one of the most influential reports into health inequalities both in the UK and worldwide.

The Black Report (Black, 1980) identified that access to health services varied according to social class and was comprehensive in its identification of health inequalities in the UK. It is striking however that the older population is only mentioned once in the Black Report. Most of the recommendations specific to the older population were about caring for older people in the community, and thus avoiding hospitalisation, an idea reiterated in later years in the NHS and Community Care Act 1990; the Department of Health, Social Services Inspectorate report (1990); and later the National Service Framework for Older People (NHS Executive, 2001).

Despite the identification of health inequalities in the Black Report, three decades later inequalities were found to have widened (Marmot, 2010). The Marmot Report (2010) saw health inequalities as more than just inequalities in healthcare provision and the health of the population, and identified inequalities in all aspects of life including income, work, heating, transport, environment etc. The Marmot Report identified inequalities across the life course, and made recommendations for each part of the life course, including the older population. These recommendations went further than just identifying healthcare needs. Adequate income, safety in the

community, reducing fuel poverty and healthy living (including food, stopping smoking, reducing alcohol intake etc) were all identified as important factors in reducing inequalities. Integration of services was a continued theme, only this time included many more services such as housing, police and welfare as well as health and social services.

It seemed that the introduction of a National Health Service that was free from the point of access was not in itself sufficient to reduce inequalities in health, but that, in fact, the problem was much more complex. Although reducing inequalities in all aspects of life may seem to be the key to reducing health inequalities overall, having an equal society does not in itself stop people from becoming unwell.

This summary of arguments about social justice therefore supports the view that it is important to consider how variation in 'potentially' avoidable emergency admissions relate to socio-economic conditions. If more deprived populations in poor health have higher rates of 'potentially avoidable' emergency admissions to hospital this may indicate that the 'wider determinants of health' for these groups are producing conditions in which they are more likely to 'need' to make 'potentially avoidable' emergency admissions to hospital. This might reflect a failure of primary care to prevent admission or it might mean that living conditions for these groups (which are not the responsibility of the health service) make care in the community impossible, so that hospital admission is 'needed' and is not, in fact, 'avoidable' in all cases. To be sensitive to arguments about social justice, an analysis of 'potentially avoidable' emergency admissions should therefore take into consideration deprivation and other social 'need' variables.

2.4 PRIMARY CARE

For ‘potentially avoidable’ conditions to be effectively treated and hospitalisation avoided, it is essential that early intervention or careful monitoring of the condition occurs, and for this to happen it is essential that health care services, in particular primary care, can be accessed quickly. At present ‘86% of all health problems managed in the NHS are managed entirely within primary care’ (Department of Health, 1999b, p3). The NHS introduced statutory fund holding to GP practices that allowed GP practices to independently purchase their own non-urgent care and community services (Smith and Mays, 2007). Local health authorities continued to fund the majority of services required. The rationale for introducing local funding was that GPs were uniquely placed to know the needs of the local population and the services available (Goodwin *et al.*, 1998). Increasing number of GP practices joined together to form independent Primary Care Groups (PCGs) to take advantage of the new fund holding mechanism and jointly buy services (Smith and Mays, 2007). These were replaced in 2002 when the NHS introduced Primary Care Trusts (PCTs), transferring allocated funding to a local level, allowing PCTs to decide how funding (for all services) should be best spent in order to meet the needs of the local population (Smith and Mays, 2007). The introduction of PCTs followed the recommendations of the World Health Organisation (World Health Organization and UNICEF, 1978) *Alma Ata Declaration* which stated that “[A]ll governments should formulate national policies, strategies and plans of action to launch and sustain primary health care as part of a comprehensive national health system and in coordination with other sectors. To this end, it will be necessary to exercise political

will, to mobilize the country's resources and to use available external resources rationally”.

Funding for PCTs (at the time of writing) is based on area need indicators using a complex formula based on the work of Carr-Hill. Carr-Hill (1994) and uses a complex set of indicators, including illness rates (based on hospital activity), mortality rates, unemployment rates, people in single carer households and pensioners living alone. Resources are allocated on a weighted capitation basis and funding is aimed at where need is i.e. where people live, not where the services are. PCTs can also purchase hospital services on a contract basis (Carr-Hill, 1994).

For the period covered by this research, PCTs make decisions about primary health services and secondary care provided to PCT populations. Primary health services are those services that can be directly accessed by the public, including GPs, Dentists, NHS Walk-in Centers, NHS Direct and pharmacies. They also include some services that are directly accessed via a GP to help support the patient within the community such as district nurses and specialist community nurses. Secondary services include those services provided by hospitals such as specialist doctor services and outpatient services. These usually require access via primary care services. Emergency hospital care is also included in the definition of secondary care; however access to emergency care may be through GP practices or through emergency departments directly. All hospital care is ultimately funded by PCTs (Department of Health, 2001). As Central Government has become increasingly involved with the health service it has encouraged all sectors to become more accountable for their actions and to be more open to scrutiny. This has given rise to

an increase in evidence based practice within PCTs in order to justify decisions made and how monies are spent.

To monitor performance in health care services, two new bodies were introduced, the *National Institute of Clinical Excellence* (NICE) and the *Centre for Health Improvement* (CHI); NICE sets clinical standards for health, and CHI ensures these targets are met. As Payne (1999, p26) explains, “accurate outcomes data will be the key to the successful management of local services and health improvement planning and PCT management boards must have a way of collecting and analysing these from operational data.” In particular, PCTs are required to reach key performance targets set out in *The New NHS: A National Framework for Assessing Performance* (NHS Executive, 1998). Part of these key performance targets includes reducing ‘potentially avoidable’ emergency hospital admissions, i.e. admissions which should not be necessary if adequate primary care is in place (Department of Health, 2000b).

Initially GPs were still paid under the capitation system which pays for the number of patients registered rather than quality of care or the increased demand for care. GP payments were calculated using the ‘Jarman score’ that gave more money to GPs working in deprived areas with large proportions of demographic groups most likely to require primary care, where ‘need’ was considered greater and so the workload was higher (Talbot, 1991). However, as Smith (2001) explains, GPs were unhappy with this payment method that reward list sizes rather than quality of care and change was demanded.

In 2004 a new General Medical Services (GMS) contract for general practitioners was introduced. Although GPs working in deprived areas were still given an

‘incentive payment’, the quality of GP performance was now to be monitored, using the *Quality of Outcomes Framework* (QOF). This enabled additional payments to be made to GPs using more evidence based care, according to achievement in caring for patients with certain chronic diseases, and for achievement in terms of practice organisation and management (British Medical Association, 2003).

QOF data measures the performance of GP practices across a number of domains, resulting in an overall percentage of potential points achieved scores by domain and sub domain for each GP practice and for each PCT. As discussed later in this thesis these measures provided useful information for the research carried out here, so it is interesting to consider the debates surrounding QOF indicators and their usage. The domains include a clinical domain, organisational domain, patient experience domain, additional services domain and QOF ‘depth of quality measures’ domain. Several criticisms have been made regarding the introduction of QOF. In particular it was felt that patient care may be neglected in favour of reaching targets to boost income (Marshall and Harrison, 2005; Lester et al., 2006). Certainly it seemed that increased effort to reach targets was being made and one study found that in 18 GP practices, the number of targets achieved for the 6 indicators introduced as part of QOF increased from 75 per cent in 2003 (prior to the introduction of QOF) to 91 per cent in 2005 (after the introduction of QOF), statistically significantly higher than for targets that did not have financial incentives attached (Steel et al, 2007). The overall number of GP practices reaching the set QOF targets has increased since their introduction (Majeed and Molokhia, 2008). Despite this, studies have suggested overall quality of care (measured by QOF indicators) is significantly lower in GP practices in deprived areas (Ashworth and Armstrong, 2006; Wright *et al.*, 2006).

However, improvements in health outcomes in some of the conditions monitored by QOF have been seen since its introduction (Millett *et al.*, 2007; Millett *et al.*, 2009b; Millett *et al.*, 2009a).

There has been criticism that some GP practices may overuse exception reporting to help them gain better QOF results, leading to criticisms that having financial incentives for treating certain conditions could be detrimental to the care of those patients with non-incentivised conditions (Maynard and Bloor, 2003; and Armstrong, 2006; Doran *et al.*, 2006, Downing *et al.*, 2007; Steel *et al.*, Ashworth, 2007). Exception reporting allows practices to discount certain patients from aspects of the performance indicators, for example when patients are on maximum treatments without optimal healthcare outcomes being achieved, or non-attendance for review despite being sent three invitation letters. Initial studies that have adjusted QOF payments to take account of exception reporting have found only a slight increase in overall payments, however these preliminary studies suggest it is too early to tell conclusively whether exception reporting is overused to inflate QOF payments (Doran *et al.*, 2006, Downing *et al.*, 2007; McDonald *et al.*, 2007; Mannion and Davies, 2008).

Studies have found that GP practices that score higher in terms of quality of performance have less hospital admissions, particularly for ambulatory sensitive, long-term or 'avoidable' admissions (Bottle *et al.*, 2008, Saxena *et al.*, 2006). Despite these associations, the studies also found that after controlling for the effects of quality and performance, associations with socioeconomic conditions (in particular deprivation) were dominant when examining hospital admission rates. However, one study of premature re-admissions for heart failure suggested that although GP

practices with lower QOF points may admit patients more, the decision to re-admit was based purely on clinical need (and was unrelated to QOF points achieved (Trujillo-Santos *et al.*, 2006). Despite this, it may be argued that given adequate monitoring post discharge from hospital, the patients' conditions should not have deteriorated to such a state as to require re-admission to hospital. These studies suggest that analysis of 'potentially avoidable' conditions should consider the possible effects of the performance of primary care, as measured by QOF indicators.

2.5 HEALTHCARE USAGE AND ACCESS

It is often believed that increased provision of health care will result in better health, however this is not always the case; healthcare availability does not guarantee its use, or a healthy population (Joseph and Phillips, 1984) and 'medical care does not guarantee health' (Gold, 1998a, p626). There is a difference between the potential to utilise a service and the actual utilization of that service (Aday and Anderson, 1975). The process of healthcare utilization is much more complex than just requiring a service (Fielder, 1981). Utilisation of services is influenced by characteristics of the health delivery system, characteristics of the population at risk and patient satisfaction all influencing process and outcome indicators. Figure 2.2 shows how these process and outcome indicators influence each other within the health care system and community.

HEALTH POLICY

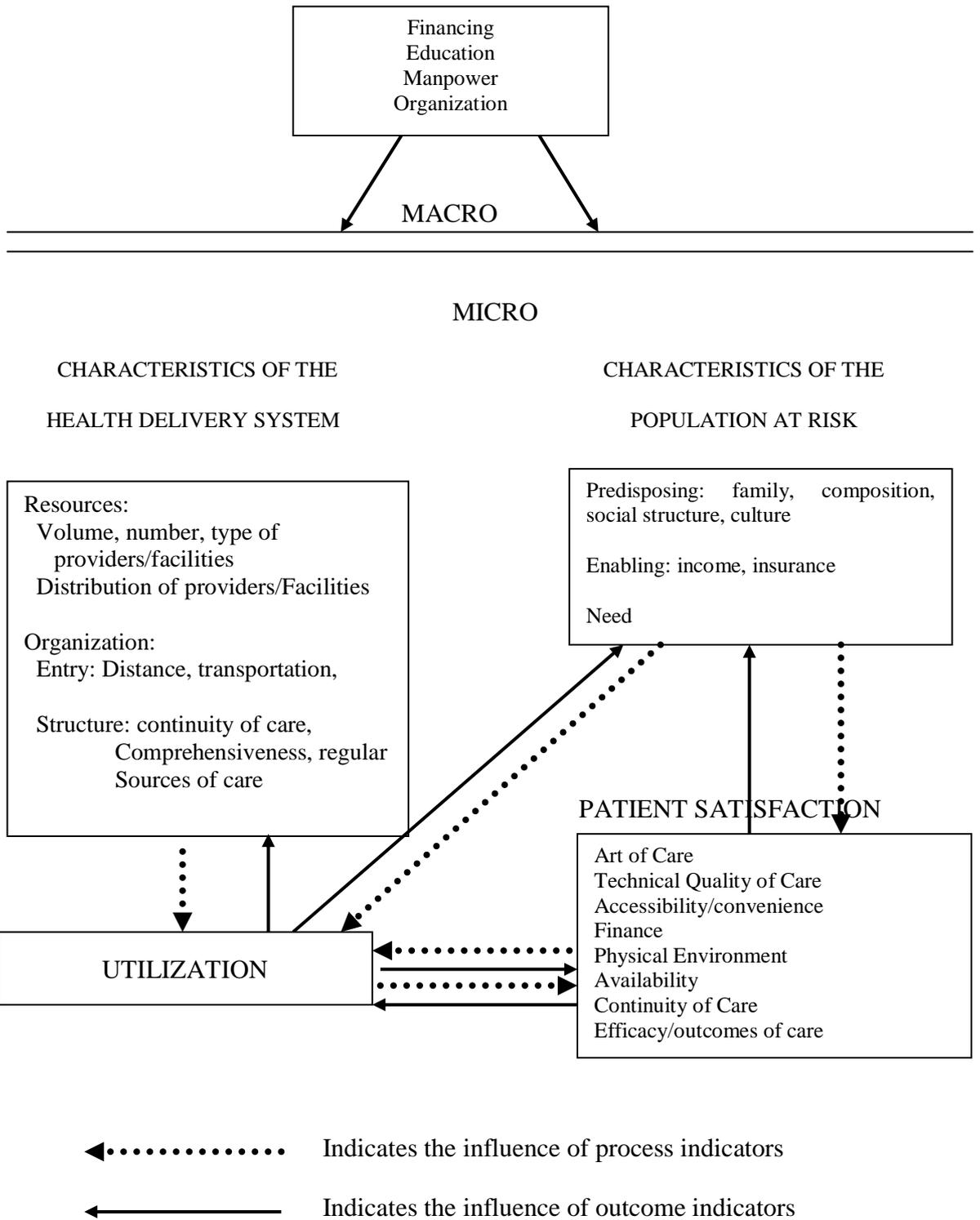


Figure 2.2: THE INTERRELATION OF 'PROCESS' AND 'OUTCOME' INDICATORS IN HEALTHCARE UTILIZATION

Penchansky and Thomas (1981, p127) further explore access and utilization of healthcare services and suggest that access is “a general concept that summarizes a set of more specific dimensions describing the ‘fit’ between the patient and the health care system”. They identified five dimensions of access (the five A’s): *availability, accessibility, accommodation, affordability and acceptability*.

“*Availability* [refers to] the relationship of the volume and type of existing services (and resources) to the clients’ volume and types of needs. It refers to the adequacy of the supply of physicians, dentists and other providers; of facilities such as clinics and hospitals; and of specialized programs and services such as mental health and emergency care.

Accessibility [refers to] the relationship between the location of supply and the location of clinics, taking account of client transportation resources and travel time, distance and cost.

Accommodation [refers to] the relationship between the manner in which the supply resources are organised to accept clients (including appointment systems, hours of operation, walk-in facilities, telephone services) and the clients’ ability to accommodate to these factors and the clients’ perception of their appropriateness.

Affordability [refers to] the relationship of prices of services and providers’ insurance, or deposit requirements to the clients’ income, ability to pay, and existing health insurance. Client perception of worth relative to total cost is a concern here, as is clients’ knowledge of prices, total cost and possible credit arrangements.

Acceptability [refers to] the relationship of clients' attitudes about personal and practice characteristics of providers to the actual characteristics of existing providers, as well as to provider attitudes about acceptable personal characteristics of clients'. ...the term appears to be used most often to refer to specific consumer reaction to such provider attributes as age, sex, ethnicity, type of facility, or religious affiliation of facility or provider. In turn, providers have attitudes about the preferred attributes of clients or their financing mechanisms. Providers may be either unwilling to serve certain types of clients (e.g. welfare patients) or, through accommodation, make themselves more or less available" (Penchansky and Thomas, 1981, p128/129).

As Penchansky and Thomas (1981, p129) note "the dimensions of access are not easily separated", for instance, accessibility and availability are closely tied, whilst "service areas having equivalent availability may have different accessibility". Rogers *et al* (1999, p30) suggest that these five dimensions of access can be reduced to just three: "*supply* factors (e.g. differences between the consulting hours and services offered by GP practices): *access* factors (e.g. distance from the practice) and *need* factors (e.g. mortality risk measured by ward standard mortality rates, chronic disease, life events, smoking and economic position)".

Supply factors include how primary care provides care and may affect how the general population as a whole use those services. A number of studies have explored differences in GP characteristics in terms of their practice size, range of services offered, differences in consultation rates and measures of 'quality of care' (Madeley *et al.*, 1990; Hippisley-Cox J, 2001; Roland *et al.*, 2001; Hammersley *et al.*, 2002; Royal College of General Physicians, 2004; van den Hombergh *et al.*, 2005).

It is commonly thought that group practices perform better overall than single-handed practices. They are thought to be advantaged by economies of scale in that they are able to provide more extensive services, share information and provide more choice to patients (van den Hombergh *et al.*, 2005). Despite these assumptions, a number of studies have found that there is no difference in the quality of clinical care between single-handed GPs and group practices (Hippisley-Cox J, 2001; Roland *et al.*, 2001; van den Hombergh *et al.*, 2005). Conversely other studies show conflicting results, finding in fact quality of care is in fact better in larger group practices (Campbell *et al.*, 2001; French *et al.*, 2008).

In 2005 a survey by the Royal College of General Practitioners found 22 per cent of GP practices in the UK were single-handed practices (Royal College of General Physicians, 2004). Within Barking & Dagenham, 54 per cent of GP practices are single-handed practices. Hippisley-Cox *et al* (1997) found that single-handed practices did in fact have higher hospital referral rates than group practices in a study in Nottingham. Group practices were found to be more up-to-date, with better access to computers and more likely to have support staff such as practice nurse (Leese and Bosanquet, 1995). Despite these findings, access to care was found to be better in single-handed practices (Roland *et al.*, 2001; van den Hombergh *et al.*, 2005). Survey results also showed patients prefer smaller practices (Baker and Streatfield, 1995). A number of studies have found that there was no difference in hospital admission rates associated with practice size (Madeley *et al.*, 1990; Hammersley *et al.*, 2002).

The size of GP practice lists was found to affect access to GP services. GP practices with more patients per GP (usually larger practices) were found to have poorer

access (Heje *et al.*, 2007). Previous studies have suggested that hospital admissions lower as the number of GPs per head rise (Jarman *et al.*, 1999; Reeves and Baker, 2003; Gulliford *et al.*, 2004). Studies have also suggested that that increasing the amount of GPs per head of population could decrease mortality rates overall (Jarman *et al.*, 1999; Bloor *et al.*, 2006).

Rogers *et al* (1999, p30) note there are marked differences in the number of consultations per year between different age groups and between genders, so the sex and age of patients on a GPs list may affect consultation availability. Young children (aged 0-4) and the elderly (aged over 75) have the highest consultation rates, whereas men aged 16-44 consult their GP the least; half as many times as women. Figure 2.3 shows patient consulting rates for all diseases and conditions per age group.

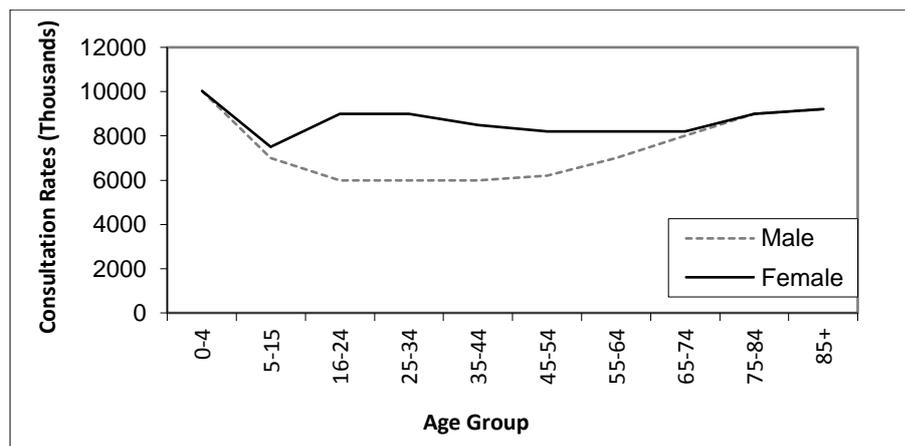


Figure 2.3: All Diseases and Conditions: Patient Consulting Rates

Source: Rogers *et al* 1999, p 32

Women were shown to access GP services more than men (Haynes, 1991; Rogers *et al.*, 1999; Wellstood *et al.*, 2006). Rogers *et al* (1999) also notes that whether a person lives alone or co-habits can affect health care utilisation. Males aged 16-64

that live alone were found to have higher consultation rates than those that co-habit. Both males and females who live alone consult their GPs for mental disorders more than those who co-habit.

The ratio of doctors to the population does not always guarantee availability of a GP as GP usage varies according to 'need'. In the UK the introduction of a 48 hour access to GP services attempted to improve access to GPs (Department of Health, 2000b, 2002b). Access to GP services within 48 hours has been greatly improved overall (Pickin *et al.*, 2004; Dixon *et al.*, 2006; Salisbury *et al.*, 2007). However as Dixon *et al.* (2006) note, one criticism of this system is that patients cannot always get to see their GP of choice. Thiede (2005) suggests there needs to be an element of trust between the patient and health care services for effective utilization to take place, and goes further to suggest that the availability of information and good communication may be key to this trust. If a person feels a service is not accessible for any reason, they may feel unable to use them (Joseph and Phillips, 1984; Curtis and Taket, 1995; Fell *et al.*, 2007). It is more likely that patients will see the same GP if in a smaller practice.

Longer consultation times have also been shown to be important in ensuring good quality of care (Campbell *et al.*, 2001). QOF assessments include payments for increasing consultation times from 5 to 10 minutes (Department of Health, 2004d). Since the introduction of pay for performance consultation times have increase and are now 40% longer per patient than in 1992/93 (The Information Centre, 2007).

Wellstood *et al.* (2006) noted patients found the geographic location of the surgery from the patients' home or work was problematic where greater distances had to be

covered to get to the surgery, and that opening hours of surgeries were particularly problematic when patients were working. How important these problems were varied between neighbourhoods, with different neighbourhoods prioritising different problems. Other factors such as the range of services on offer and the organisation of the practice were also demonstrated as important issues in patient consultation rates by Thomas and Penchansky (1984) and Hays *et al* (1990).

GPs are more likely to admit patients to the most local hospital where they have knowledge of the available services and the PCT may have a contract for services (Smith and Morris, 1994; Bindman, 1995). Patients also may be more reluctant to be admitted to hospitals far from their home. Going to hospital can be a traumatic experience for a patient, particularly if the hospital is far away from family and friends who may have trouble visiting. GPs whose practices are closer to hospitals may be more likely to refer a patient to hospital where a bed is available, than practices located further away from a hospital providing available beds. Hospital admission rates for 'potentially avoidable' conditions are found to vary with spatial proximity to hospitals and the available supply of beds (Smith and Morris, 1994; Bindman *et al.*, 1995; Johnson *et al.*, 1998a; Parker and Campbell, 1998). As (Carr-Hill, 1994) notes, a distance decay effect occurs, where admission rates decrease as distance increases. Figure 2.4 shows a hypothetical example of distance decay effect:

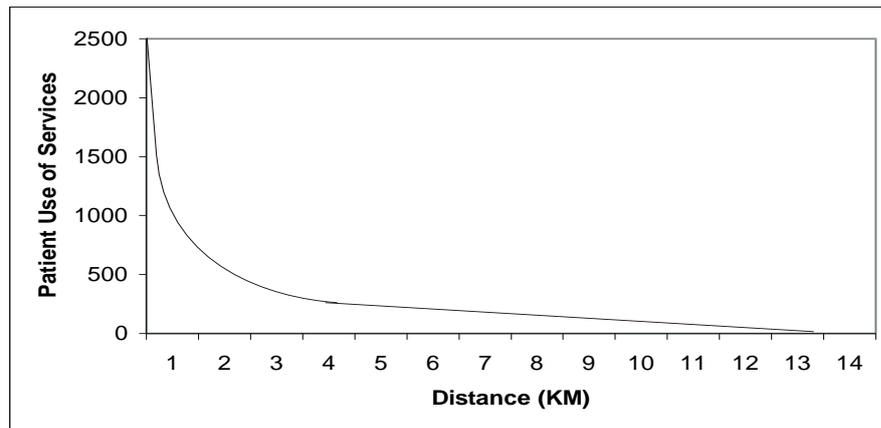


Figure 2.4: Hypothetical Example of Distance Decay Effect

This distance decay effect is particularly notable for hospital admission, but is also noted for use of GP practices, especially when studied at a wider scale such as urban/rural disparities, where rural populations are seen as disadvantaged when it comes to access to services. Within a city, distance may play less of a role, as the increase in population density tends to lead to an increase in service provision and distances correspondingly decrease (Joseph and Phillips, 1984; Rogers *et al.*, 1999). Despite this, a study by the author demonstrated this effect with hospital admissions for the older population of Barking & Dagenham in North East London (Copeland and Curtis, 2002).

Access to hospital services is also controlled for in Carr-Hill's (1994) research on factors associated with hospital use, which uses Euclidean distances to hospitals weighted by the number of beds. However proximity to a service does not guarantee accessibility. Even when the distance may appear short, other obstacles, such as mobility or transport problems may occur (Fielder, 1981).

Euclidean distance is often the measurement of choice in these types of analysis, for its ease of use when measuring distance to multiple service sites (as with this study),

however, this fails to take into account many factors of travel such as the distance by road, volume of traffic, lack of public transport or physical barriers such as rivers. Other methods that use travel distances by road are much more complicated, and involve complex models that allow for speed restrictions and volume of traffic, In contrast, Euclidean distance is relatively easy to measure compared to other methods as it uses straight line distances from one or many points to one or many points. It is often assumed that physical access to services is a problem of rural locations, but can equally apply to inner city areas.

Various models of access and use of health care have been proposed to try to overcome these problems. However models based on Carr-Hill's work, calculating access to hospital beds using a function of Euclidean distances and distance decay combined with access opportunities to compensate for differences in local provision is still the most common way to compare access to hospitals systematically across areas (Penchansky and Thomas, 1981; Carr-Hill, 1994; Curtis and Taket, 1995; Gold, 1998b). Patients themselves may visit emergency departments if access to primary care is poor (for whatever reason), particularly where there is a hospital in close proximity (Smith 1994; Bindman *et al.*, 1995). However, as Curtis *et al* (2006) state, 'historically, large hospitals in major cities like London and New York have grown up in inner city areas and they are now often located in relatively deprived areas so that socioeconomic factors and proximity to beds may be spatially correlated'. This underlines the importance of examining the significance of spatial access in studies considering the association between local social conditions and geographical variation in hospital use.

Where emergency departments are reaching targets set by the Department of Health (Department of Health, 2000b), waiting times should be no longer than 4 hours, often more acceptable to patients than waiting days or weeks to see a GP. This may put further pressure on hospital services as patients choose to use Accident and Emergency (A&E) departments rather than wait for a GP appointment. This is a further reason to consider proximity to hospitals, since admission for 'potentially avoidable' conditions via emergency units is a possibility, and further more if patients are bypassing their general practice to go directly to hospital A&E, this gives less opportunities for GPs to treat in the community conditions giving rise to 'potentially avoidable' emergency hospital admission.

Acceptability of GP services has been demonstrated as being a potential problem in a number of studies. Thomas and Penchansky (1984) and Hays *et al* (1990) showed how the gender or ethnicity of the GP or the type of disorder the patient has can all affect whether a patient feels able to consult their GP and hence avoid hospitalisation. Studies of access to diabetes services for Bangladeshi people in Bradford found language to be a barrier to accessing health care, where often, in particular with women, appointments were delayed while they waited for the availability of an interpreter (often the husband) (Rhodes and Nocon, 2003; Rhodes *et al.*, 2003). Cultural differences such as extended visits to Bangladesh where access to Western medicine is expensive or 40 days mourning periods where the widow is not allowed to leave the house (and so might miss appointments) were also cited as reasons for delaying access to health care services. A number of studies have shown increased hospital admissions associated with higher percentages of ethnic minorities (Laditka, 2003; Yuen, 2004; Laditka and Laditka, 2006; Robbins and Webb, 2006b).

Older populations are more likely to experience health problems but they are also the group most likely to experience difficulties in gaining access to appropriate health care services (The *Turnburg Report* cited in London Research Centre, 1999). It is noted by Fielder (1981, p133) that studies have shown the more deprived populations wait longer for health care services than others. Once a patient is able to access specialist health services waiting times may be unacceptably high. One effect of poor access to primary care for patients is that GPs are more likely to admit a patient as an emergency because the patients' condition may have deteriorated further to an 'urgent' state whilst waiting for services, or the GP may be using an emergency admission route to enable the patient to be seen quicker. Older people are also more likely to have long-term conditions and co-morbidities, again associated with increased hospital admissions (Gulliford, 2002).

As noted previously, primary care is considered the key to preventing 'potentially avoidable' emergency admissions to hospital. Good management of conditions such as asthma, diabetes and heart failure are critical. Primary care is not just GP provision but includes a number of different services, all of which can be instrumental in helping prevent 'avoidable admissions to hospital. The discussion here has also shown that various aspects of the supply of services and the characteristics of patients are likely to influence the ways that health services are used, including use for 'potentially avoidable' conditions.

2.6 PRIMARY CARE INTERVENTIONS

In addition to GPs, primary care includes practice nurses, district nurses, community care specialist nurses and community based pharmacists. Practice nurses provide

support and care within the GP surgery although some do home visits also. District nurses, community nurse specialists and community based pharmacists provide support for patients within their own homes by giving practical advice, advice on medications and direct intervention/care where necessary.

A number of studies have shown reductions in admissions for heart failure where nurse run heart clinics are held within general practices (Philbin and DiSalvo, 1999; Doughty *et al.*, 2002; McAlister *et al.*, 2004; Khunti *et al.*, 2007). Nurse run clinics for diabetes have also had positive effects on patient's health, and as such can help in the avoidance of hospital admissions (Goyder *et al.*, 1998; Kenealy *et al.*, 2004; Raftery *et al.*, 2005; Taylor *et al.*, 2005).

Regular visits from district nurses are associated with a reduction in emergency hospital admissions (Jiwa *et al.*, 2002; Unsworth *et al.*, 2008). District nurses tend to be responsible for daily or weekly practical care for patients, while increasingly community specialist nurses are taking over the role of monitoring patients with chronic conditions within the community. A number of studies have shown a reduction in emergency admissions for patients under the care of community nurses (Rich *et al.*, 1995; Cline *et al.*, 1998; Stewart *et al.*, 1999b; Wright *et al.*, 2007). The use of community nurse specialists for heart failure have been found to be particularly successful in reducing re-admissions to hospital (Blue *et al.*, 2001; Smith and Irving, 2001; Mehra, 2002; Newman, 2002; Stewart and Horowitz, 2002). Other studies have also shown associations in the reduction of admissions to hospital for diabetes where patients are supported by community nurse specialists (Koproski *et al.*, 1997; Wamae and Da Costa, 2006).

Early studies found the use of community based pharmacists were associated with a reduction in hospital re-admissions for patients with heart failure. It was felt that it was the most frail patients who benefitted the most (Horowitz, 2000). However the benefits of a community based pharmacist was not associated with reducing admissions for heart failure in a later study (Holland *et al.*, 2005; Holland *et al.*, 2007; Pacini *et al.*, 2007).

The effectiveness of methods by which local authorities undertake assessments for clients with complex needs can affect whether their needs are successfully met within the community (Stevenson, 1999). The *NHS and Community Care Act 1990* introduced the requirement for needs led assessments (Department of Health, 1990). Practitioners were encouraged to assess individual needs overall, rather than the need for individual services however there was no clear definition of what ‘need’ was (Parry-Jones and Soulsby, 2001). In fact the Department of Health (1990, p12) stated “[N]eed is a dynamic concept, the definition of which will vary over time in accordance with: changes in national legislation; changes in local policy; the availability of resources; [and] patterns of local demand”.

One of the most popular frameworks used for needs assessments is the life cycle model which “encourages needs assessors to think comprehensively about different population groups or different ages” (Stevens and Gillam, 1998, p1450). This model may not be fully sensitive to the variable needs of individual users as need is defined geographically at the population level, and does not distinguish between demand and ‘actual need’ (Stevens and Gillam, 1998). More recently there has been an increasing interest in an epidemiological and cost effectiveness approach. This models looks at “what is effective and for whom...[and is] normally a group [of people] with a

particular disease (Stevens and Gillam, 1998, p1451). The introduction of community nurse specialist fits more with this model.

A number of studies have concluded that a multi-disciplinary approach within the community is required to achieve an effective reduction in hospital admissions for chronic conditions (Department of Health, 1999a; Stewart *et al.*, 1999a; Stewart *et al.*, 1999b; Bound and Gardiner, 2002; Wellingham *et al.*, 2003; McAlister *et al.*, 2004; Holland *et al.*, 2005). Social services provision of community interventions play an important role in helping older people live at home. Initial indications are that using a collaborative approach to the care of patients in the community is associated with a reduction in emergency hospital admissions, particularly where collaboration between general practice and Social services is in place (Powell and Peile, 2000; Sommers *et al.*, 2000). The National Service Framework for older people (NHS Executive, 2001) emphasises the importance of integrating social and health care. These arguments suggest that a factor in 'potentially avoidable emergency admissions' may be the level of provision and organization of Social services which in the English case are provided by separate agencies, outside the NHS.

2.7 SOCIAL SERVICES - COMMUNITY CARE INTERVENTIONS

Community care, provided by social services is primarily aimed at helping clients to live as independently as possible within their own homes, thus reducing the need for patients to be admitted to hospital/long term care. The two main types of community support include the provision of help to live at home and meals on wheels. The aim of Social services community care is to provide for the personal needs of clients.

Langa *et al* (2001) suggest that community care is provided disproportionately to those already receiving some form of unpaid care and living with others. However, other empirical studies have shown increased use of community services for older populations that live alone and in deprived communities (Luker and Perkins, 1987; Arber, 1988). These observed differences may be reflecting how the use of home care services is often random, and affected by whether neighbours or friends are having home care input (Baldock, 1997). However, cost and staffing constraints within Social services mean homecare provision is increasingly restricted to those most in need nowadays

Where patients are assessed within hospitals, pressures for cost containment within the NHS, and the need to prevent bed blocking and meet performance criteria set by Government put pressure on Social services to deliver packages of care quickly so the patient can be discharged. At the same time, Social services budgets are stretched to the limit, and resources are scarce. Between 1996 and 2002 home care contact hours increased by 20 per cent, putting pressure on services (Department of Health, 2004c). Karlsson *et al* (2006) project that the number of older people receiving homecare in the UK will increase from 2.2 million in 2006 to 3.0 million by 2050.

Within London there is a shortfall in home carers (Douglas, 2002). The number of home care hours supplied in London more than doubled between 1993 and 1997 (London Research Centre, 1999, p21). Across London as a whole there is estimated to be a 20 per cent shortfall in social work recruitment, however, as this figure is averaged out over the whole city, it conceals shortfalls that are much higher

in some boroughs, creating increased work-loads and pressures for those in post (London Research Centre, 1999).

The Department of Health (2004a, 2006a) stress the importance in community care provision, including the use of Social services homecare to enable patients to remain in their own homes and thus reduce admissions to hospital. There are very few studies into the association of homecare provision and the reduction emergency hospital admissions, particularly in the UK. The few international studies that have been undertaken show conflicting results. Two studies in Italy (one of 200 patients and one of 1250 patients) found a reduction in general emergency admissions over a one year period associated with enhanced social care provision (Bernabei *et al.*, 1998; Landi *et al.*, 2001). A number of empirical studies have demonstrated that the provision of care at home reduces admissions to hospital (Rich *et al.*, 1993; Clini *et al.*, 1996; Heikkinen *et al.*, 2007). However, in contrast, a number of studies have found no association between homecare provision and hospital admissions (Pathy *et al.*, 1992; Van Rossum *et al.*, 1993; Stuck *et al.*, 1995).

In recent years there has been an increased emphasis on the integration of service planning to meet the growing health and social needs of the older population (Department of Health, 2001; NHS Executive, 2001; Naish, 2002; Barnett and Barnett, 2003a). Again evidence is mixed as to the success of the provision of integrated services in reducing admissions to hospital. Reeves and Baker (2003) found no relationship between integrated primary and Social services care provision and hospital admissions. However a number of studies found a combination of services provided by Social services and primary care services were associated with a reduction in hospital admissions (Clini *et al.*, 1996; Jiwa *et al.*, 2002).

When patients are no longer able to remain in their own homes, they may be transferred to a nursing or residential home. The number of patients in private or voluntary nursing homes rose from 18,200 in 1983 to 148,500 in 1994, an 800 per cent increase (Committee, 1996). Within inner London there is a lack of available nursing home places (Douglas, 2002). Inner London has less than two-thirds the number of nursing and residential homes per head of older people than England as a whole. The primary reason for this is a lack of cheap large properties in inner London (Philpott and Banerjee, 1997). The problem has been further exacerbated by the introduction of The Care Standards Act (Department of Health, 2000a) which aimed at improving nursing home care and facilities, resulting in closure for many of the homes that did exist whose upgrade costs proved too high. The result has been to push older people in need of long term nursing or residential home care away from their local home areas, to nursing or residential homes either in outer London or outside London completely (London Research Centre, 1999, p30). However, including homes in outer London, the number of older people supported in nursing and residential homes in London more than doubled between 1993 and 1997 (London Research Centre, 1999, p21). This increase in numbers has put an increasing burden on already overworked GPs.

In theory nursing and residential homes can work as a substitute for hospital beds, whereby patients in need of nursing rather than clinical care use nursing and residential home beds rather than being admitted to hospital (Carr-Hill and Sheldon, 1991; Carr-Hill, 1994). It is also reasonable to assume that should existing residents of nursing and residential homes become ill, they should be able to be cared for within their residential or nursing home care setting. However there is evidence to

suggest nursing home residents are inappropriately transferred to hospital when they become ill (Baker *et al.*, 1994; Fried *et al.*, 1995; Bowman *et al.*, 2001; Carter, 2003; Grabowski *et al.*, 2008; Konetzka *et al.*, 2008). Fried *et al* (1995) suggest this is partly due to a lack of communication from doctors to expressly say the patient should remain in the home. Some studies note how caring for nursing home residents is time consuming for GPs and increases their workload considerable (Black and Bowman, 1997; Jacobs, 2003).

Nursing home residents also require more care from GPs than previously as the composition of nursing home populations has changed over time, with patients who would previously have been cared for in a hospital setting now being cared for in nursing homes (Black and Bowman, 1997; Kavanagh and Knapp, 1998; Bowman *et al.*, 2001; Darton *et al.*, 2003). Carter and Porell (2003) suggest nursing homes can increase or reduce admission rates to hospitals depending on a number of factors: staffing rate, patients' composition and profit status.

So a number of factors are seen to influence access to and use of healthcare services, including availability/provision of services, individual characteristics of users and distance from the patient's place of residence to hospital. All these reasons can lead to inequalities in healthcare provision and usage and be associated with increasing/decreasing 'potentially avoidable' emergency hospital admissions.

2.8 SOCIO-ECONOMIC INFLUENCES ON 'POTENTIALLY AVOIDABLE' EMERGENCY HOSPITAL ADMISSION

However, as already indicated above, access to healthcare services is not the only factor that influences hospital admissions. As Saxena *et al* (Saxena *et al.*, 2006) note, socioeconomic factors and varying morbidity rates geographically have also been seen to influence ‘potentially avoidable’ emergency hospital admission rates. Saxena *et al* (2006) also explain that the “notion of avoidable admissions...[within the NHS]...rests on the assumption that provision of good primary care alone can drive down hospital admission rate”. As Marmot (2010) observed, health is influenced by a number of factors including ‘compositional’ effects related to aspects of the socio-demographic composition of local populations (for example ethnicity or age), ‘contextual’ effects operating to some extent upon the entire population in a place (for example closeness to a hospital, availability of GP services or the socioeconomic status of the neighbourhood) or ‘collective explanations’ (for example social norms in the community associated with smoking behaviour). However it is not always easy to categorise effects into compositional, contextual or collective as one may influence the other (Macintyre *et al.*, 2002). For example, individuals living in deprived neighbourhoods may not choose to eat healthy diets due to budget constraints (a compositional effect). Equally they may not eat healthy diets because they do not have access to fresh produce in the local area (a contextual effect), or it may be that within the local culture healthy eating is not seen as important or desirable (a collective explanation). Healthcare usage, when explored ignoring local neighbourhood socioeconomic factors may be missing important influences on health. Local neighbourhood effects may include deprivation, living alone (particularly for the older population), social fragmentation, housing

conditions, morbidity of the population and ethnicity, each of which is explored below.

2.8.1 Socioeconomic Deprivation

Amongst older populations hospital use in general is found to be greater in areas where levels of deprivation are high (Hippisley-Cox *et al.*, 1997; Copeland and Curtis, 2002). Various studies have found that there is a higher propensity for admission to hospital with ‘potentially ‘avoidable’ causes in areas with greater socioeconomic deprivation (e.g. Weissman *et al.*, 1992; Billings *et al.*, 1993; Billings *et al.*, 1996; Blustein, 1998; Jackson and Tobias, 2001; Duffy *et al.*, 2002; DeLia, 2003; Barnett, 2003; Barnett and Lauer, 2003; Marmott, 2003; Ng *et al.*, 2003). Equally many of these admissions have been found to be frequent admissions (Aveyard, 1997; Weissman *et al.*, 1999; Majeed *et al.*, 2000; Duffy *et al.*, 2002; Fellows, 2005; Lyratzopoulos *et al.*, 2005; Dr Foster Intelligence, 2006).

People in areas with greater levels of socioeconomic deprivation are generally found to have poorer health (Carr-Hill and Sheldon, 1991). It is known that within London, older populations living in the most deprived areas are twice as likely to die before the age of 75 as those living in the most affluent areas (London Research Centre, 1999). Evidence shows that the health divide in London was worsening in the 1990s, with the most affluent areas showing an improvement in relative mortality of 0.7 per cent and the most deprived areas a decline of 8.4 per cent (Bardsley, 1996).

2.8.2 Social Fragmentation

Social fragmentation (or lack of social cohesion and support) can impact on the way people cope with ill health (or in fact lead to ill health), particularly in the older

population. As Narayan et al (1999, p175) notes, “[s]ocial cohesion is the connectedness among individuals and social groups that facilitates collaboration and equitable resource distribution at the household, community, and state level.” Social cohesion can have effects on peoples’ lives in many ways, including helping to keep people healthy (Narayan *et al.*, 1999). Narayan *et al* (1999) suggests social fragmentation occurs for a number of reasons: the migration of family members to seek work, which can lead to social isolation; poverty and deprivation; and fear of crime in a community. Fear of crime is a particular issue for the older population and may lead to further social isolation and poor health (Department of Health, 1998). A number of studies have shown an association between social fragmentation and poor health (Kawachi and Berkman, 2000; Brummett *et al.*, 2001; Stjärne *et al.*, 2004; Greaves and Farbus, 2006; Zhang *et al.*, 2007).

Social and family networks are seen as important in providing support for the older population and enabling them to stay both mentally and physically well or in coping with chronic ill-health (Gallant *et al.*, 2007). For the older population, social isolation, living in poor housing conditions in poor areas and a fear of crime are all part of a causal pathway to poor health which could in turn lead to admissions to hospital for ‘potentially avoidable’ conditions. Evidence suggests that a lack of social support leads to increased risk of re-admission to hospital, particularly amongst the older population (Graham and Livesley, 1983; Williams and Fitton, 1988; Vinson *et al.*, 1990; Rich *et al.*, 1996; Brown, 1998).

2.8.3 Unpaid Care

Unpaid care plays an important role in the care of older populations, from both within and outside of the home, and it may have implications for the way that older populations use other services such as hospital care. Research by the Office of National Statistics (reported in London Research Centre, 1999) suggests ‘only a tenth of all older people would choose to live with relatives or friends if they became unable to care for themselves’. Much of the care provided informally is from people who live outside the home and visit at varying intervals. The Alzheimer’s Society (2003) suggests the bulk of care comes from family, with Social services providing on average around 5 hours a week.

Estimates suggest there are around 6 million people providing unpaid care in the UK (Disability Rights Commission, 2007). Where there is more than one person responsible for a relative or friend, over half (58%) the carers in Britain are women (Adams, 1999). As the NSF for Mental Health (Adams, 1999, p70), 1999, p70) state, “while caring can be rewarding, the strains and responsibilities of caring can also have an impact on carers’ own mental and physical health”. Despite the Carers (Recognition and Services) Act 1995 giving regular carers the right to ask for an assessment of needs, the NSF (Adams, 1999, p70) reports that there is considerable variation in whether these assessments are carried out, and how successful they are. The Disability Rights Commission (2007) note that strains on unpaid carers can lead to an increase in ‘potentially avoidable’ emergency hospital admissions and increased lengths of stay, as the carers are no longer able to cope with looking after the relative or friend at home. Without support, there is the possibility that the carers themselves will become ill and be unable to continue the care they give. A lack of

respite care in London (Douglas, 2002) could lead to further strains on NHS beds when carers can no longer cope. Despite the amount of unpaid care being provided in the UK, there are no studies that actually explore whether there is an association between the provision of unpaid care and ‘potentially avoidable’ emergency admissions which would seem particularly important for the older population.

2.8.4 Living Alone

Changing household structures over the past few decades, with a rise in single person households, an increasingly ageing population and a change in family structures and demography of families has brought about discussions over who will care for older populations in the future (NHS Executive, 1999b). As Warnes (1997) observes, London’s highly mobile population results in dispersal of family networks, leading to higher proportions of older populations living alone and without immediate family support than elsewhere in the country.

Although over-all the proportions of older populations living alone have varied little over the past 30 years, there has been a marked increase in the percentage of older people over the age of 75 who live alone, with 59 per cent of women and 32 per cent of men in this age group living alone in 2001 (Office of National Statistics, 2001a). Much of this difference between the proportions of men and women living alone is due to men dying at a younger age than women. Living alone is strongly associated with ill health and increased hospitalisation (Williams and Fitton, 1988; Copeland and Curtis, 2002; Moser *et al.*, 2005; Luttik *et al.*, 2006; Arbaje *et al.*, 2008; Jacob and Poletick, 2008; Tanaka *et al.*, 2008).

Research by Dolinsky and Rosenwaike (1988) and Grundy (1992) suggests those living alone and with little or no social support are more likely to be hospitalised than those with spouses or good social support, and are much more likely to be institutionalised in nursing homes. Cafferata (1987) suggests this may be because living with others not only provides informal home care support but can also be influential in promoting both physical and mental health.

The suggestion that living alone affects health is reiterated by the research of the London Research Centre (1999) and Bruce (2002) where it was found that social isolation as a result of living alone can lead to depression and other physical illnesses. Depression in the older population is often misunderstood and under-diagnosed (Godfrey and Denby, 1994). It is often expected for the older population to feel depressed and a number of factors are found to confound this; the onset of decreased mobility and deteriorating health, often expected with old age (Beekman *et al.*, 1995; Roberts *et al.*, 1997; Prince *et al.*, 1998); socioeconomic conditions (Harris, 2001; Harris *et al.*, 2003; Harris *et al.*, 2006) and social fragmentation/isolation (Harris *et al.*, 2003; Harris *et al.*, 2006). Depression can lead to a reduced immune system, leaving the older person more vulnerable to opportunistic infections and leading to possible 'potentially avoidable' emergency hospitalisation (Evans *et al.*, 1994; Yirmiya, 1997).

2.8.5 Housing Tenure and Conditions

Housing tenure and conditions are likely to be associated with health status and with demand for health care. A number of studies have shown an association between rented accommodation and increased hospital admissions in the UK and this is not

unique to the UK, particularly amongst the older population (Lowry, 1991; Arblaster and Hawtin, 1993; Howden-Chapman, 2004; Robinson *et al.*, 2004). There is often an emphasis on the relationship between social rented housing (from local-authorities or housing associations) and ill health. Carp (1975) notes how poor housing can be detrimental to health.

It would be a mistake to assume that all social rented accommodation is associated with ill health. Even within the same city some social housing estates are better than others and as such report better health (Byrne *et al.*, 1985; Blackman *et al.*, 1989; Byrne and Keithley, 1993). As Howden-Chapman (2004, p164) notes, “[t]his may be the result of health selection, whereby the social allocation system filters people with poorer health into certain estates, or it may be that the reputation of certain areas means that people become less attached to these communities”.

Studies of housing conditions and health used to concentrate on the social housing sector as more deprived communities tended to live in social housing. However, increasingly, studies of the relationship of rented accommodation to health are also considering private rented accommodation as the private sector gradually takes up the shortfall in social housing. The increase in private renting closely follows policies in the UK in the 1980s that encouraged home ownership by selling off much of the social housing stock whilst reducing Local Authority obligations to provide social housing. Unfortunately much of the property available to rent on the private market is family sized, often unsuitable and certainly unaffordable for the growing numbers of single households requiring accommodation, particularly for the older population (Rugg, 1997). Rugg (1997) also found that in some areas, such as those close to universities, the landlords were far more willing to opt for a selective market

and let exclusively to students, thereby excluding elderly tenants. The lack of suitable housing for the older population then leads them to accept less suitable housing that may be damp and poorly kept.

Landlords are often reluctant to rent to people on housing benefit (Rugg, 1997, p174). Crook *et al's* (1995) survey of private landlords found that 49 per cent of landlords preferred to let their properties to people in paid employment, and 29 per cent of landlords least wanted unemployed tenants (cited in Rugg, 1997, p174). This unwillingness to take on tenants on housing benefit was, in the majority of cases, explained 'by the difficulties experienced with the housing benefits system itself', including 'problems with applications and the lengthy time taken to process the benefit (Rugg, 1997, p174). Kemp and Rhodes (Kemp and Rhodes, 1997) study of private tenants found that almost half of them had a wait of between one and three months for their housing benefits to be paid. Access to the private rented market is also often restricted for financial reasons. The deregulation of the private rented sector in the 1980s led in many cases to high rent increases (Edgar *et al.*, 1989, p29). Although the older population are not unemployed, many are on lower incomes, and so may have to rely on housing benefits.

The problem of 'affordable' private rented accommodation in London is further exacerbated by the rise in house prices in recent years. Many people can no longer afford to buy houses and are forced into the private rented market, paying increasingly high rents. Central Government produced planning policies relating to the provision of 'affordable' housing in Planning Policy Guidance 3: Housing (Office of the Deputy Prime Minister, 2001), but this only related to new build housing, of which there is little in London. Much of this affordable housing is

allocated to 'key' workers and excludes the older population. All this makes it increasingly difficult for older populations to afford good quality private accommodation. As Smith (1989) notes, the elderly are among the most disadvantaged when it comes to housing and this may have statistically significant health implications.

Studies of housing conditions for the older population of London conducted by Shelter in 1997 found that 'older people occupied 32 per cent of the worst dwellings' (quoted in Howse and Prophet, 1999). It was also found that between 40 and 60 per cent of dwellings occupied by older populations were pre 1919 – the most likely to be unfit, with single households being the worst affected. These poor conditions could have a profound effect on the mental and physical health of older populations, which can in turn lead to worsening of existing health problems (Goldberg, 1972; Bartley *et al.*, 1992).

Those who own their homes are usually healthier than those who rent their homes (Hiscock, 2003). However the older population who are home owners may have problems of living in homes ill-equipped for the problems of old age, such as poor mobility but be reluctant or unable to afford to move to more 'appropriate' accommodation. Studies by Zhao *et al* (1993) found mortality rates higher amongst those elderly living in poor housing conditions. Studies have also shown a relationship between damp housing and ill health (Platt *et al.*, 1989). As Krieger (2002) notes, poor housing conditions are particularly associated with increased risk of Asthma.

It is often difficult for older people living in social housing to be re-housed, particularly as housing is allocated on a ‘needs’ basis, with homeless families with children being given priority. Housing specifically for the older population is no longer available in most local authorities because of this. This may mean older people remaining in high-rise flats, with no lifts, causing emotional distress and can lead to ill health (Conway, 1995; Halpern, 1995).

Lack of central heating is still a problem for many in the UK. As the Fuel Poverty Site (New Policy Institute, 2008) shows, although the numbers of households without central heating is decreasing over time, in 2003/2004, a tenth of households in the poorest fifth of the population in the UK were still without central heating (see Figure 2.5).

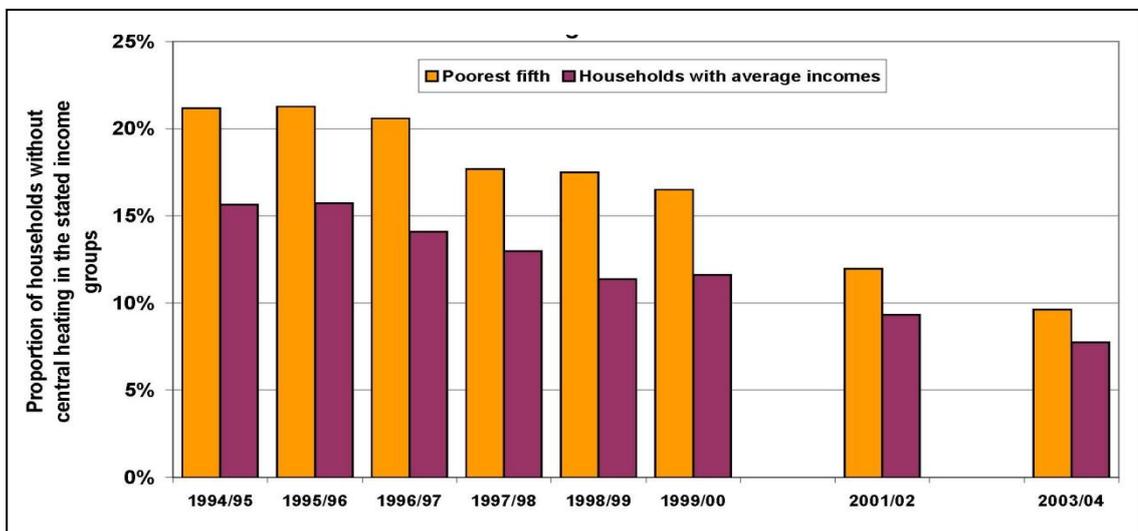


Figure 2.5: The Proportion of households without Central Heating by Year and Income Group in the UK

(Source: The Family Resources Survey, ONS; Great Britain in New Policy Institute, 2008)

As Figure 2.6 shows, the proportion of households without central heating varies by region. Rural areas have the highest proportion of homes without central heating,

however within London; some of the most deprived areas also have high proportions of households without central heating.

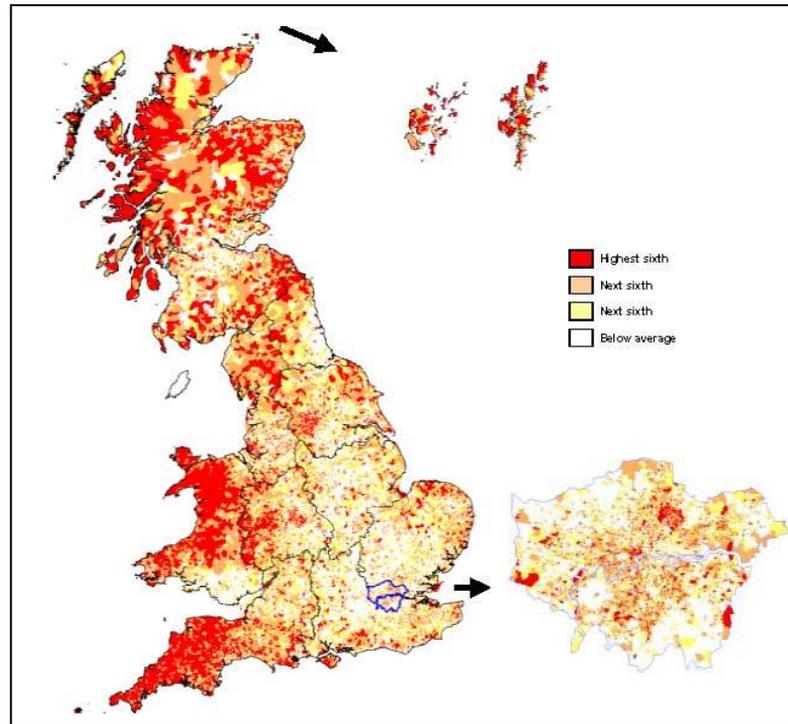


Figure 2.6: Proportion of Households without Central Heating

(Source: The Family Resources Survey, ONS; Great Britain in New Policy Institute, 2008)

It would seem that the regional variations in the proportion of households without central heating are not driven by the mix of type of tenure, with the exception of households in private rented accommodation (furnished or unfurnished) where the likelihood of being without central heating is greater (New Policy Institute, 2008).

However it is not just older people who lack central heating in their homes whose health is at risk, but also those suffering from fuel poverty. As the Baker (2001) states, “[t]he widely accepted definition of a 'fuel poor household' is one which needs to spend more than 10% of its income to heat its home to an adequate standard of warmth: 21°C in the living room and 18°C in other occupied rooms. However, fuel

poverty is not merely about cost, but “describes the interaction between low income, poor access to fuel company services, poorly insulated housing and inefficient heating systems” (Baker, 2001, p3). Fuel poverty is a major issue within the UK, affecting around 4 million households (DTI/DETR, 2001). As Figure 2.6 shows, within England in 1998, older people account for more than half of the households in fuel poverty, with older people living alone affected the most.

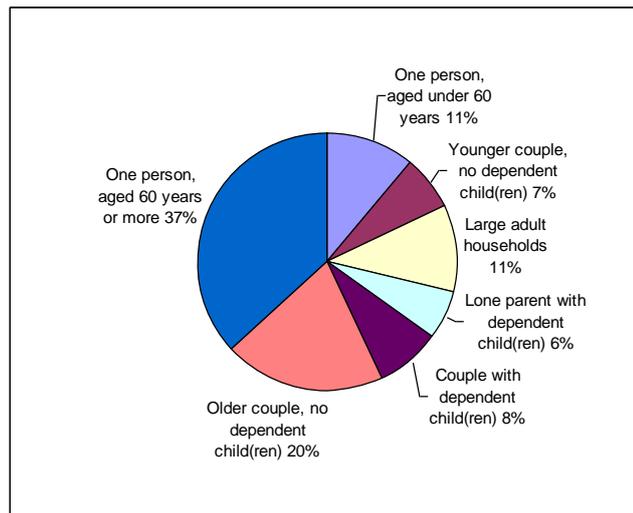


Figure 2.7: Household Composition of the Numbers in Fuel Poverty in England, 1998

(Source: Building Research Establishment Building Research Establishment, 2001)

Fuel poverty affects all housing tenures, but there are far greater numbers of households in fuel poverty amongst owner occupied homes (Building Research Establishment, 2001). Fuel poverty is as much about affordability as it is about the availability of adequate heating. The 1996 English House Condition Survey found that 0.6% of households that had central heating did not use it at all – many of these people were older people (Rudge and Winder, 2002). Mortality rates are seen to rise in winter months with around 30,000 extra deaths annually (House of Commons,

2003). It is estimated that around 80 per cent of these extra deaths are associated with changes in temperature.

A number of studies have shown an association between respiratory illness, cardiovascular diseases and lowering of temperatures in winter months particularly amongst older people (Bull and Morton, 1978; Fleming, 1993; Laake and Sverre, 1996; Rudge and Gilcrest, 2005). Curwen (1990) estimated that around a third of all excess deaths in winter were in fact attributable to respiratory illnesses and over half to cardiovascular diseases. Aylin's (2001) study of winter mortality found an association between lack of central heating and premature mortality amongst the older population in the UK.

Lack of central heating can also lead to an increased risk of damp and mould in homes. As the 1996 English House Condition Survey (Office of the Deputy Prime Minister, 1998) notes, 15 per cent of homes in England have problems with damp. As Press (2003) explains, "damp leads to growth of moulds and fungi which can cause allergies and respiratory infections" A number of studies have shown an association between damp housing conditions and increased viruses and respiratory problems (Hyndman, 1990; Packer *et al.*, 1994; Williamson *et al.*, 1997). As Williamson *et al* (1997) note, people with asthma are 3 times more likely to live in damp homes. Collins (2000) explains the reason for increased respiratory disease in damp homes is that dampness and mould trigger broncho-spasm in chronic obstructive airways disease and asthma.

2.8.6 Ethnic Minorities

Studies in the United States shows that older patients from ethnic minority backgrounds experience inequalities in healthcare provision, both at a primary and secondary level (Wolinsky *et al.*, 1989; Probst *et al.*, 2004). In the UK, higher rates of hospital admissions have been shown to be associated with ethnic minorities (Bottle *et al.*, 2006; Gilthorpe *et al.*, 1998). An increase in admission rates and more frequent admission have also been found in ethnic minority groups in other studies (Laditka *et al.*, 2003; Yuen, 2004; Laditka and Laditka, 2006; Robbins and Webb, 2006b). It has been suggested that the higher rate of admissions may in fact be related to levels of disease within the population. For instance Nyenwe *et al.*'s (2006) study of type 2 diabetics in New York found higher rates of type II diabetes in ethnic minority groups, leading to higher admission rates and more frequent admissions. A number of New Zealand studies have examined the relationship of Maori populations and health and found that even after controlling for socioeconomic conditions, the Maori population are consistently found to have poorer health and greater healthcare disparities (Ministry of Health, 1999; Carr *et al.*, 2002; Smartt *et al.*, 2002; Sporle *et al.*, 2002; Ajwani *et al.*, 2003; Bramley *et al.*, 2004; Sharpe and Wilkins, 2004). Increasingly there has been concern raised over whether in fact the relationship of ethnic minorities and healthcare use can be viewed independently of social class (Adler and Rehkopf, 2008; Kawachi *et al.*, 2005). However there are also disparities in the types of healthcare ethnic minorities receive. Evidence in the North-West of England found that Asian patients received statistically significantly fewer angioplasties than expected according to need (Gatrell *et al.*, 2002).

As the National Health Service Executive (NHS Executive, 1999a, p6) note, London has higher concentrations of ethnic minority groups in middle to later life than anywhere else in the country and has the fastest growth of older populations from ethnic minorities. Ethnic minorities report more difficulties in access GPs of the same ethnic origin (30 per cent) despite having higher consultation rates (Department of Health, 2002c). Miranda *et al* (2003) found similar problems accessing GPs in the US. Asian women also often prefer to see female doctors however this is not always possible so they may put off early treatment leading to possible hospitalisation (Abercrombie and Warde, 1994). Furthermore, older patients from ethnic minorities may experience language barriers, again leading to the possibility of a lack of early intervention of an illness, leading to hospitalisation. Ansari *et al* (2006) note how increased access to primary care can help in reducing 'potentially avoidable' emergency admissions to hospital. All of socioeconomic differences may be reflecting differences in morbidity of the population.

2.8.7 Morbidity of the Older Population

The general health of the older population is an important factor in whether they are admitted to hospital for a 'potentially avoidable' emergency admission. As seen above the causes of ill health are complex, not merely about whether a person has a chronic illness, but there are many causal pathways that can lead to ill health. Social isolation, poor housing, deprivation, and fear of crime can all affect the health status of an older person.

2.8.8 General Health Indicators

The 2001 Census asks questions about long term limiting illnesses and the general health of the respondents over the past year. The questions rely on a self-assessment so may be subject to over or under reporting. Carr-Hill's (Carr-Hill, 1994) study showed that self-reported long-term illness rates were positively associated with visits to the GP, suggesting the figures are relatively accurate reflections of varying need to use medical care.

Older people reporting long-term limiting illnesses have a propensity to use hospital care more than those who do not (Payne and Saul, 2000). Long-term limiting illness rates increase with age, and within London, increased from 26.8 per cent for the age group 60-64 to 60.3 per cent for those aged over 85 according to the 1991 census (London Research Centre, 1999, p10). Overall, those of pensionable age in London reported a lower percentage of long-term limiting illness rates (38.1 per cent) than the UK average (39.2 per cent); however inner London rates were considerably higher than outer London.

London also reported higher rates of poor health than other metropolitan cities, and again reported poor health rose with age (London Research Centre, 1999, p10). As has been seen, depression is a common long-standing illness in older populations and as the (London Research Centre, 1999, p11) notes older people with depression and other physical illnesses are more likely to die from their physical illnesses than those who have the same physical illnesses without depression. Older people living alone are also more likely to suffer from a long-term limiting illness, although it was found that clustering occurs for those cohabiting (Glaser *et al.*, 1997). A number of studies

have found an association between hospital admission rates and long-term limiting illness (Billings *et al.*, 1993; Coast *et al.*, 1996; Copeland and Curtis, 2002).

2.9 CONCLUSION

This chapter has shown how ‘potentially avoidable’ emergency hospital admissions are distinctly different to inappropriate hospital admissions. The former are medically defined conditions where hospitalisation should not be necessary given early diagnosis or intervention from GPs. Despite efforts to reduce ‘potentially avoidable’ emergency admissions, admission rates have been seen to increase in recent years. This not only increases costs of healthcare and blocks hospital beds that could be used for more routine admissions, but also has profound effects on the health of individuals. The key to preventing ‘potentially avoidable’ emergency hospital admissions is primary care; however access to primary care is complicated and multi-faceted. The rise in admission rates is unequally distributed, and leads to questions of whether this unequal distribution is down to inequitable provision of, and access to healthcare, or whether it is due to population characteristics, such as deprivation, living conditions, the morbidity of the population, or the distribution of ethnic minority populations who may have differing burdens of disease. Both access to health services and population characteristics have been shown to be associated with a rise in hospital admissions.

Concerns are also growing for the provision of paid community care for the older population as presently funding is limited and there are staff shortages, particularly in London. Currently community care tends to be provided on discharge from hospital, rather than being implemented at an earlier stage to help prevent potential

and un-necessary hospital admissions. At present much of the burden of the lack of community care is taken up by unpaid carers, often relatives, however this puts added strains on the carers, particularly when the patient becomes ill, again leading to potential hospitalisation of the patient. The use of nursing and residential homes to house the frail elderly has risen dramatically over recent years, adding to the burden of over-worked GPs who often find it necessary to admit patients to hospital rather than treat them in their homes as they are unable to take on the extra work. This can be very distressing to the patient and in many cases is unnecessary where there are nurses available in the homes.

All these factors play an important role in the study of 'potentially avoidable' emergency admissions in the older population. The aim of this thesis is to explore whether socioeconomic conditions and the provision of unpaid care is associated with 'potentially avoidable' emergency admissions for the older population of London. It then explores service level provision of care by Social services and PCTs, examining a whole health care system. Finally it explores the relationship between individual level 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham, examining the effects of GP practice provision of care and individual level receipt of Social services care (homecare and meals on wheels). The objective is to address the following more specific questions:

Is it possible to interpret 'potentially avoidable' admissions as an 'equitable' response to local need (over which local services have little control)? For example: Are 'potentially avoidable' emergency admissions ratios related to population characteristics? Is the provision of unpaid care associated with 'potentially avoidable' emergency admissions ratios?

Is provision, quality and use of primary community care and social care associated with reduced 'potentially avoidable' emergency admissions at an ecological and individual level? For example: Do varying levels of health and social care provision or characteristics of GP services have a relationship to frequent admissions to hospitals for 'potentially avoidable' conditions?

Overall the study address questions of scale of analysis influence conclusions about what drives 'potentially avoidable' emergency admission? For example: Can studying 'individuals' tell us more about health care service delivery? Does the geographic level avoidable admissions are studied at affect results?

A study of 'potentially avoidable' emergency admission for the older population in London has been undertaken to answer some of these questions.

CHAPTER 3 Methods, concepts and data sources

3.1 INTRODUCTION

As chapter 2 showed, the relationship between the use of hospitals for ‘potentially avoidable’ emergency admissions, socioeconomic factors in the population and the provision of primary, secondary and community care is complex, particularly when one considers the needs of the older population. This thesis uses an ecological study of ‘potentially avoidable’ hospital admissions for the older population in London to explore this complex relationship further, focusing on the research questions posed at the end of chapter 2.

The study uses quantitative statistical techniques to explore the relationship of socioeconomic conditions and primary, secondary health services and Social services care to ‘potentially avoidable’ emergency admissions for the older population at various geographic scales using ecological and individual level data and statistical methods. This quantitative approach involves three groups of analyses using different geographic scales for areas chosen as case studies.

At a macro level the case study involves an ecological study of the whole of Greater London, exploring the relationship between socioeconomic conditions and ‘potentially avoidable’ emergency admissions for the older population (reported in chapter 4). It explores ‘potentially avoidable’ emergency admissions and *frequent* ‘potentially avoidable’ emergency admissions for the older population at small area (ward) level using Bayesian regression. The association between the provision of unpaid care by the community along with the availability of nursing home beds and

'potentially avoidable' emergency admissions is explored; an area lacking in previous studies.

The study then explores a whole health system for the London. Using multi-level modelling techniques it explores the associations of primary care organisation (funding, numbers of GPs and the proportion of GP practices that are single-handed), Quality of Outcome Framework (QOF) scores and Social services provision of care (spending on older people, home care provision for older people and intensive homecare provision for older people) with 'potentially avoidable' emergency admissions for the older population of London at Primary Care Trust (PCT) level. It then explores whether these effects still prevail after introducing socioeconomic conditions at ward level. The results are reported in chapter 5.

The final section explores individual level data for the London Borough of Barking & Dagenham (reported in chapter 6). Data on individuals who had been admitted to hospital at least once per year (excluding multiple admissions) was joined to a data base of individuals within the practice population of Barking & Dagenham. Multilevel binary logistic regressions were then utilised to explore the relationship of GP practice level characteristics and quality of care with 'potentially avoidable' emergency admissions for the older population. Lower super output area (LSOA) level socioeconomic conditions and individual level Social services care provision was then introduced.

Using the individual level data it was then possible to identify those patients who were frequent users of hospital beds for 'potentially avoidable' conditions (i.e. more than one admission in any one financial year). Multi-level binary logistic regression

modelling was again used to explore the relationship with socioeconomic conditions, GP practice characteristics and community care provision in combination to explore how this complex integration of the varying aspects of patient characteristics and service provision impacts on service use.

The study uses quantitative techniques throughout to try to explain some of the variations in 'potentially avoidable' emergency admissions for the older population of London.

3.2 QUANTITATIVE TECHNIQUES

Quantitative techniques have been chosen as the method for this study as they are ideal for exploring large data sets (Kitchin and Tate, 2000). Quantitative analysis allows for the exploration of data at different ecological levels over time, exploring in this case how a health system works and the local socioeconomic influences on health and health care. They allow a realist approach to investigations as they allow for generalisation across large populations; large data sets can be explored, looking for causal associations so they can be used to test ideas about causal mechanisms that may affect large numbers of people, whilst at the same time recognising that there may be a degree of uncertainty (Fotheringham *et al.*, 2000). This makes quantitative techniques ideal for complex mechanisms such as a health care system for they allow us to seek “the underlying mechanisms of policy and practice that made these possible in the first place” (Kitchin and Tate, 2000, p21) .

What quantitative techniques cannot do however is explain why people behave as they do. For instance, some people choose to use accident and emergency care instead of going to their local GP service. We can surmise that this is because the

local A&E department is close by and they know they will be seen within 4 hours, however the reasons may be far more complex, involving perhaps a lack of faith in their GP, or a belief that they will have to wait weeks for an appointment with the GP while a neighbour told them they would be seen quicker at the local A&E. Whilst qualitative methods allow the researcher to use a humanistic approach, using smaller sample sizes (actual people) allowing the respondents to give a subjective response to questions, quantitative methods have the advantage of being able to explore large data sets, using information on populations and incidences in a structured way (Kitchin and Tate, 2000).

Quantitative techniques use an empirical approach that is testable and repeatable on a number of different geographic scales. They are ideal for exploring patterns of use in health care systems and explore associations with socioeconomic conditions, GP Practice characteristics and Social services provision at a variety of scales, allowing the data to be modelled and certain assumptions to be arrived at. However care must be taken over the geographic scales used.

3.2.1 Analytic Units of Analysis

Geographic inequalities in health are not just about individual behaviour but may be influenced by place effects; by characteristics of the area in which individuals live (Curtis and Jones, 1998; Mitchell *et al.*, 2000; Diez Roux, 2001). Processes operating across space, influencing whole groups of individuals in some places, can be important for health because “geographical areas are more than just containers of people but rather represent the complexity of meaning and processes associated with place” (Pearce, 2007, p2). Studying ‘contextual effects’ enables researchers to look

beyond the individual and use an ecological approach to explore the correlation between the characteristics of groups of people and thus examine the effects of place (Pearce, 2007, p2). Regression analysis is ideal for this sort of analysis.

Regression Analysis

Regression methods test the independent relationship between the *dependent* variables, in this case 'potentially avoidable' emergency admission rates, and *predictor* variables; such as the characteristics of different groups of people, and the socioeconomic conditions they live in. This is not assuming that if a relationship *is* present the predictor variables are the *cause* of this, just that it is a possible explanation and could be used as a predictor of future events. There are a number of different types of regression analysis. The simplest of these is bivariate, single level linear regression which tests the relationship between the predictor variable and one dependant variable. This only explains the interaction of one variable, possibly deprivation or living alone. In reality people may be affected by multiple risk factors and contextual as well as individual effects appertaining to where they live these effects interact with each other. Therefore using linear regression misses these important interactions. One way to overcome this is to use multilevel, multivariable regression, which allows the user to control for the effects of one predictor on the dependant variable while exploring the effect of other variables. This only explains the interaction of one variable, possibly deprivation or living alone. In reality people may affected by multiple contextual effects attaining to where they live and this effects interact with each other. Therefore using linear regression misses these important interactions. One way to overcome this is to use multilevel regression,

which allows the user to control for the effects of one predictor on the dependant variable while exploring the effect of other variables.

There may always be some degree of spatial autocorrelation between areas as “many phenomena are spatially dependant” (Tunstall *et al*, 2004). For instance, people on low incomes tend to be located near other people on low incomes. However, people do not fit neatly into their one area, whether that is a ward or district, but in fact move between nearby areas, thus taking on characteristics of those areas (Kawachi and Subramanian, 2007). To combat this problem, spatial smoothing can be used where the data for each area unit is averaged to the values of the surrounding areas.

The choice of geographic units of analysis is crucial if this type of approach is taken. As Hox (2002) explains, “if data are aggregated the result is that different data values from many sub-units are combined into fewer values for fewer high level units. As a result, much information is lost, and the statistical analysis loses power. On the other hand, if data are disaggregated, the result is that a few data values from a small number of super-units are ‘blown up’ into many more values for a much larger number of sub-units.” Therefore, whether data is aggregated to a local, regional or national level can affect the relationships observed (Tunstall *et al.*, 2004).

Geographic boundaries are manmade, and as such are subject to the Modifiable Area Unit Problem (MAUP). As Openshaw (1984, p3) explains "the areal units (zonal objects) used in many geographical studies are arbitrary, modifiable, and subject to the whims and fancies of whoever is doing, or did, the aggregating." Where boundaries are placed can therefore change the results of studies. Boundaries are often drawn up for political reasons to capture certain ratios of voters. By modifying

the boundaries, the socioeconomic structure of the populations within them may change. To see this results of changing boundaries in effect, the Redistricting Game (<http://www.redistrictinggame.org/>) developed by USC Game Innovation Lab - part of the USC School of Cinematic Arts', Interactive Media Division allows participants to move boundaries around, enabling them to select their voters and thus change the outcome of an election.

A number of authors have suggested that using aggregated data may lead to ecological fallacy (Cliff and Ord, 1981; Openshaw, 1984; Gatrell and Löytönen, 1998). It is important to avoid the ecological fallacy, which is the assumption that the characteristics of a group or area can be inferred upon individuals (Tunstall *et al.*, 2004). For instance, it could be inferred that where there are high levels of illness in areas with high levels of older people living alone, all older people who live alone will have poor health. This of course is not the case, and there will be older people who live alone who have good health.

Rather than using aggregated contextual data, one school of thought is that examining the compositional effects of individual people's behaviour explains geographic inequalities in health far better (Sloggett and Joshi, 1994; Davey Smith *et al.*, 1995; Duncan *et al.*, 1998). This would imply that "similar types of people will have similar health experience, no matter where they live" (Curtis and Jones, 1998, p647) and therefore place has little influence on health and health care. Equally, using entirely compositional explanations to explain the geographical differences in health outcomes may lead to atomistic fallacy because this would suggest these differences are entirely due to the characteristics of individual residents living in those areas, ignoring any potential neighbourhood, regional or even national effects

that may be apparent and explain the variations more clearly (Curtis and Jones, 1998). One way to overcome this is to use multilevel modelling.

3.2.2 Multilevel Modelling

Multi-level modelling is being increasingly used to adjust for the problem of using data of differing scales, particularly for hierarchically nested data (Bower (Von Korff *et al.*, 1992; Fagg *et al.*, 2006; Feinberg, 2006; Bower *et al.*, 2007). Individuals have characteristics that may be important for the outcome of interest, but may also be influenced by the local area conditions they live in, and may be influenced by what is happening at a higher geographic level. As Diez Roux (2002, p591) explains, “[m]ultilevel analysis allows the simultaneous examination of the effects of group level and individual level variables on individual level outcomes while accounting for the non-independence of observations within groups. Multilevel analysis also allows the examination of both between group and within group variability as well as how group level and individual level variables are related to variability at both levels.” Many authors have used this approach to analyse examination results within schools, exploring whether differences between and within schools are due to the status of the school (private or state) or the socioeconomic status of the student or a combination of both (Hox, 2002; Green and Berridge, 2007; Twisk, 2006).

For this study both what is happening at ward level and what is happening at PCT level is of interest. As wards nest within PCTs (Figure 3.1), multilevel analysis is ideal for answering this sort of question.

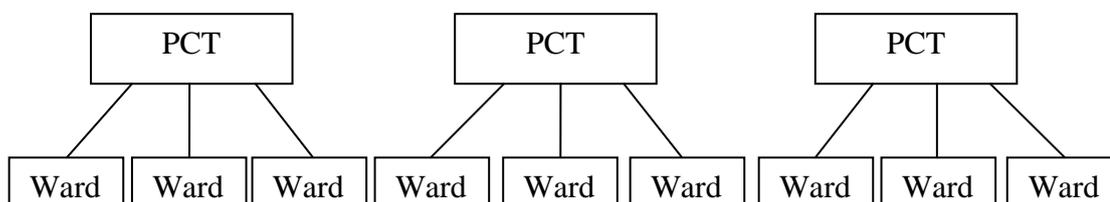


Figure 3.1: Hierarchical Structure of Wards and PCTs

Research reported below in Chapter 4 explored whether ward level measures of socioeconomic conditions and health status were associated with 'potentially avoidable' emergency admissions for the older population of London at ward level. What this cannot tell us is whether these associations are present equally across all PCTs or whether the effects are more prominent in some PCTs than others. For instance, if two groups of people are compared, living in equally deprived wards, are they equally likely to be admitted to hospital if they are located in different PCTs (that might, for example, vary in primary care provision)? These PCT differences might be illustrated as in Figure 3.2 where the graph showed increasing ward level admission rates on the vertical axis and increasing deprivation on the horizontal axis. Figure 3a shows the relationship plotted for groups of wards categorised by PCT giving a 'varying intercepts' model, as shown in Figure 3.2(a). Which shows that the relationship of deprivation to admission increases equally across all PCTs but that wards with similar deprivation levels in some PCTs have higher admission rates than others.

The trend of the relationship of ward deprivation to admission rates may also be allowed to vary among PCTs in a 'random slopes' multilevel model as shown in Figures 3.2 (b) and (c). In the case of Figure (b) the strength of the association of deprivation and admission is greater for some areas than others and the 'PCT effect' is strongest for the less deprived wards.

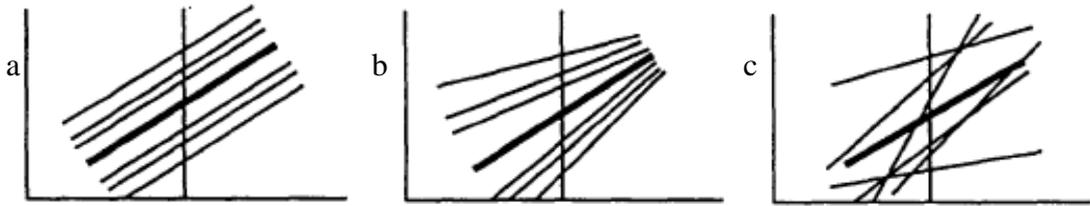


Figure 3.2: Varying Slopes and Intercepts in Multilevel Models

(Adapted from Duncan *et al*, 1996)

Equally it may be that each PCT shows a distinct pattern of variation in admissions, and whilst admissions increase with deprivation, this varies from PCT to PCT in a rather random way. This would give varying slopes as shown in figure 3.2(c).

Multilevel modelling can therefore help predict hospital admission ratios as a function of ward and PCT characteristics, exploring the contextual effects of PCT level variations in care provision whilst also taking account of influences at ward level.

Multilevel modelling further allows the exploration of cross level interactions between the wards and PCTs. Using the example of deprivation, it may have been found that admission ratios vary with level 1 deprivation at a fixed local (ward) level, whilst it may also have been found that admission ratios vary within PCTs, shown in the level 2 slope. Using cross level interactions it is possible to explore whether this variation is consistent across all PCTs or whether the effect is more prominent in more deprived PCTs.

This structure can also apply to individuals nested within areas. The health of individuals may be influenced by where they live, and by factors related to the GP practice they are registered with, and there may be cross level interactions between

them. Multilevel modelling allows the exploration of whether individuals with a similar socioeconomic or health status are equally likely to be admitted to hospital for a 'potentially avoidable' condition regardless of characteristics of the GP practice they are registered with, or whether patients registered with a better performing GP practice would be less likely to be admitted to hospital.

Human behaviour is extremely complex, and cannot be fully explained through quantitative methods alone, however quantitative methods do have the advantage of being able to look at the broader picture at varying scales. Using a variety of methods from simple descriptive techniques to Bayesian regression through to multi-level modelling enables the exploration of 'potentially avoidable' emergency admissions to hospitals at a variety of scales, exploring the mechanisms behind admissions such as service provision and ecological conditions of the population as a whole.

3.3 STUDY SITES FOR 'POTENTIALLY AVOIDABLE' ADMISSIONS FOR THE OLDER POPULATION

Chapter 4 reports the results of analysis of 'potentially avoidable' emergency admissions for the older population of London, using data on small areas (wards). Chapter 5 then continues to explore differences in scale of studies and enable the exploration of PCT level primary and Social services care. Finally chapter 6 reports the results of smaller scales studies in the London Borough of Barking & Dagenham using individual level data on 'potentially avoidable' admission rates, GP Practice population, GP Practice characteristics and community care provision. This section explores the reasons for choosing these study sites.

London has been chosen from all the UK cities as the case study site for a variety of reasons. Firstly, it has a population of over seven million people, spread throughout 649 wards and covered by 33 Primary Care Trusts. This allows for a macro scale ecological study of a health care system in operation to be undertaken, using large data sets at ward and PCT level, allowing for greater accuracy of results (reported in chapter 5) and setting the context for a smaller more detailed study later on (reported in chapter 6).

As chapter 2 showed, socioeconomic conditions play an important role in hospital admissions, with deprived and socially fragmented populations having poorer health, and poorer access to primary care services. There is likely to be a strong association with socioeconomic conditions and ‘potentially avoidable’ emergency admissions, with more deprived populations being admitted more often.

For a study of the associations of socioeconomic conditions with ‘potentially avoidable’ emergency admissions London makes an ideal study site. London has wide range of socioeconomic conditions likely to influence ‘potentially avoidable’ hospital admissions. Although overall London is one of the most successful regions in the UK, it has areas of extreme wealth and extreme deprivation. London contains some of the wealthiest and poorest Boroughs in the country (Evandrou, 2003). As the National Statistics Office (2003) notes, “the average gross weekly earnings of male full-time, non-manual London employees is a third higher than in the UK as a whole, and yet 20 per cent of wards in London are in the 10 per cent of the most deprived wards in England.”

London also has an ethnically diverse population. The latest census (2001) showed that 29 per cent of London's population came from ethnic minority groups, compared to just 9.5 % for England as a whole (National Statistics, 2003). As chapter 2 has demonstrated, ethnicity has been shown to be associated with poorer health often due to poor access to primary care services. There is a strong association between ethnic minorities and hospital admission rates.

As Evandrou (2003) notes, London is often seen as a young persons' city, however is still home to more than one million older people (over age 65) accounting for around a sixth of the population. As chapter 2 demonstrated, older people use hospital services more than any other age group, particularly those living in poorer socioeconomic areas. London is split into Inner and Outer London, and differences in the socioeconomic status of the older population are very evident. Amongst the older population 44 per cent live in social housing within Inner London, compared to only 17 per cent in Outer London and 19 per cent in England (National Statistics, 2003).

The percentage of older population living in overcrowded accommodation, living higher than the 5th floor, or housing lacking central heating, is also greater within Inner London, reflecting poorer housing conditions for the older population in Inner London compared to Outer London (Evandrou, 2003). Within Inner London, 44 per cent of the older population (over the age of 65) live alone, compared to only 36 per cent in Outer London and 34 per cent nationally (National Statistics, 2003). As chapter 2 showed, living alone may be one of the most important factors associated with 'potentially avoidable' hospital admissions for the older population. These distinct differences in social and economic conditions for the older population of

London makes London the ideal place for an ecological study of the effects of a health care system at work as it enables the exploration of whether variations in healthcare to combat the effects of combinations of socioeconomic conditions that may affect the older population have an effect.

Chapter 2 also demonstrated how morbidity is likely to be associated with increased hospital admissions in general particularly for people with long-term ill health. There are differences in life expectancy between Inner and Outer London. As Evandrou (2003, p3) reports, “[i]n 1999-2001, men aged 65 in Outer London could expect to live on average 0.8 years longer than men in Inner London. Similarly women aged 65 in Outer London could, on average expect to live 0.4 years longer than their counterparts in Inner London.” However, gross inequalities are noted within Inner London Boroughs, with life expectancy from age 65 ranging from 14.5 years to 18.1 years, with only 2 of the 14 Inner London Boroughs having male life expectancy higher than the UK average. A similar picture is observed for women.

In Outer London there is much more variability, with nine boroughs reporting life expectancy higher than the UK average and ten boroughs reporting life expectancy below the UK average (Evandrou, 2003). Self-reported ill health amongst the older population of Inner London is also higher than in Outer London when age is controlled for. Again morbidity rates correlated with deprivation and poor housing conditions at Borough level in both Inner and Outer London for the older population (Evandrou, 2003).

Although there are profound differences in socioeconomic conditions between Inner and Outer London, there are also distinct differences within these regions themselves

at ward level. As chapter 2 showed, socioeconomic deprivation, social fragmentation, morbidity and ethnicity can all have effects the health of the older populations, and the relationship between ill health and increased hospitalisation has previously been established at a cruder scale of PCTs (Bottle *et al*, 2008; Saxena *et al*, 2006). However these socioeconomic conditions may be relevant for hospital admission rates for ‘potentially avoidable’ emergency conditions at a finer geographic scale, indicating an increased need for local interventions by health care services.

As chapter 2 showed, spatial proximity to hospital beds is also likely to be an important factor in whether a patient is admitted to hospital with a ‘potentially avoidable’ condition. This can be the proximity of the patient’s home or the GP Practice, with patients living closer to hospitals more likely to be admitted than those that live further away. The distribution of tertiary healthcare in London differs from the rest of the UK. Most UK cities have one or two major hospitals, whereas Greater London has around 25 acute NHS Trusts (although some of these are specialist Trusts). This means spatial proximity to hospital beds may play a less important role in ‘potentially avoidable’ hospital admissions for the older population as there are more hospitals to choose from so distances may vary less, making spatial proximity to hospital beds less important a factor. The distribution of hospitals within Greater London is mainly a result of historical factors, with most of the hospitals being built in Victorian times by entrepreneurs. The distribution of the hospitals is seen as haphazard, “shaped in part by the growth in the size and wealth of the city populations, the illnesses from which people suffered, and the advance in the capacity of doctors to treat them” (Rivett, 1986). The location of hospitals varies

according to how they were funded. Some hospitals were built in more affluent areas, whereas a number of hospitals were built by charitable donations in more deprived areas, something relatively unique to London. As the distribution of hospitals is not necessarily relevant for present day needs of the population, and also patients may in theory have access to different hospitals in London, it will be interesting to examine how far proximity to hospital is important for admission rates.

In a large city such as London there is significant diversity of primary health care. London has 33 Primary Care Trusts covering 434 General Practices (as of 2005). As chapter 2 showed, early intervention or diagnosis at primary care level is the key to reducing ‘potentially avoidable’ emergency admissions, most commonly by a patients’ GP. Information on GP services is recorded and collated by PCTs and is available at PCT level. Although GPs work with a measure of autonomy, ultimately PCTs are responsible for GPs, and ensuring health targets set by the Department of Health are met. As each PCT is run separately under guidelines from the Department of Health, there is large diversity in health care provision at this level, and the availability of information on service organisation at PCT level allows for the study to explore the impact of varying health care provision and organisation on the variations in health care use (‘potentially avoidable’ emergency admission) for the older population of London.

3.3.1 Barking & Dagenham

As chapter 2 showed, primary care is the key to reducing ‘potentially avoidable’ emergency admissions. Primary care includes input from General Practitioners and Community Care services including homecare, meals on wheels and district nursing

and all these services combined can have an impact on reducing ‘potentially avoidable’ admissions for the over 65s. As chapter 2 noted, the provision of well coordinated health and social care for older people is an essential part of helping reduce ‘potentially avoidable’ hospital admissions, however at present, there are no routine sources of data on the important inter-sectoral aspects of service provision for older people (1).

Integrated care is being encouraged between PCTs and Social services to try to reduce ‘potentially avoidable’ emergency admission, as chapter 2 showed, and the London Borough of Barking and Dagenham is innovative in this area. At the time when this study was carried out Barking & Dagenham had a joint initiative between the PCT and Social services to share information (data) on social and primary care and hospital activity to try to establish a picture of what is happening currently and develop joint strategies to help reduce admission rates in the future. Individual level data on hospital admission rates, social care provision, GP Practice Populations and GP Practice characteristics were made available.

Although the London Borough of Barking & Dagenham was chosen primarily for the integration of services and availability of data, it is interesting in its own right. The London Borough of Barking & Dagenham is in outer London on the east side. It is relatively deprived and in fact has been identified as a ‘Spearhead’ Local Authority. Spearhead Groups were identified following the introduction of the Public Health White Paper *Choosing Health - making healthier choices easier* (Department of Health, 2004a), which identified tackling health inequalities as a priority through improvements in Public Health. The Spearhead Group consists of 70 Local

Authorities and 88 Primary Care Trusts around the country that fall within the bottom fifth of the country for at least 3 out of 5 of the following indicators

Male life expectancy at birth

Female life expectancy at birth

Cancer mortality rate in under 75s

Cardio Vascular Disease mortality rate in under 75s

In fact Barking & Dagenham falls within the bottom fifth of the country for all five of the indicators.

Barking & Dagenham has been identified as having many of the socio-economic factors known to be likely to be associated with an increase in ‘potentially avoidable’ hospital admissions, on the basis of research reviewed in chapter 2 . For example, 14 of Barking & Dagenham’s 17 wards are amongst the fifth most deprived in the UK (Department of Health, 2004f). Life expectancy in Barking & Dagenham is lower than the UK average and deaths from cancer and cardio vascular diseases are greater than the UK average. Although Barking & Dagenham’s ethnic population of 15 per cent is lower than average for London at 29 per cent it is higher than the UK average of just 9.5 per cent. The majority of its ethnic population is of Asian descent. As with the rest of the UK, Barking & Dagenham has an increasing aged population. This has led to high numbers of its older population being admitted to hospital for ‘potentially avoidable’ conditions, in particular heart failure and urinary tract/renal infections. Despite more of their older people being supported to live at home than in the rest of

the UK, Barking & Dagenham is failing to reduce the amount of admissions to hospital for ‘potentially avoidable’ conditions (Copeland and Curtis, 2002).

Barking & Dagenham has diverse population needs and deprived communities, and the Primary Care Trust is keen to reduce the health disparities seen and meet key government targets such as the reduction of ‘potentially avoidable’ emergency admission for the older population. As such the PCT and Social services are keen to integrate their services to improve these outcomes. Although they do not have any control as such over local area conditions, they are able to redirect services to the areas of greatest need and to tackle care at a primary care level.

This unique opportunity of the availability of individual level data from differing sources coupled with diverse socioeconomic conditions at a local level has allowed the exploration of an integrated health and social care system at work at an individual patient level using ‘potentially avoidable’ emergency admissions to hospital for the older population and *frequent* ‘potentially avoidable’ emergency admissions.

Overall this Greater London case study, combined with a local case study within London has enabled a study of ‘potentially avoidable’ emergency admissions at a variety of geographic levels, each level enabling a full picture of healthcare usage for the population of London.

3.4 GEOGRAPHIC UNITS OF ANALYSIS FOR ECOLOGICAL ANALYSIS

As section 3.2 showed, the choice of geographic units of analysis is an important factor in any spatial study of health inequalities. Within the UK a number of

geographic units are available, from the smallest unit, output areas (OAs), to country-wide.

In the UK previous to 2001, the smallest areas for census data were enumeration districts (EDs). EDs were manually constructed by the census office to organise the task of distributing the census by equalizing the workload. They varied in geographic area and population size and did not fit with postcode geographies. In some cases the populations of EDs fell below the threshold required for the publication of data and so this data had to be suppressed by combining EDs together. To overcome some of the problems mentioned above, Output Areas (OAs) were constructed for the 2001 census. The process involved creating bounded zones for each of the postcode units using a Geographic Information System (GIS). These postcode units “are grouped into OAs which meet a mandatory criterion on population size and contiguity and optimise the criteria of shape and homogeneity” (ONS, 2001b). Figure 3.3 shows an example of how OAs were produced.

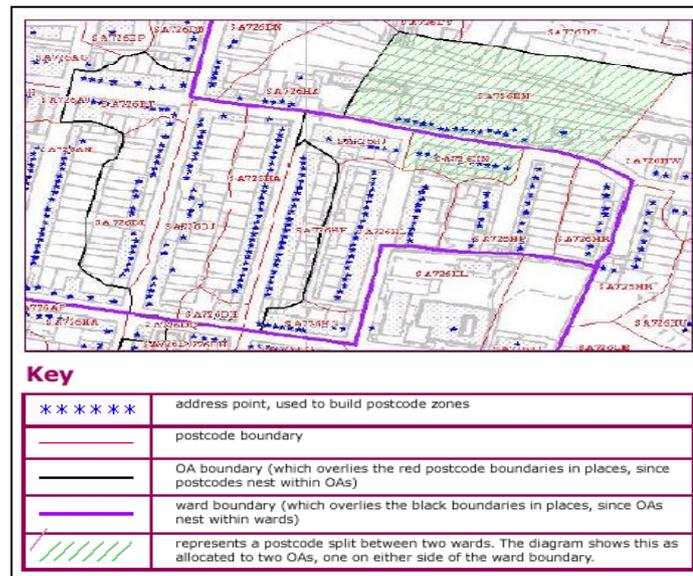


Figure 3.3: The Building Blocks of Output Geography

(Source: Office of National Statistics, 2001c))

Each OA contains an average of 124 households or 297 populations which tend towards homogeneity (Vickers and Rees, 2007). The 175,000 OAs for England and Wales nest within Super Output Areas (SOAs). There are currently two layers of Lower Super Output Areas (LSOAs) and Middle Super Output Areas (MSOAs) for which Census data are available. The LSOAs typically contains 4 to 6 output areas, with a minimum population of 1000 and a mean population of 1500 and are constrained by the Standard wards ((ST) wards) as of 2001. The MSOAs have a minimum population of 5000 with a mean population of 7200. They are built from groups of LSOAs and are constrained by the 2003 local authority boundaries used for 2001 Census outputs. Above LSOAs there are ward boundaries.

Over time, electoral ward boundaries have frequently changed, therefore in 2003 a new policy was introduced by ONS to minimise these changes and Standard Wards (ST Wards) were introduced. As ONS (Office of National Statistics, 2003a) explain, “2003 statistical wards are accordingly those that were promulgated by 31 December 2002. In general they reflect actual electoral wards as at May 2003, but for 28 local authorities they also include boundary changes that were not operational until June 2004.”

ST wards and Census Area Statistics (CAS) wards were created out of the standard wards. As ONS (2003) explain “ST wards are those for which the 2001 Census Standard Tables are available. They are a further subset of the statistical wards such that those with fewer than 1000 residents or 400 households have been merged. This was required to ensure the confidentiality of data in the Standard Tables” and “Census Area Statistics (CAS) wards are used for 2001 Census outputs ... in England and Wales they are identical to the 2003 statistical wards except that 18 of

the smallest wards (all in England) have been merged into other wards to avoid the confidentiality risks of releasing data for very small areas. This has occurred to those wards with fewer than 100 residents or 40 households”. There are a total of 8800 (ST) wards and 8850 (CAS) wards in England and Wales. The total resident population size in each electoral ward varies from 1000 people to 35,000 people (Office of National Statistics, 2002).

Above the level of wards the geography for England and Wales gets more complicated, dependant on the type of boundaries observed. For administrative purposes, wards are generally nested in to districts (local authorities) or boroughs for the case of London. There are a total of 660 districts and boroughs in England and Wales. Districts are administered by local government. They are responsible to Counties then to Regions who in turn are responsible to Central Government. However, wards also nest in PCTs, used for health provision. PCTs sometimes follow the boundaries of Local Authorities but this is not always the case. PCTs in turn nest into GORs.

As chapter 2 explained, when this research was carried out funding for health services was allocated from the NHS centrally, down to PCTs, for PCTs to then decide how that funding should be used to meet the needs of the local population. The different boundary levels and how they may affect any statistical results has to be carefully considered.

Various considerations must be taken into account when choosing geographic units, including the theoretical relevance of the unit to represent important variation in geographical space of the factors of interest, the scale of the study to be undertaken

and what data are available at each available geographic unit. For example, if the researcher were trying to undertake a study of the whole of the UK, output area data would be highly inappropriate as the units of choice would be too small, making analysis difficult and any data mapped would be difficult to see at that level. Equally a small area study using district data would also be inappropriate, as the study would only show district wide variations, and completely miss variations than can occur within districts.

For small area studies OAs can be of use, however have major disadvantages in data availability and accuracy. OA data are not as accurate as ward data. In distributing census data it was important to protect individuals anonymity, so to avoid the possibility of recognition of any individual, +/- 3 was added randomly to any data set containing small numbers over 0 (Office of National Statistics, 2001c). Much of the research on 'potentially avoidable' hospital admissions shows a relationship with deprivation (see chapter 2) however within the UK the primary data set used to measure deprivation is only available at super output level making the use of OAs inappropriate, whereas using LSOAs or above enables deprivation data to be used effectively.

For the purpose of this study a number of different geographic units have been chosen in order to best represent the scale of each part of the study.

For the study of the association of spatial proximity to hospital beds and socioeconomic conditions with 'potentially avoidable' emergency admissions for London (reported in chapter 4), statistical wards were the chosen geographic unit of analysis. Data on older patients admitted to hospital during the period 2001/2002 to

2004/2005 aggregated to 2002 statistical ward boundaries was obtained from the London Health Observatory. At the London wide scale, using wards as the geographic scale has an advantage over smaller geographic areas in that they represent areas of social and political significance for collective action, and are often considered to correspond well to recognized 'neighbourhoods' of residence. Also, pragmatically, they are easier to view visually when mapped. This means differences are more easily identified when using such a large study area. Wards also have distinct names so are more easily identified when dealing with large numbers. Using wards for the whole of London means computation of data is less 'processor hungry'.

Furthermore, when this study began, a lot of census data was not available at LSOA level. Even now, some of the variables used in this study at ward level are not available for LSOA level. This is particularly so for data appertaining to the older population, where producing data at a finer scale may cause problems with disclosure of information. Therefore at LSOA level it is necessary to use data on socioeconomic conditions for older people at OA level that has been subject to the random +/- 3 method of anonymising the data and aggregate it to LSOA level. The other alternative is to use data designed for the population as a whole, which is not exclusive to the specific needs of the older population.

For chapter 4 and 5, the analysis uses the 649 statistical wards for London in force in 2002. Most of the wards in the District of the City of London have no residential population, as most of the district is a central business district. Therefore all the wards in the City of London have been amalgamated into one district.

In chapter 5, PCT level data were added to support the next part of the analysis (reported in chapter 5). At a macro level the study explores a complete health care system. QOF data are available at the GP practice or PCT level. GP practice boundaries are not coterminous with administrative boundaries of wards or LSOAs and usually overlap each other as individual patients within one small area may be registered with different GP practices. The advantage of using PCT level healthcare data is that as explained in chapter 2, healthcare funding is distributed from Central sources to PCTs, and it is then the responsibility of PCTs to distribute funds meet the needs of their local populations. Chapter 5 therefore explores ‘potentially avoidable’ emergency admissions for the older population of London at two different geographic levels; wards and PCTs. Admissions and socio-economic conditions are included at ward level and health/Social services provision is included at PCT level. This allows the data to be hierarchically modelled and to explore whether similarly deprived wards have similar ‘potentially avoidable’ emergency admission ratios for the older population regardless of PCT/Social services influences, or in fact whether some of the variance in admission ratios can be explained by PCT/Social services organisation and funding.

In chapter 6, individual level data are analysed for one PCT, Barking & Dagenham. Geographical information about place of residence was linked to basic demographic details to provide a proxy measure of likely socio-economic conditions for the individual, or at least for their immediate residential setting. Data for OAs were ruled out on two counts, firstly because of accuracy issues with the data as discussed above and secondly because the ODPM Index of Multiple Deprivation and its component indices were not available at this level. As chapter 2 demonstrated,

deprivation appears to be associated with ‘potentially avoidable’ emergency admissions and other emergency hospital admissions in many of the studies. Also it was considered important to use a relatively up to date deprivation index that was available at LSOA level but not below, so this was chosen as the unit of analysis for exploring the association of socioeconomic conditions with ‘potentially avoidable’ emergency admissions for individuals in the London Borough of Barking & Dagenham. GP practices have also been chosen as a study unit in Barking & Dagenham. By using individual level data, it is possible to explore whether GP practice characteristics have an influence on whether older individuals are admitted to hospital with ‘potentially avoidable’ conditions, or whether in fact these variations explained by the socioeconomic conditions of where they live or a much more complex combination of both.

3.5 DATA FOR ANALYSIS AND DATA PREPARATION

The aim was to explore the relationship between urban socioeconomic conditions, health and social care provision and healthcare use in old age using *all* and *frequent* ‘potentially avoidable’ hospital admissions for the older population at a number of geographic scales. This was done using a combination of multiple regression techniques and multilevel modelling of the type outlined above. This research involved a significant amount of work to generate and combine a number of data sets from a wide variety of sources, each of which will be explained in detail below. This section describes the data used, how the data set was operationalised and the methods used in the analysis.

3.5.1 'Potentially Avoidable' emergency admissions

As noted in chapter 2, 'potentially avoidable' emergency admissions refer to emergency admissions to hospital where hospitalisation 'should not be necessary if adequate primary care is in place' (Department of Health 2000) and therefore can be an indicator of how primary and community care is performing.

The defining conditions for 'potentially avoidable' emergency admissions have been taken from the National Health Service Definition (discussed in Chapter 2), using only the primary diagnosis. The data have been classified according to the World Health Organisation (2007) *International Classification of Diseases Version 10* (ICD-10) three digit classifications using the following conditions and codes:

ENT Infections	H66	J02-J06	J31
Kidney/Urinary Tract Infections	N15	N30	N39
Heart Failure	I11	I50	
Asthma	J45	J46	
Diabetes	E10-E14		

On discharge from hospital, information about the patient and their reason for admission is recorded on a hospital discharge form. Every medical condition has a code assigned to it from the ICD10 code records (World Health Organisation, 1992). Specially trained staff take the discharge records for each person, convert the diagnosis to the relevant ICD10 code and electronically record the information on a database. The primary reason for the person's admission is recorded as a primary diagnosis. The records also include information on the type of specialty the person was admitted under, any procedures undertaken, personal details of the patient (such as date of birth, age, sex and address) and details of who provided the care (i.e.

which hospital they were admitted to). This information is then be submitted to the NHS Information Centre to be recorded on the Hospital Episode Statistics (HES) data base.

Data for ‘potentially avoidable’ emergency admissions to hospital for the older population for the financial years (April – March) 2001/2002 to 20054/2004 for London using the definition given above was obtained at ward level. This was the most up-to-date data available at the time. The data were obtained from the London Health Observatory. The total numbers of admissions and number of frequent (or multiple) admissions for each condition were obtained for each financial year (April 1st – March 31st) by 10-year age group (65-74, 75-84, 85 plus) and by sex.

PCT boundaries in force in 2002 are used in this analysis for chapter 5, where PCT and social service care provision is introduced. Some of the PCT boundaries changed in 2002 (due to administrative changes at district level) so to ensure the accuracy of modelling it was important that any data requested/downloaded at PCT level for this study were from areas compatible with the 2002 geographic boundaries.

Barking & Dagenham Primary Care Trust provided complete individual level HES data for patients over the age of 65 living in Barking and Dagenham with the NHS code, address details except postcode, and date of birth removed, for the years 1997 to 2005 (1st April to 31st March). Each of these large data sets contained around 70,000 records on all hospital admissions for the over 65 population for each year. The data contained information on the sex, age group (10-year age-band), postcode and GP practice code of each patient. Any records where any one of these attributes was not included (or had been recorded incorrectly) were removed. The data also

included the ICD10 code for the primary diagnosis and all subsequent diagnosis codes, episode and spell start and end dates, provider codes, admission method and source codes, the code for the admitting hospital, discharge destination codes and the financial year. The data with the relevant ICD10 codes for 'potentially avoidable' emergency admissions had to be selected. The study was only to include those patients living within the boundaries of each PCT and registered with a GP included in the study. This enabled the data to be aggregated to either LSOAs or GP Practices, ensuring the same data was included for both.

Before any of the individual level analysis could take place, whether or not each record related to an individual, or in fact were multiple admissions for the same patient had to be identified. To protect the anonymity of the patients the hospital admissions data sets were supplied without NHS numbers, dates of birth or full postal addresses attached. Furthermore, the community care data (home care and meals on wheels) also used different identification system so the ID numbers of the different data sets couldn't be matched. A method was produced to enable the joining of the different attributes of each patient to create unique 'pseudo-identities' for each patient. This then made it possible to identify the frequent users, and join the community data to the admission data to identify those patients receiving community care. For each individual record in the admissions and community data sets, the data contained four specific attributes: the patients' postcode, sex, 10-year age band, and GP Practice code. 'Individual' persons were identified using unique combinations of these four attributes. A new code was created for each 'individual' person by concatenating the four attributes to produce a code as below (in this case a pseudo code):

	Sex	Practice
		Code
RM109BX	M 75-79	F82001
Postcode	Age-	
	band	

When creating an ‘individual’ person it was assumed that:

For a discrete population, at any given postcode, there will only be a small number of households (on average for the UK there are 14 households per postcode).

It is unlikely that any 2 people within the same postcode will be of the same sex, have the same age band and be registered with the same GP

For all the services of interest age, sex, GP Practice, and postcode will be recorded.

In order to test the method, Barking & Dagenham PCT provided data for all emergency admissions for patients over the age of 65 with NHS numbers (replaced by unique IDs for confidentiality purposes) still attached for the financial year 2000-2001. The data set consisted of 3,945 records, of which 3,582 of the records (91%) had their unique NHS ID numbers attached. The NHS ID numbers identifies individual people, as each person on first registering with an NHS service (usually at birth) is given an individual NHS ID number. The emergency admission records were used for testing the synthesising process for creating ‘individual’ people. It was found that of these 3,582 records, 87% of the people with unique NHS ID numbers could be unambiguously identified using the triangulation method. A number of reasons for data not matching were identified, including:

The patient moved address within the area

The patient had a birthday between admissions and moved age band

The patient changed GP practice

There is more than one person sharing these attributes, for example living in a nursing or residential home at the same postcode.

It was not possible using this method to account for changing address or moving up an age band, however it was possible to test whether individuals having the same attributes were the same patient each time (i.e. frequent users), or whether they were separate patients. To begin with, potential frequent users (those patients with more than one admission in any one financial year) were identified using the unique 'individual' person code with a value of 1 assigned to potential multiple people and 0 to definite individuals. The data on individual GP practice populations (described in detail below) then had the same four attributes (age band, sex, GP practice code and postcode) concatenated and the data aggregated to allow for whether or not those attributes were assigned to individual patients or to multiple patients. This data was then joined to the admissions data, and where single individuals were identified, their potential frequent user code was changed to 0 to show they were definitely individuals with multiple admissions rather than multiple admissions.

There were still some patients remaining who could be individuals with multiple admissions or could be separate people, as there were more than one individual with those attributes in the GP practice data set. There was still the potential that information appearing to indicate individuals with multiple admissions could be produced by single admissions for each of a group of residents living in a nursing home, at the same address. Therefore the data set on the location of nursing and residential homes was joined to the 'individual' people hospital admissions data set

by the postcode. If there were multiple people sharing the four attributes and there was a nursing or residential home at that postcode then the data were explored further. As the numbers were fairly small (less than 40 cases) each set of potentially multiple or individual records were examined by hand. Now the reason for admission was explored. If the patients had the same underlying cause of admission it was assumed that they were the same patient (although potentially it is possible that 2 or more patients in a nursing/residential home with the same individual attributes could have the same reason for admission but it was assumed this was highly unlikely). The further causes of admission were also examined as if a patient suffers from diabetes for example, then this should be recorded somewhere on the admissions records even if not the main cause for admission. Now a data set of individual level admissions with an identifier for whether or not the patient had multiple admissions was complete for the older population of Barking & Dagenham for the financial years 2001-2005.

3.5.2 Population

In order to accurately produce standardised admission rates (SARs) for 'potentially avoidable' hospital admissions for the older population, population data were required for each of the financial years of admission data used. Population data for each financial year was requested along with the 'potentially avoidable' hospital admissions data for older people from the London Health Observatory. In each case the population data are based on population estimates.

In the UK, yearly population statistics are based on mid yearly population estimates as recorded by the Office of National Statistics. They use the latest census data

(collected every 10 years) as a starting block, and then each year (April) add on a year to each person's age. The numbers of registered births during the year are added on and the number of registered deaths during the year is subtracted. The migration of residents to, from and within the UK is then included. Migration statistics within the UK are calculated using data supplied by local health authorities on patients moving GP practices, as it is believed most residents register with new GP practices within 1 month of moving residence (Office of National Statistics, 2001b, 2003b).

GP practice data cannot solely be relied upon, however, as it is estimated that approximately 6 per cent of addresses held by GPs are inaccurate or out of date (Public Health Network, 2003). Inaccuracy may occur due to not registering newborns, failure of young adults to register with a GP or (more relevant here) the failure to remove deceased patients from the GP Practice register. A minority of people may delay registering with a new GP when moving address; however older patients are more likely to have on-going conditions (related to old age) and are therefore more likely to change GPs sooner. Furthermore the Office of National Statistics (2003b) noted that "[t]he July 2003 patient register count of persons was 2.74m greater (5.2 per cent) than the England and Wales mid-2003 estimate, thus indicating list inflation. For some areas e.g. London Boroughs, the list inflation is more pronounced." This partly because as the ONS (2003b) explain GPs are paid according to list size so there is no incentive to remove patients who have died or emigrated from their lists. Also some patients may be erroneously registered with more than one GP Practice and have multiple NHS numbers.

Data on migration into the UK comes from the Home Office, including data on asylum seekers. The International Passenger Survey that is conducted at airports

provides data on migration out of the UK. The varying sources of data are then combined to produce mid-year population estimates (Office of National Statistics, 2003b). The advantage of using population estimates is that it takes into account internal and international population migration, births and deaths each year, rather than relying on a static population count on census night every ten years. Census Population Data from 2001 has also been used to calculate census-based demographic statistics. The census records data on age and sex for every person in England and Wales resident on the night of the census. The data is published in age bands and sex, aggregated to output areas, wards, districts and counties etc. Census data has the advantage of being extremely accurate as it records actual counts of the population. It is available to a low geographic level; census output area, however, as explained earlier, the census randomly adds or subtracts 3 to small numbers to protect against disclosure of information. Therefore for the individual level study in Barking & Dagenham LSOA level data was used where appropriate. For London, ward level data was used.

For Barking & Dagenham, population data were generated as follows. A register of individual patients registered with GPs within the PCT was provided. The records contained the same attributes as the admissions data, GP practice code, postcode, sex and age band for each patient. Patients living outside the boundaries of Barking & Dagenham were removed. The four attributes were concatenated as per the admissions data to produce individual patients. This data was then aggregated to show where there was more than one patient with the same attributes. Where it was sure the concatenated code belonged to one patient only, the 'potentially avoidable' hospital admissions data was 'matched' directly by the concatenated code to the GP

practice register of patients. However where there was more than one person with the same attribute the matching process was more complex. Codes identified in the GP practice patient register as belonging to more than one person were given a further identifier in the concatenated code to identify them as individuals. The same coding system was used on the multiple people in the ‘potentially avoidable’ emergency hospital admissions data set (adding a 1, 2 or 3 to the concatenated code for each individual with the same code). Now the ‘potentially avoidable’ emergency hospital admissions data for multiple individuals could also be joined to the GP patient data base, ensuring no duplicate entries occurred. The postcode for each record was matched to the relevant LSOA the patient lives in using a National postcode lookup table provided by the Office of National Statistics. The outcome was a data set of individuals registered with GP practices within Barking and Dagenham and living in the boundaries of Barking and Dagenham, with the LSOA of where they lived, whether they had been admitted to hospital as an emergency for an ‘avoidable’ condition and whether they had multiple admissions.

3.5.3 Hospitals

Only data on the number of beds per NHS hospital trust were readily available online. As trusts may include a number of hospitals, and trust headquarters may not be located at any hospital site, each individual trust was contacted and information on the number of acute and care of the elderly beds was requested under the freedom of information act. The address of each hospital was then looked up online. The postcode of each hospital was then matched to geographic coordinates using ArcGIS and a file supplied by the Office of National Statistics (UK) containing postcodes for Britain and the corresponding output area population weighted centroid (accurate to

100 meters). This allowed a map layer to be produced showing the number of available beds per hospital using graduated symbols. The data were further used to produce a spatial proximity to hospital beds score.

3.5.4 Spatial Proximity to Hospital Beds (Access)

As demonstrated in chapter 2, several studies have shown closeness to hospital beds can increase hospital use, particularly if access to GP services is poor (Bindman *et al.*, 1995; Johnson *et al.*, 1998a; Parker and Campbell, 1998). This effect decreases exponentially as distance decreases. Spatial proximity to hospital beds uses the data on the location of hospitals and the number of beds available. The Euclidean distance for the populations' place of residence to the ward centroid containing each hospital with beds was calculated using Pythagoras. This distance was then used to create a general measure of spatial access opportunity based on a gravity model (which expresses the 'friction of distance' as the square of measured distance so weights longer distances most heavily).

The model assumes that equal competition to hospital beds occurs throughout the population, however patients living closer to hospitals are more likely to use those services than those further away, creating a distance decay effect (Carr-Hill, 1994). The distance travelled to a hospital is also dependant on the supply of beds; although someone with a 'potentially avoidable' emergency condition may have a hospital within close proximity, if the number of beds available is small, they may have less chance of admission unless they travel further to a hospital with a greater number of beds.

Access to each hospital is ‘shared’ among small areas across the city rather than there being specific catchment areas for hospitals. Therefore, the Euclidean distance from the population to the available number of hospital beds in each hospital was used to create a measure of access to hospital assuming a distance decay effect is in operation, proportional to squared distance (d^2). The spatial proximity to hospital beds for each ward was based on the formula provided by the work of Carr-Hill *et al* (1994):

$$A_i = \frac{\sum_k B_k / d_{ik}^2}{\sum_i P_i / d_{ik}^2}$$

where A_i = Access score for i^{th} ward

B_k = No of Beds Available in hospital k

d_{ik} = distances from k^{th} hospital to i^{th} ward respectively

P_i = population in the i^{th} ward

As chapter 2 showed, using spatial proximity to hospital beds as a measure of access to hospitals has been subject to a number of criticisms, and a number of alternative methods suggested. However many of these methods do not use variables that are easily measured (e.g. patient satisfaction with services or appointment systems); therefore the method described above was considered the most suitable.

3.5.5 Socioeconomic Deprivation

Numerous studies have shown there is a significant positive relationship between ‘potentially avoidable’ hospital admissions and deprivation (see chapter 2). Within the UK, three main measures of deprivation are used in research of this type in England, including the Jarman score, the Townsend score and the Index of Multiple Deprivation, all using ecological data. At GP practice level LISI scores are also used.

3.5.5.1 Jarman Score

The Jarman score was developed in the mid-eighties as a measure of General Practice workload, by assuming more ‘deprived’ populations used GP services more (see appendix 1 for the variables used). The Department of Health uses this score to determine the additional ‘deprivation’ payments made to GPs in areas with greater ‘need’. The Jarman score is useful for measuring deprivation at a small level and is available at both GP Practice and Ward level with the data readily available from the census. However it uses ecological census data, so does not measure variations of deprivation that may be found within wards and can quickly become out of date. It does not indicate the proportion of people in an area that are deprived and is biased towards areas with greater densities of population. Demographic as well as socio-economic variables are included in Jarman score because it was designed to reflect factors likely to increase workload, as perceived by General Practitioners, it is therefore not a ‘pure’ indicator of deprivation of the local population (Davey Smith, 1991; Carr-Hill, and Sheldon, 1991; Talbot, 1991)

3.5.5.2 Townsend Material Deprivation Score

The Townsend score was also developed in the mid-eighties in response to the limitations of the Jarman score as a measure of deprivation (see appendix 1 for the variables used). The Townsend Index of Deprivation is useful for measuring deprivation at a small level and data readily available from the census. The Townsend Index has been found to be highly correlated with measures of ill health e.g. self-reported long-term limiting illness or standardised morbidity rates (Morris and Carstairs, 1991). Also, because it uses the sum of the standardised scores it is easy to calculate. However because the Townsend Index uses census data it quickly becomes out of date and it also only uses a few variables in its calculations, so is not representative of the whole population, and can be very unrepresentative of the older population. Furthermore, for London, including the variable on households not owning a car can be misleading as non-car ownership is not always associated with deprivation in London due to the lack of available parking and the provision of public transport.

3.5.5.3 Index of Multiple Deprivation (Office of the Deputy Prime Minister, 2004)

The ODPM Index of Multiple Deprivation (IMD) (Office of the Deputy Prime Minister, 2004) uses a wide variety of data sources including the 2001 census, benefit claims, asylum seeker claims, education statistics, crime statistics and measured distances by road to a variety of services. The IMD (2004) consists of seven domains. In addition to these main domains, a number of sub domains are included, most notably, the Income Deprivation Affecting Older People Index (IDAOPI). For a more detailed account of how the IMD 2004 is constructed and the

sources of data used see appendix 1. The IMD has the advantage of using the most recent data available and is updated bi-annually so remains current. It uses a much wider source of data than other indices. As well as an overall deprivation score, different domain scores are also provided including one for older people. It provides rankings for the whole country, so areas can easily be compared to the national average.

The 2004 IMD is difficult to compare with earlier ODPM deprivation indexes as it uses different boundaries and a different set of variables to previous indices (such as the 2002 index which used 1998 electoral ward boundaries). Furthermore, as much of this study uses census variables to describe socioeconomic conditions, then some inaccuracies may occur using the 2004 deprivation index rather than the 2002 index which would be closer to the census year for accuracy, but uses 1998 rather than 2002 electoral ward boundaries, so is not compatible geographically.

The 2004 IMD (ODPM) has been chosen for this study however, as it has the advantage of being the most accurate of the deprivation scores and is also the most recent at the time the work was conducted and the most commonly used in other UK studies. The IDAOPI was also included as this domain is more specific to the older population, whereas the IMD is calculated for the whole population. As the data are provided only at Lower Super Output Level (LSOA) or PCT level, it required converting to wards. A LSOA to ward lookup table was obtained from the Office of National Statistics. Using 2004 population data at LSOA level it was then possible to convert the LSOA deprivation scores to wards. For each LSOA, the IMD score was multiplied by the population. The LSOA scores for each ward were then summed and divided by the total population for each ward to give a ward level IMD score.

This was also repeated for the IMD Affecting Older Peoples Index (IDAOPI). For the individual level study of Barking & Dagenham, the IMD (2004) and IDAOPI scores were converted to GP Practices. To do this a table of the number of people from each GP practice and which LSOA they lived in was devised. From this, the proportion of each practice population living in each LSOA by GP practice was calculated and the deprivation scores proportioned accordingly. The deprivation scores were then added up across all people from each practice and divided by the total population for each GP practice. The LSOA level data was also maintained for the analysis of individual level admissions in chapter 6, and PCT level deprivation scores were obtained for the ward and PCT analysis in chapter 5.

3.5.6 Social Fragmentation

As chapter 2 showed, there are a number of factors about the way people live that may lead to poor health in the older population and thus admission to hospital for a 'potentially avoidable' condition. These factors include the living conditions of the population, with rented accommodation and living in high-rise flats (which for the older population tended to be rented flats) showing a high association with increased hospitalisation for the older population. Furthermore there is evidence that living alone for older people is associated with admission rates, as is living in overcrowded accommodation (which is highly associated with increased mental health problems and further ill health). Congdon (1996) devised a social fragmentation index by creating a composite index derived of standardised rates of single person households, none married adults, population turnover and private renting as these factors were associated with increasing rates of suicide. For this study, a social

fragmentation index has been produced based on Congdon's (1996) index but adapted to be more representative of the older population. The index has been altered to include variables that reflect either social isolation for the older population, or poor living conditions. The index includes: the percentage of older people living alone; the percentage of older people living in overcrowded accommodation; the percentage of older people living in rented accommodation; and the percentage of older people living on the fifth floor or above. These variables have been chosen in particular as they are shown to have some degree of correlation between them for London as a whole as table 3.1 shows:

	alone	overcrowd	rented	5thfloor
alone	1			
overcrowd	0.601	1		
rented	0.730	0.744	1	
5thfloor	0.574	0.608	0.588	1

Table 3.1: Correlation Between Social Fragmentation Variables

It may seem strange that there is a correlation between living alone and overcrowding, however there are some wards in London where housing is very mixed. In fact Earls court not only has the highest percentage of older people living alone (66%) it also has the highest percentage of older people living in over-crowded accommodation (43%). There was no correlation with migration, households lacking amenities or the crime domain of the Index of Multiple Deprivation (ODPM 2004) so these 3 variables were omitted from the final social fragmentation score. The index was created by standardising each of the variables to enable variables with different distributions to be combined. The data sets was then added together and restandardised. A social fragmentation index was calculated for LSOAs, wards and

PCTs (using the same data obtained for each geographic level) as the social fragmentation index is included in each chapter of the analysis.

3.5.7 Living Alone

Living alone was included as a separate variable even though it is included in the social fragmentation index. This is because of the overwhelming evidence seen in chapter 2 that living alone is associated with increased hospital admissions, particularly for the older population. The percentage of older people living alone was calculated for LSOAs, wards and PCTs (using the same data obtained for each geographic level) as the percentage of older people living alone is included in each chapter of the analysis.

3.5.8 Morbidity Index

Ill health has been shown to be associated with ‘potentially avoidable’ emergency for the older population in London (see chapter 2). However although it may seem obvious for ill health and hospital admissions to be associated, there are more complex causal pathways in operation, with local living conditions and the provision of care all affecting health and possible admission to hospital. The Morbidity index has been designed to try and reflect this complex pattern. Chapter 2 showed how living in rented accommodation is associated with poor health, and that the provision of unpaid care can be stressful for the carer, so as well as the obvious long-term limiting illness and bad health variables from the census, variables have been included to reflect this. The morbidity index therefore consists of a number of correlated variables including: the percentage of older people with a long-term limiting illness; the percentage of older people living in rented accommodation with

a long-term limiting illness; the percentage of older people reporting bad health; the percentage of older people living in rented accommodation with a long-term limiting illness and bad health; and the health domain of the Index of Multiple Deprivation 2004. Table 3.2 shows the correlations between these variables:

	lli	rentlli	badhealth	rentbadlli	health domain IMD
lli	1.00				
rentlli	0.58	1.00			
badhealth	0.89	0.43	1.00		
rentbadlli	0.66	0.73	0.69	1.00	
health domain IMD	0.81	0.35	0.87	0.54	1.00

Table 3.2 Correlation Between Morbidity Variables

As with the social fragmentation index, the morbidity variables were standardised, added together and re-standardised to produce a final morbidity index. A morbidity index was calculated for LSOAs, wards and PCTs (using the same data obtained for each geographic level) as the morbidity index is included in each chapter of the analysis.

3.5.9 Ethnicity

In chapter 2, the specific needs of ethnic groups in relation to ‘potentially avoidable’ emergency admissions for the older population were discussed and showed how ethnic minority groups can have difficulty accessing primary care, leading to increased hospital admissions for ‘potentially avoidable’ conditions. Therefore the percentage of older people from ethnic minorities variable has been included in this study. Nursing and Residential Home Care

As chapter 2 showed, nursing and residential home residents increased health needs (particularly for nursing home residents) can impact heavily on a GPs workload. As such hospital care is often used inappropriately for some patients in an effort to reduce GP and staff workloads. Whether a nursing or residential home is present in an electoral ward has therefore been included in the study to reflect this extra burden of. For the localised study, whether each patient is resident in a nursing or residential home is flagged and this variable included in the analysis to explore the association with 'potentially avoidable' emergency admissions for the older population.

3.5.10 Unpaid Care

Unpaid care is measured in the Census 2001. The question asks whether the respondent provides any unpaid care and they are asked to tick boxes accounting for the amount of unpaid care provided from 5 hours per week to over 50 hours per week. Evidence in the literature to support whether unpaid care was associated with reducing admissions to hospital was sparse. Certainly it would seem studies suggested that providing a lot of unpaid care could be stressful on the care giver. Therefore the proportion of the population providing any amount of unpaid care and the proportion of the population providing over 50 hours of unpaid care has been included. This enables a comparison to be made to explore whether a smaller amount of care could in fact help in reducing 'potentially avoidable' hospital admissions, whereas it was suspected that a higher amount of unpaid care may be reflecting a higher burden of disease which may show in an increase in admissions.

3.5.11 GP Practice Characteristics and Service Delivery

As chapter 2 showed GPs play an important role in patient care in the community, – swift and timely access to a GP is essential in preventing unnecessary admissions to hospital. Equally once access to a GP is obtained, how effective the care is also plays an important role in the prevention of admissions to hospital. As data on individual practices was not available for the whole of London, data was obtained by PCT. This had the advantage of being able to see the effects of service organisation on a wider scale, as it was expected that there would be wide variation in the number of whole time equivalent GPs at PCT level as numbers tend to increase with affluence of the local population.

Until very recently with the introduction of the Quality and Outcomes Framework (QOF) in 2004 there was little way of measuring GP Practice efficiency. QOF records data from each GP Practice on service provision and practice management along with indicators of clinical needs for patients, and information is readily available at PCT level. The QOF system was introduced primarily to determine practices' QOF payments but has equally become useful as a tool of measurement for researchers and health care managers. Although records only began in 2004 and therefore do not date back through the whole time period for this study, they can still be useful as it is unlikely that many of the records will have changed in the last two to three years. The data is split into 3 main sections: clinical indicators; organisational indicators; and a domain summary.

Clinical indicators can be a useful tool for assessing how well on-going management of patients with chronic diseases is performed. It looks particularly at the recording

of information in patients' records to observe whether certain clinical guidelines for their disease management have been adhered to; for instance the recording of blood pressure for patients with Coronary Heart Disease. Evidence of disease management is monitored for the following conditions (Table 3.3):

Coronary Heart Disease	Epilepsy
Left Ventricular Dysfunction	Hypothyroidism
Stroke or Transient Ischaemic Attack	Cancer
Hypertension	Mental Health
Diabetes	Asthma
Chronic Obstructive Pulmonary Disease	

Table 3.3: Conditions included in QOF Disease Management
(Department of Health, 2004d)

The data are recorded as the total points achieved, and the total points achieved as a proportion of the maximum points available, expressed as a percentage for each PCT. A total of 550 points are available for the clinical indicators domain. A total of the clinical indicator domains are also provided as part of the domain summary (under disease domain). These individual clinical indicator scores enable the effectiveness of GP practice in the prevention of hospital admissions to be measured at PCT level, particularly for asthma, diabetes and heart failure (where coronary heart disease can lead to heart failure). Equally, the total domain score for disease management can be used to measure the effectiveness of clinical practice by PCT for

all 'potentially avoidable' hospital admissions for the older population as it can be assumed that where good clinical practice is in place for the diseases mentioned, then good clinical practice would be in place overall.

Organisation indicators provide information on:

- Records and information about patients;
- Information for patients;
- Education and training;
- Practice management;
- Medicines management.

Much of the evidence for records management is obtained through visits to GP Practices and includes for instance information on whether any written records are written clearly and legibly, records of any telephone advice given or whether systems are in place for the recording of hospital visits. Information for patients includes such things as whether the practice has a system to allow patients to contact the out-of-hours service by making no more than one telephone call, the role of various members of the GP Practice, and the availability of smoking cessation clinics.

Education and training refers to the practice staff, ensuring that basic life support training updates are undertaken at least every 18 months, a variety of other training sessions are made available to staff and a system for staff appraisals is in place.

Practice management refers to the smooth and safe running of the GP Practice including equipment maintenance, safe and accurate data storage, and that the practice can offer a variety of appointment times to patients.

Medicines management includes information on whether, for instance, there are details of prescribed medicines available to the prescriber at each surgery consultation, emergency drugs are in-date, patients on more than 4 repeat medicines undergo a medicines review every 15 months, and repeat prescriptions are available within 72 hours (Department of Health, 2004e). A total of 184 points is available for the organisation domain indicators. All this information can be useful in assessing how efficient and well organised a Practice is.

For this study, the most informative part of this index is the practice management indicator, which included information on the provision of a variety of appointment times. The information is available as a combined 'organisation domain' in the domain summary indicators and it will be this combined score that will be included in the study as no single indicator looks at access to GP services alone, but in combination can be a useful indicator of how well organised the practice is, reflecting good service provision.

One of the most useful set of indicators is the final set: the domain summary. As well as a summary of the clinical indicators domains (disease domain) and organisational summary domains (organisation domain), this section includes information on a:

- Patient Experience Domain;
- Additional Services Domain;
- Holistic Care;
- Overall Quality of Practices (Total score);
- Access Bonus.

As timely intervention and good access to GPs is key to avoiding un-necessary admissions to hospital, the Patient Experience Domain provides valuable information on how patients feel about access to their GP. This is achieved through a patient satisfaction questionnaire which asks the questions:

- Are patients able to consult a GP within two working days;
- Are patients able to book ahead for non-urgent appointments;
- Are patients able to contact their practices by telephone; and
- Are patients able to make an appointment with a particular GP if that is their preference (even if this means waiting longer) (Department of Health, 2006a).

Points are awarded for achieving each of the goals set.

At PCT level data are available on PCT funding. This data is provided for the whole population, which does not reflect the greater need for spending on older people, or differences in the population distribution within each PCT. Therefore the GP funding data were weighted using the European Standard Population weights for the older age bands (readjusted to average 1) (Ahmad et al, 2002).

Data have also been included on the number of single-handed GPs per PCT as chapter 2 showed previous studies suggesting single-handed practices may have higher emergency admission rates. This data was obtained from the NHS information centre and included the number of single-handed practices in each PCT as of 2005.

The number of GPs in each PCT was also provided by the NHS information centre for 2005. Combined with the number of older people in each PCT using population estimates for 2005, the number of GPs per 1000 population was calculated.

At a local level for Barking & Dagenham detailed information was available on aspects of GP characteristics at individual GP Practice level. Data on several measures are therefore combined here to explore how GP characteristics may affect hospital admissions for ‘potentially avoidable’ conditions for the older population of Barking & Dagenham. Within Barking & Dagenham 51 per cent of GP Practices are single-handed practices (the national average is 28 per cent), therefore whether or not a Practice is single-handed has been measured. The number of whole time equivalent GPs per 1000 older population will be used. The more patients a GP Practice has registered, the harder it may be to get an appointment, particularly if they are predominantly from the older population who tend to use health services more. Practice nurses also play an important part in patient care so the number practice nurse hours per 1000 practice population has been recorded.

General service delivery by GP Practices is measured by a set of ‘indicative’ variables: cervical screening rates; immunisation and vaccination uptake, contraception service provision; efficient prescribing practice i.e. the prescribing rates for benzodiazepines, lipid lowering drugs, and generic drugs; and preventative prescribing i.e. the prescribing ratio of preventive/relieving asthma medication including the prescribing of generic drugs. Data on the provision of all these services were standardised and then combined to provide a score per GP Practice to allow GP Practice service delivery to be measured.

3.5.12 Socioeconomic conditions at GP Practice Level

For the individual level analysis in Barking & Dagenham it was likely that the socioeconomic conditions of the GP practice populations may vary from the LSOA

the practice is located in. GP practice boundaries are not coterminous with administrative boundaries of LSOAs. Practice catchment areas may include small areas with diverse socioeconomic conditions. Some studies have linked socioeconomic conditions to the postcode of the GP practice as a proxy for the socioeconomic conditions of the practice population (e.g. Saxena *et al.*, 2006; Wright *et al.*, 2006; Ashworth *et al.*, 2007). However McLean *et al* (2008) found considerable differences in GP practice deprivation scores when using the GP practice postcode as a proxy for the overall deprivation score of the registered practice population compared to assigning deprivation data proportionally from the LSOA of the registered patients postcode to the GP practice. Even though a person may live in a deprived area, they may themselves not be deprived; however they will be influenced by the deprivation of that area. The same however cannot be said for other socioeconomic variables. Living in an area with a high level of older people living alone, or where there are high levels of ill health does not mean it can be assumed that any particular older person will themselves live alone or be of poor health. However, for the multilevel models to work, individual level characteristics needed to be aggregated to the GP practice of the patients. The socioeconomic variables were attached to the postcode of each older person living in Barking & Dagenham. A practice level score was then calculated by multiplying the scores for each practice according to the number of older people they had living in each LSOA and dividing by the total Practice population. This then produced a weighted score for each of the socioeconomic variables for the population each GP practice covers.

3.5.13 Provision of Community Care

Community care provision (home care, meals on wheels and district nursing) plays an important role in reducing ‘potentially avoidable’ hospital admissions for the older population as chapter 2 showed. At Local Authority (LA) level for all of London, data on Social services spending on homecare provision for older people, the number of older people helped to live at home per 1,000 older people and the amount of intensive homecare per 1,000 older people were available from the Commission for Social Care Inspection (CSCI) (http://www.csci.org.uk/care_professional/councils/paf/paf_reports_and_data.aspx.)

Some of the LA boundaries were different to the PCT boundaries, so the Social services data were proportioned to the PCTs by weighting the data to the numbers of older people per LSOA within the LA boundaries and aggregating the data to the relevant PCTs.

Individual patient records on home care and meals on wheels was provided by Social services in Barking & Dagenham for the financial years 1998 to 2004 and data on district nursing was provided for 1998 to 2001 (record keeping stopped after this time). The district nursing data were incomplete in around 50 per cent of records so were not suitable for use in this study. The data for Social services included information on the age group, sex, postcode and GP practice codes of each patient as well as the number of hours care provided per week for home care, and the number of meals provided per week for meals on wheels.

Unfortunately the home care and meals on wheels data contained multiple entries for each patient. Each time a patient changed the amount of care provided or the number

of meals provided, a new line of record was produced. Changes appeared regularly, for instance, if a patient was admitted to hospital, or went on holiday, care would be stopped, then reinstated on their return, producing more lines of data. This made it extremely difficult to identify individuals. It was achieved by firstly checking if for each potential individual the start and finish date for care/meals on wheels overlapped. Where this happened, then they were considered separate patients. Fortunately this was a rare occurrence and where it did happen the data were examined by hand and a start and finish date worked out for each patient. Where this was not the case, the first start and final end date of the care package was worked out using the unique id and identifying the first and last record for each id. This now produced a new data set showing the id of the patient, the age band, sex, GP practice code, patient postcode and start and finish date for both meals on wheels and homecare. Because the data set was so complicated, the number of meals or the hours of care were not included as they seemed to constantly change.

The homecare and meals on wheels data was joined to the GP practice data (which now included whether a patient was admitted to hospital with a ‘potentially avoidable’ condition) using the unique id. The resulting data set now contained information on all individual ‘potentially avoidable’ hospitalisations for the older populations of Barking & Dagenham and Lewisham with information on community service provision for those receiving any as shown below:

Unique ID Code	Condition Admitted	homecare	MOW	Nursing/Res.Home	GPPractice	LSOA
RM109BX275-79F82001	Diabetes	1	1	0	0	F82001 E102333

This individual level data now had observed values of 1 (for a multiple admission or admission from the GP practice population) or 0 (single admission or no admission at all). Information on whether the patient receive home care, meals on wheels or lived in a nursing/residential home was also attached using 0's and 1's. The LSOA and GP practice of each patient were attached and the appropriate GP practice or LSOA socioeconomic data attached. All of this was performed under fire walled conditions as discussed in section 3.7 to protect the confidentiality of the data.

3.5.14 Confidence Intervals

Results are produced with confidence intervals where appropriate and confidence intervals are shown on graphs in this thesis. Confidence intervals are a range of values that are used to describe the uncertainty around a point estimate of a quantity to compensate for the possibility that the result obtained was through chance. This is because there may be random fluctuations in the data between different area units and time periods or random differences between the sample and the population itself. As The Indicator Guide: Health Profiles (Department of Health/Association of Public Health Observatories, 2010) note, “the stated value should therefore be considered as only an estimate of the true or underlying value”. Confidence intervals provide additional information about the data, quantifying the uncertainty in the estimate. 95% confidence is usually expected, although this will depend on the size of the sample they are applied to: the larger the sample the more likelihood of meeting a 95% confidence interval and the wider the confidence interval, the greater the uncertainty in the estimate. For the standardised admission ratios used in this thesis, confidence intervals were calculated using the NHS Performance Indicators

(2000) equation, which uses Poisson probabilities and Byar's approximation. For a 95% confidence interval the equation is:

$$LL = \frac{x}{e} * 100 * (1 - \frac{1}{9x} - \frac{1.96}{3\sqrt{x}})^3$$

$$UL = \frac{(x+1)}{e} * 100 * (1 - \frac{1}{9(x+1)} + \frac{1.96}{3\sqrt{(x+1)}})^3$$

where x is the observed number of events and e is the expected number of events.

The 95% CI consists of two numbers which define a range (a lower and an upper) of expected, or normal, values for the SAR for each Ward. If both numbers are less than 100 (the value representing the level for the reference population), then it is assumed admissions are occurring less frequently in that Ward than it is in the rest of the London (the population of reference in this study). If both of the numbers in the confidence interval are higher than 1, then it is assumed that admissions are occurring more frequently in that Ward than in the rest of London. Lastly, if one of the confidence limits spans the value of 100, then we conclude that rates of admissions occurring in that Ward are not statistically different than in the rest of London.

3.6 METHODS

In order to explore the relationship between urban socioeconomic conditions, health and social care provision, and variation in 'potentially avoidable' emergency admissions to hospital among older people a number of techniques were employed.

The results sections are split into three distinct sections. Chapter 4 explores the effects of spatial proximity to hospital beds and socioeconomic conditions using an ecological study of wards in London. Firstly descriptive techniques and bivariate tables are used to explore healthcare usage of interest (i.e. 'potentially avoidable' emergency admissions). The data are reduced using linear regression techniques on each of the variables individually. Multiple regression is performed on the 'potentially avoidable' emergency admissions and the socioeconomic variable using multiple regression techniques.

Chapter 5 then continues by introducing primary and Social services data at PCT level, examining a whole healthcare system to see how organisation and funding by local service providers impacts on 'potentially avoidable' emergency admissions for the older population of London. Since PCTs are the administrative units within which services are organized, this is the geographical level most suitable to assess variation in service provision. Multilevel regressions can show how much of the variation in admissions is within PCTs or how much is between PCTs; i.e. do PCTs with similar populations have similar admission rates. Variation at PCT level that is not explained by the socio-economic characteristics of the wards within the PCTs might result from differences in service provision, which would be particularly relevant to the idea that the NHS might be able to 'prevent' potentially avoidable emergency omissions. If service provision variables 'explain' variation in admission across PCTs, this would further support the argument that admissions are 'potentially avoidable' through NHS intervention.

Various groups of variables, starting with PCT and Social services service provision data were then included in the models to explore how these variables might explain

some of the variation found. The socioeconomic variables found to be associated with 'potentially avoidable' emergency admissions for the older population of London at ward level were then introduced to see if any of the associations with PCT/social service variables still exist. This sets the context for a finer scale study of health care use using a single PCT within London; Barking & Dagenham, shown in chapter 6 where much more detail on service provision was available. Individual level data on 'potentially avoidable' hospital admissions, GP Practice populations and Social services provision were available. Binary logistic regressions were used to explore a whole GP practice register using binary data on whether or not older people on the GP practice registers are admitted to hospital for a 'potentially avoidable' conditions. Whether the variation in service use of older people (i.e. 'potentially avoidable' emergency admissions) is associated with GP Practice characteristics and organisation or whether the socioeconomic conditions of the local area (lower super output areas) are more important in explaining variations in 'potentially avoidable' emergency admissions for the older population is explored. Chapter 6 then continues to explore whether community care provision (home care and meals on wheel) for individuals is associated with 'potentially avoidable' emergency admissions for the older population.

Finally frequent users of hospital services at an individual level in Barking & Dagenham PCT are explored. This section uses data on all the older people admitted to hospital in Barking and Dagenham in the 5 year study period and assigns 0 to single admissions and 1 to multiple admissions. Multi-level modelling techniques were employed to explore further the complex relationship between socioeconomic

conditions, GP Practice characteristics and organisation and community care provision by combining these three areas in the analysis.

3.6.1 Directly Standardised Admission Ratios

For chapter 4, standardised admission rates were created (and standardised community care rates for chapter 5) using direct standardisation. Direct standardisation is used to show the incidence of events controlling for specific differences in the population. It is expressed as events per 1000 population. Direct standardisation of the data allows the data to be compared within an area and with different areas or nationally and across time. It is useful for assessing the relative burden of disease or events such as the number of admissions per year (time series) or to compare different conditions such as asthma and diabetes using overall rates, however with large data sets (as here) the data can quickly become unmanageable, particularly if trying to compare small areas. Standardised rates were produced by year and age group and by condition and age group for ‘potentially avoidable’ admissions and *frequent* avoidable admissions for each chapter.

3.6.2 Indirect Standardised Admission Ratios

Before any statistical analysis of the data could be undertaken, standardised admission ratios (SARs) were produced using indirect standardisation methods. SARs express the numbers of admission observed locally as a proportion of the ‘expected’ number that would occur in the area if the sex and age specific rates of admission were the same as for a reference population. Age and sex specific rates (i.e. the observed events) of the reference (or standard) population, in this case London as a whole, are applied to the age and sex structure of the subject population.

This gives an ‘expected’ figure i.e. in this case the number of ‘potentially avoidable’ emergency admissions that would be expected if the pattern of admissions was the same as that of the standard population. The crude observed and expected values were used further to explore the joint relationships of deprivation with each of the other variables using bivariate tables to explore whether there was a joint relationship occurring.

3.6.3 Data ‘Smoothing’

In chapter 4 and 5 the data for London were ‘smoothed’ using WinBUGS. Population characteristics are not defined by ward boundaries but are contiguous, i.e. they cross boundaries. Just because a person lives in ward *a*, that overall has certain characteristics different to the wards *b* and *c* next to it, does not mean that any one person within ward *a* may not actually have the same or some of the characteristics of the overall populations of wards *b* and *c*. Over and under-dispersion occurs where the observed variance is higher or lower than would be expected given what is happening in the surrounding wards. To adjust for this the models for the ecological analysis allow for over and under-dispersion of the data by using spatial auto-correlation techniques. It is based on the models produced by Besag *et al* (1991) and adds a spatially structured random effect that pushes higher or lower values towards the mean of the surrounding wards. Professor Peter Congdon produced the model to be used in this analysis.

The admissions data at ward level (observed and expected values) were ‘smoothed’ using the characteristics of the neighbouring wards. Data on which wards neighbour each other were obtained using GIS techniques to convert a basic map of each study

area into grid format. This was then exported as text file into a program specially written to produce data on the neighbouring wards for each ward.

The WinBUGs program used adjustments for potential overlapping of population characteristics in each ward by using the information on which wards neighbour each other and the characteristics of those wards: for instance admission rates. The program moves the observed and expected values of each ward towards the averages of the wards surrounding it and then returns ‘smoothed’ standardised rates. This smoothing technique makes greater adjustment for areas with small numbers of data points, for which calculation of rates will be unreliable, while having less effect on areas with larger numbers of observations. Standardised admission ratios do not give any indication of burden of disease as standardised admission ratios do, however they do provide a summary figure that is easy to interpret as they are based around an average of 100 for the whole study area. Anything below 100 is below what is expected given the reference population and anything above 100 is greater than what would be expected given the reference population. The smoothing of data may move the overall average up or down slightly however.

3.6.4 Maps

The ecological ‘smoothed’ data were mapped (using ArcGIS) to show wards with higher than expected rates of ‘potentially avoidable’ emergency admissions in shades of red, average admission rates in white and lower than expected admission rates in shades of blue. The percentage increases/decreases chosen were numbers of standard deviations away from the mean.

The socioeconomic and health status and care data were also mapped, however this time categorical shades of blue were used. The darker the colour, the higher the value.

For each map, graduated symbols of the location and number of hospital beds were plotted. This allowed for visualisation of proximity to hospital beds combined with other variables.

3.6.5 Bivariate Plots and Regressions

Bivariate plots of the data for small areas were produced to explore the relationships between the dependant variable ('potentially avoidable' emergency admissions for the older population) and the predictor variable (socioeconomic and care variables) in chapter 4. In each case the predictor variables were standardised to produce z-scores and then divided into quintiles. Standardising the data enables data with differing arithmetic means to be compared.

Single regression models were performed for each variable to show the associations of the variables individually with standardized admission ratios for 'potentially avoidable' emergency admissions for the older population in London. Once the individual relationships between the socioeconomic variables and 'potentially avoidable' emergency admissions for the older population had been established, it was important to explore how the variables interacted with each other using multiple regression models.

3.6.6 Multiple Regression for the Wards of London

For chapter 4, multiple statistical regression methods were performed on the data for London at ward only level using WinBUGS. Multiple regression methods test the independent relationship between the *dependent* variables - ‘potentially avoidable’ emergency admission rates and lengths of stay, and the *predictor* variables - spatial proximity to hospital, socioeconomic conditions, the provision of unpaid care and the presence of a nursing or residential home. This is not assuming that if a relationship *is* present the predictor variables are the *cause* of this; rather, the association would suggest a possible causal relationship and could be used as a predictor of future events.

The data sets included the observed and expected ‘potentially avoidable’ emergency admission values for the older population of London, the socioeconomic data and unpaid care variables to be included in each model, and data on the neighbouring wards to allow the data to be smoothed (i.e. moving the observed and expected values to the means of the surrounding wards to control for the modifiable area unit problem) during the modelling process. Standardised data were used for the predictor variables. The models included a spatially unstructured and structured random effect to control for effects that may be present outside of the data being modelled; this assumes that no matter what variables are placed within the model there may always be random events or unmeasured variables that could have an effect on the dependant variable (such as the proximity of day care centres or NHS walk in centres, for example).

WinBUGS calculates Deviance Information Criterion (DIC) values (similar to scale deviance values) using hierarchical modelling generalization to explain the goodness of 'fit' of the models used. This shows how well the dependant variables explain the variation in the predictor variables. As Curtis *et al* (2004) explain, "the size of the deviance coefficient should be similar to the number of degrees of freedom in the model" i.e. how precisely the model predicts the variability in the outcome variable.

If no random effects are present, the degrees of freedom are $N - p$, where N equals the number of wards and p equals the number of independent variables. This becomes more complicated where random effects are included (as with the models used in this analysis) because the numbers of parameters have to be estimated. The general rule however is the lower the DIC value, the better the fit. The aim is to reduce the model deviance and with these models, a reduction of 3 or more was considered significant.

With WinBUGS, if statistically significant associations between the dependant and predictor variables are present, then the 'mean' value for the beta coefficient across all the samples must be twice that of the standard deviation. Also the lower and upper confidence interval must straddle the mean value. A positive 'mean' value indicates a positive association and negative value a negative association. The DIC was also examined to see if the model 'fit' had improved and hence that set of variables explained the variation in 'potentially avoidable' emergency admissions for the older population better. For a random effect to be present for each ward, the lower and upper confidence intervals had to straddle the mean value, where this happened a value of 1 was given and the 1's added up to give an overall number of wards with a significant random effect. For a model to show improvement it would

be hoped the number of wards with a significant random effect would have decreased from the previous significant model.

The models are always given a 'burn in' time to allow for them to 'stabilise'. Once the models have undergone an initial 'burn-in' and convergence has been achieved, the DIC and the random effects ('u' and 'e') were set. Once completed the statistics and DIC data were copied and pasted into Microsoft Excel and tables of results were produced.

The various models at an ecological level were then run using the dependant variable ('potentially avoidable' emergency admission rates and *frequent* admissions) with groups of predictor variables (spatial proximity to hospital beds, socioeconomic conditions, unpaid care and nursing/residential homes). The models were built up, starting with spatial proximity to hospital beds, and then a new variable added each time. By adding new variables each time it is possible to see the association of each variable after controlling for the effect of the next variable. If a new or previously included variable showed no association with admissions then it was dropped from the following models. If an association was seen and continued to be seen then the variable was retained in the model. Groups of variables allow for the exploration of the combined effects of local conditions rather than one factor alone as it is more likely hospital admission rates are influenced by a number of factors. No more than 4 dependant variables were included in the models at any one time as the models become increasingly unstable with too many variables, consequently skewing the results.

3.6.7 Multi-level modelling of the ecological hierarchical data

For the analysis of services provision on 'potentially avoidable' emergency admissions for the older population of London, reported in chapter 5, the data included two different geographic levels of data: ward level admissions and socioeconomic conditions and PCT level service level provision by PCTs and social services. The inclusion of data at PCT level meant that the multiple regression techniques described above were not appropriate, as they cannot cope with different hierarchies of data. As explained above, aggregating the ward data to the higher PCT level loses important information in the data. It was therefore necessary to use multi-level modelling techniques. Stata was the chosen package. Stata allows the user to use the command `.xtmixed` which is "appropriate for mixed model estimation in general, including cross-sectional applications (Albright and Marinova, 2010).

The first part of the multilevel models is to partition the variance between wards and PCTs, using an 'empty' multilevel model (i.e. a model with just the smoothed standardised admission ratios). This shows how much of the variance in 'potentially avoidable' emergency admissions is attributable to conditions at PCT level, regardless of cause. The command for this is

```
xtmixed smoothedsar || pct: cov(un)
```

The `xtmixed` part of the model states the type of model to be used, in this case a cross sectional model. The model type is then followed by the dependant variable (smoothed standardised 'potentially avoidable' emergency admission ratios for the wards of London - SARs). The dependant is then followed by `||` to signify the end of the independent variables (at this point no independent variables are included). This

is then followed by the grouping variable (PCTs). The cov(un) specifies that the covariance for the random effects is unstructured. At this point in the model this is not so important however becomes important when exploring covariance in later models.

The model returns a value for the constant, which reflects the value of the intercept (or the mean value of the results, in this case SARs). The SARs were initially standardised to the London average, giving a mean of 100. However, because the SARs were then smoothed, this increases the mean, or intercept to 104. The model also returns values for the random effects. The variance component, corresponding to the random intercept (var(_cons)) relates to how much of the variance is unexplained by PCT differences. This is reported in the results as PCT level variance. The variance component corresponding to the random slopes (var(Residual)) relates to how much unexplained variance remains (i.e. random effects not included in the model). This is reported as the residual variance. When the estimate is at least double its standard error, a significant variation is concluded. The two variance components are then used to partition the variance across the wards and PCTs. The amount of variation attributable to PCTs is calculated by

$$\frac{\textit{between PCTs estimate}}{\textit{between PCTs estimate} + \textit{within PCTs estimate}}$$

To explain some of this variation, the models were built up to include PCT and ward characteristics, beginning with socioeconomic conditions. For each of the socioeconomic variables (IDAOPI, high demand and social fragmentation), new variables were made to calculate the ward level deviation from the mean of the PCT

socioeconomic value. This enabled within PCT effects to be explored. The command for generating each new variable is:

Gen newvar = [ward level variable] – [PCT level variable]

Now each of the socioeconomic variables was modelled separately to show the how much of the variation in 'potentially avoidable' emergency admissions for the older population of London might be explained by within and between PCT socioeconomic effects. The command for each model is:

```
Xtmixed smoothedsar [PCT level socioeconomic variable] [ward level socioeconomic variable difference from the PCT mean] || PCT: , cov(un)
```

This returns 'fixed' effect values for within and between PCT effects and shows how much of the variance remains unexplained as before. A mean twice or more of the standard error means an association is present. The random effects of the intercept and the residuals are compared to the 'empty model' and any other models run. It would be hoped that these scores reduce, showing that more of the variation within and between PCTs is being explained.

After each model is run, a separate instruction is run:

```
estat ic
```

This returns values for AIC and BIC, which are essentially deviance values, similar to that of the multiple regression models. The deviance corresponds to the model 'fit' and if the 'fit' is improving then the deviance should be decreasing.

The next part of the models was to include the PCT level data (numbers of doctors per 10,000 population, PCT funding, the proportion of GP practices that are single-handed and quality of care – QOF total). Only one of the socioeconomic variables was included in the models, and each PCT level variable was modelled separately. Two new variables were created for this part of the model, to test for cross level effects. This tests interactions between different levels as different covariables can have different effects on different levels, for as Albright and Marinova (2010, p22) explain “[b]ecause there are interactions in the model, the marginal fixed effects of each variable now depend on the value of the other variable(s) involved in the interaction”. In this case, the marginal effect of what is happening with the ward level part of the cross sectional data and the PCT part. For instance, the effects of deprivation may be more in more deprived PCTs, or where there is poorer quality of care from GP practices. Two different levels of cross level interactions were tested – the effect of socioeconomic conditions across wards and PCTs, and the effects of socioeconomic conditions across wards and PCTs plus the PCT level variable. These interactions were included in the models along with the between and within PCT socioeconomic conditions and the PCT level variable to be tested. Each model therefore was set up as:

```
Xtmixed smoothedsar [PCT level socioeconomic variable] [ward level
socioeconomic variable difference from the PCT mean] [PCT level variable] [cross
level interaction socioeconomic] [cross level interaction socioeconomic x PCT
variable] || PCT: , cov(un)
```

The intercept now corresponds to the expected SAR taking into account the variables included. Now the results show the 'fixed' effects for within and between PCT socioeconomic conditions and the PCT level variable, but also include cross level effects for the socioeconomic conditions and for the socioeconomic conditions plus the PCT level variable. If there are any cross level effects in operation, the mean would be twice or more of the standard error. The random effects part of the model also includes two new variables: between PCT unexplained variance; and a covariance value which shows the strength of the correlation between the random variates.

The models were repeated in the same format for the Social services care data (number of older people helped to live at home per 1,000 population over 65, intensive homecare provision per 1,000 older people and Social services spending on homecare for older people. The final part of this section explored the association of 'frequent' 'potentially avoidable' emergency admissions for the older population of London with the PCT level and Social services data that showed significant associations and the socioeconomic data. The results are reported in chapter 5.

3.6.8 Multi-level modelling of the individual level data

Multi-level modelling was also required for the individual level data on individuals registered with Barking & Dagenham GP practices and whether or not they were admitted to hospital with an avoidable condition (reported in chapter 6). Where an individual was admitted to hospital they scored 1 and if not they scored 0. Binary logistic mixed effect models were used to explore whether hospital admissions for individuals were associated with local GP practice provisions and quality of care or

with socioeconomic conditions at the LSOA level. The models were set up in a similar way to the multilevel models above, except this time the model type was changed to `xtmelogit` to indicate the data are binary, and produce a logistic regression model suitable for binary regression. The levels were partitioned by GP practice to explore how much of the variation in 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham are explained by variations in GP practices. The first model partitions the variance between GP practices. The `xtmelogit` models only provide one variable for the random effects at this point, the GP practice variance. However, by taking the exponential value of the value returned, the percentage of the variance explained by differences in GP practices can be calculated.

As previously, the socioeconomic variables were modelled one by one. This time the deviance of the individual from the GP practice mean was calculated for each socioeconomic variable. The average of the registered practice populations socioeconomic conditions across each practice was also included (the method for this was explained in section 3.5.12).

GP practice service variables (number of patients per GP, number of older people per GP, whether the practice is single-handed and QOF total score) were then included separately for a number of models and cross level effects between the individual deviances from the practice mean and the practice level socioeconomic conditions, followed by the inclusion of the practice level variable. The results returned are in a similar format to the previous multilevel models.

The next models include Social services care information (receipt of homecare and meals on wheels). As these were available at an individual level, they were not aggregated to the GP practice mean. However, the overall per cent of patients in each GP practice in receipt of home care and meals on wheels was calculated as the home care and meals on wheels variables were attached to the GP practice patient data base (described in section 3.5.13). The Social services models excluded cross level interactions as it was felt the individual receipt of homecare or meals on wheels was a more important interaction to explore.

The final part of the models explored *frequent* 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham. *Frequent* admissions were taken as whether or not a patient who was admitted to hospital had more than 1 admission in any one year. Using the full data set of patients admitted to hospital it was also possible to explore methods of admission i.e. via A&E or GP, mortality rates amongst admitted patients and whether patients had any comorbidity on admission.

Multi-level binary logistic regressions were then used to explore the relationship with of *frequent* 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham with socioeconomic conditions and the receipt of community care data across GP Practices. As with the multi-level and multiple regression models, a mean coefficient of least twice the value of the standard deviation means an association is present (positive or negative).

3.7 ETHICAL CONSIDERATIONS

There are unresolved issues of confidentiality related to multi-sectoral information sharing. The Data Protection Act requires that the confidentiality of information about individuals must be preserved. The Caldicott Committee Report (2) recommended safeguards for patient information, focusing directly on the responsibilities for handling person-identifiable data. As using the four attributes of age-band, sex, GP Practice code and postcode to create 'individual' people meant patients were essentially identifiable, the data sets containing these four attributes had to be protected and then modified before they could be used for any analysis.

All the data sets containing individual data on the patients and the GP Practice data were kept on a separate computer in the Department of Health Sciences, Queen Mary, University of London. The computer was password protected and not connected to the internet (so the system could not be accessed via the internet in any way). The room was kept locked whenever not in use or on leaving the room for any reason. All data preparation was undertaken on this computer and efforts to anonymise the data were taken before any data was removed from the system. Firstly on the newly formed 'individual' patient file the unique concatenated ID was replaced with a unique number for each patient – a key to the original codes was kept separately and password protected in case it was needed in the future (so the method could be replicated if necessary). Under firewalled conditions, the concatenated code on the Social services and district nursing data was then deleted as once the data had been joined to the hospital admissions data it was no longer required. On all the files ('potentially avoidable' hospital admissions, Social services data, and GP practice population data) as the files all now had the electoral ward of each patient, the

postcode of the patient was removed and the GP practice code was replaced with a unique ID number (for which again a password protected key was kept). Finally the GP Practice codes of the GP characteristics file and the spatial proximity to hospital beds file had the GP Practice code replaced with the same ID numbers as the other files. Keys to each ID system were kept password protected on the original data computer. This now meant all the data was anonymised and so the data could now be safely removed from the protected system for analysis to begin.

At no point was any individual data to be reported or published. All reported data was reported at either ward or GP Practice level or overall results were reported by age, sex and year or by condition and year. At no point in the reporting of results could an individual be identified in any way.

3.8 CONCLUSION

The relationship of health care usage with socioeconomic conditions, GP Practice characteristics and organisation and community care for the older population is complex, involving many different factors. By using a number of different statistical methods this complex relationship has been explored, using ‘potentially avoidable’ hospital admissions and *frequent* ‘potentially avoidable’ emergency admissions for the older population. Multiple regression techniques were used to see whether socioeconomic conditions were associated with admission rates within the wards of London.

The effects of service provision on a wider scale were then introduced at PCT level. Multiple regressions were performed to explore relationships at PCT level. Multi-level modelling was then used to model the associations of PCT level service

provision and ward level socioeconomic conditions with ward level ‘potentially avoidable’ emergency admissions for the older people of London.

Having set the context of health care provision at a wider scale, a local area study in Barking & Dagenham was undertaken, using finer scale (individual anonymised data) on hospital admission rates, GP Practice Populations and the Practices themselves, and community care input. Using the individual anonymised data sets on ‘potentially avoidable’ emergency admissions in combination with GP Practice characteristics and organisation, LSOA socioeconomic conditions and community care provision, multi-level modelling techniques were employed to explore the relationship withal and frequent users of hospitals. Finally patients whose length of stay in hospital was extended (so they were potentially ‘bed blocking’) were identified by using a combination of unique attributes common to the admissions data and community care data and joining the data sets using this data.

Multi-level modelling was then used to explore this relationship with GP characteristics, and ward socioeconomic variations and community care provision. The local part of the study highlighted the difficulties in using large data sets, with the time consuming cleaning of data to obtain the data required; miscoding of data; and in some cases poor quality of data. However it was shown that by using key information within the data, data sets from different sources can be joined together. This information tool could be a valuable tool for planners of future care, particularly with the integration of different services the NHS is currently promoting. Finally, although by exploring large data sets using quantitative techniques can provide useful information for future service provision, it cannot explain the human response to ill health, or the response of care providers, but is invaluable in exploring how

health care services are organised and the effects on hospital use for the older population.

CHAPTER 4 :Small Area Variations in ‘Potentially Avoidable’ Hospital Admissions for the Older Population of London: Associations with Socio-Economic Conditions

4.1 INTRODUCTION

As chapter 2 demonstrated, older people use hospital services more than any other age group. With an increasingly aging and aged population there are greater demands on existing healthcare provision (NHS, 2001). Efforts both nationally and locally are being made to reduce ‘potentially avoidable’ admissions to hospital for all age groups, and particularly for the older population (Department of Health, 2000; NHSE, 2001). Chapter 2 demonstrated how a number of geographic factors are likely to be associated with ‘potentially avoidable’ hospital admissions (‘potentially avoidable’ admissions) for the older population, including spatial proximity to hospital beds (access), and socio-economic factors. However there is less evidence of the effect of unpaid care provision within the community and the effects of and nursing/residential care provision.

In this chapter the basis is laid for subsequent analyses by examining in some detail the socio-economic variables that predict variation in ‘potentially avoidable’ hospital admissions for older people at the local level. This chapter also starts to assess the effects of service provision by examining how the pattern of admissions at ward

level is related to some measures of care provision (spatial proximity to hospital beds, nursing home provision and informal care in private households).

This study uses hospital episode statistics (HES) data on ‘potentially avoidable’ conditions including asthma, diabetes, urinary tract/renal infections, heart failure and ear nose & throat infections for the financial years 2001/02 to 2004/05. This chapter begins by demonstrating that despite efforts from the Department of Health and Primary Care Trusts (PCTs) to reduce ‘potentially avoidable’ emergency admissions to hospital in London, admission rates have risen over time. The association of spatial proximity to hospital beds (access) and socio-economic conditions with ‘potentially avoidable’ hospital admissions for the older population is explored before including the provision of unpaid care and availability of nursing/residential home beds. This chapter then continues to explore these effects on frequent ‘potentially avoidable’ emergency admission for the older population of London.

4.2 BACKGROUND

As chapter 3 showed, London has marked areas of socio-economic deprivation, and a significant percentage of older people living alone. Within the literature surrounding ‘potentially avoidable’ admissions the effects of the provision of unpaid care and the provision of nursing/residential homes is largely ignored. This chapter attempts to redress this imbalance by exploring the relationship between the provision of unpaid care and nursing/residential homes with ‘potentially avoidable’ emergency hospital admissions for the older population of London.

4.3 METHODS

This chapter uses data on ‘potentially avoidable’ admissions for the older population supplied as Hospital Episode Statistics (HES) by 10 year age band and sex for the financial years 2001/2002 to 2004-2005 for London (supplied by the London Health Observatory, 2006). Chapter 3 described the details of these data.

The first section of results shows the pattern of ‘potentially avoidable’ emergency admissions for the older population of London, showing rates per 1000 population by age group and year, and also by year and condition. ‘Smoothed’ standardised ‘potentially avoidable’ emergency admission ratios (referred to below as smoothed SARs) were mapped to show the information cartographically alongside a population density map.

This chapter then continues to explore the association of spatial proximity to hospital beds, socio-economic conditions and the provision of unpaid care with ‘potentially avoidable’ emergency admissions to hospital for the older population of London (see chapter 3 for more explanation of variable choices). A social fragmentation index has been produced based on the work of Congdon (1996) but adapted to reflect variables available for the older population. A number of variables are available that include various aspects of morbidity and thus a greater demand for health care provision; however these variables were highly correlated. Therefore, a morbidity index was produced to combine these variables. Chapter 3 explains how the social fragmentation and morbidity indices were created in detail. Table 4.01 shows a summary of the variables included in this chapter.

Variable	Description
Spatial Proximity to hospital beds (Access)	Calculated by the author using method explained in Chapter 3 (Population data from 2001 UK census; coordinates of wards from UK Borders; hospital beds from individual hospital trusts)
Deprivation	Income Deprivation Affecting Older People Index (IDAOPI) (from ODPM)
Living Alone	% Older people living alone (2001 Census)
Housing Conditions	% of older people lacking amenities (central heating and/or bath/shower (2001 Census) % of older people living in rented accommodation (2001 Census) Index of multiple deprivation – poor housing index 2004 (ODPM)
Social Fragmentation	Social Fragmentation Index for the Older Population calculated by the author as explained in chapter 3 using data (from 2001 UK census) on: <ul style="list-style-type: none"> • % older people living alone; • % older people living in overcrowded accommodation; • Net migration of older people; • % older people living in rented accommodation; • % older people living on the 5th floor or above.
Ethnic Minorities	% of older people from ethnic minority backgrounds (UK census 2001)
Morbidity	% of older population with a long-term limiting illness (UK census 2001) Morbidity Index for the Older Population calculated by the author as explained in chapter 3 using: <ul style="list-style-type: none"> • % of older population with a long-term limiting illness (UK census 2001); • % of older population with a long-term limiting illness and living in rented accommodation (UK census 2001); • % of older population reporting bad health in past year (UK census 2001); • % of older population reporting bad health in past year and living in rented accommodation (UK census 2001); • Index of multiple deprivation health domain (2004) (ODPM).
Nursing/Residential Home Provision	Nursing or residential home in ward (yes/no) – numbers of beds provided by the UK census 2001) and assigned yes/no by the author;
Unpaid Care Provision	% of the population providing any unpaid care (over 5 hours per week) (2001 UK census) % of the population providing greater than 50 hours of unpaid care per week (2001 UK census)

Table 4.1: Summary of Variables Chosen and Data Sources

Descriptive analysis of the data was undertaken to explore differences in the ‘potentially avoidable’ admissions and socioeconomic conditions. Bivariate tables were introduced to explore the joint impact of deprivation with other variables on standardised ‘potentially avoidable’ emergency admission ratios (SARs) for the older population of London. Single linear regressions were performed to explore the relationship of each of the socioeconomic and care variables with ‘potentially avoidable’ admissions individually. Data were grouped to allow analysis in sections, beginning with spatial proximity to hospital beds, deprivation and ethnicity, then continuing with living conditions before introducing the need for extra care and the provision of unpaid care.

Multiple regression models were performed to test the independent relationship between the *dependent* variables - ‘potentially avoidable’ emergency admission ratios (SARs), and the *predictor* variables - spatial proximity to hospital, socioeconomic conditions, and unpaid care. Chapter 3 describes these techniques in detail.

4.4 RESULTS

Figure 4.1 shows overall admissions to hospital for ‘potentially avoidable’ conditions per 1000 older population in London between the financial years of 2001/2002 and 2004/2005.

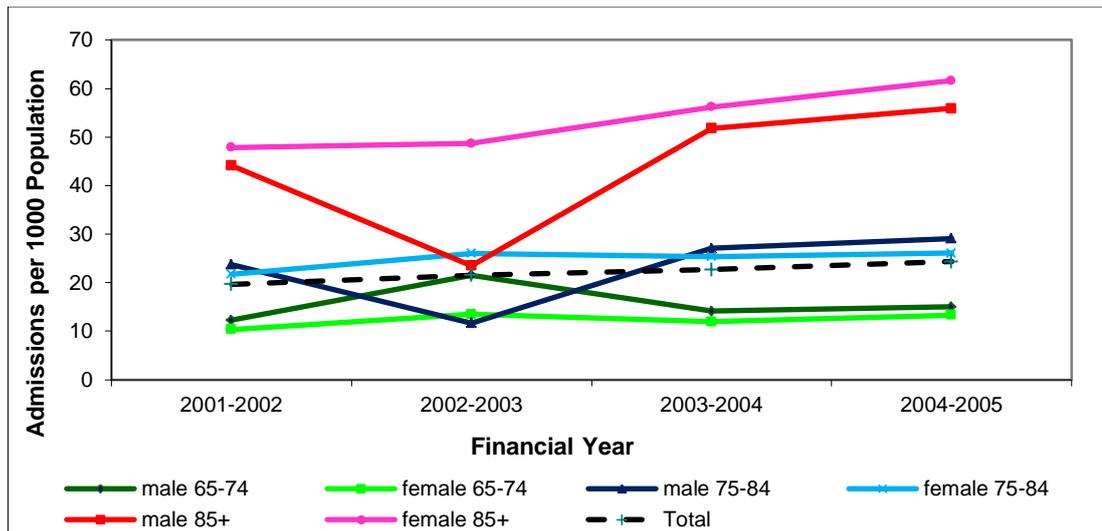


Figure 4.1: Potentially Avoidable' Emergency Admissions Rates per 1000 Older of London by Age Band and Financial Year (2001/02-2004/05)

For all age bands and sex, admission rates increased consistently over time. The over 85 age group have the highest admission rates and the steepest rise in admissions, with the females of this group having the highest admission rates of all.

Figure 4.2 shows admission rates per 1000 population by condition and year.

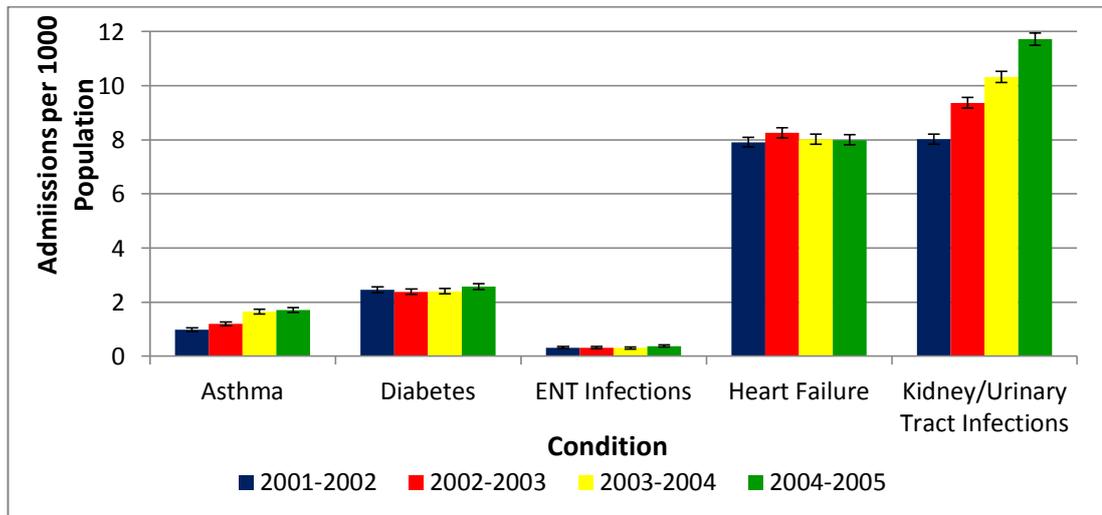


Figure 4.2: Potentially Avoidable' Hospital Admissions per 1000 Population by Condition per Financial Year (2001/02-2004/05)

Kidney/urinary tract infections are responsible for the highest admission rates per 1000 older population in London between the years 2001/02 and 2004/05 and are rising annually. This is closely followed by heart failure admissions which remain consistently around 8 admissions per 1000 older population over the time period 2001/02 – 2004/05. After an initial decrease in admission rates for diabetes, admissions have continued to increase over time, and although rates are lower than for heart failure or urinary/renal infections, it remains a cause for concern. Admission rates for asthma are rising over time and have increased from 0.7 admissions per 1000 older population in 2001/02 to 1.6 admissions per 1000 older population in 2004/05, more than doubling. Admissions for ENT account for very few admissions and have remaining consistently low over the time period.

It is difficult to know from the data whether the increases in admission rates for some conditions are due in part to changes in diagnosis patterns. For instance the increased use of spirometry for diagnosing respiratory conditions could mean that older patients are being diagnosed with asthma that may previously have been assumed to have Chronic Obstructive Pulmonary Disease (COPD), a condition associated with increasing old age. However it is clear that in London admission rates are increasing over time, and increase with age.

Admission ratios also vary geographically when standardised for age and sex. Figure 4.3 shows the population density and smoothed standardised emergency ‘avoidable’ admission rates for the older population of London. The latter are expressed in terms of variation above and below the ‘standard’ rates for London.

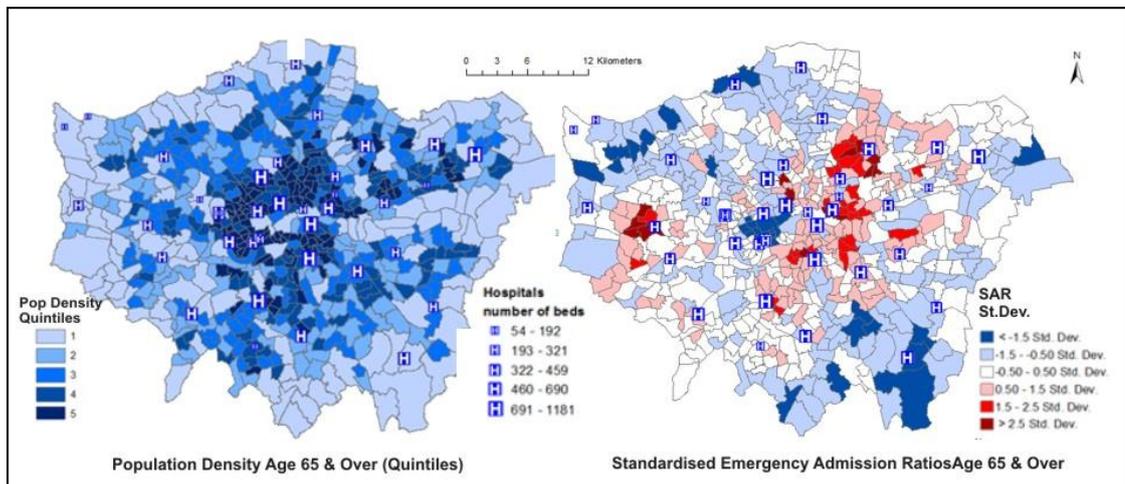


Figure 4.3: Geographic Distribution of Population and Smoothed ,Standardised Rates of Emergency ‘Potentially Avoidable’ Emergency Admissions for the Older Population of London

In London there are lower densities of older people in the wards around the outskirts of London, and higher towards the centre. Around the centre of London and towards the North East have particularly high densities of older people.

‘Potentially Avoidable’ Emergency admissions to hospital for the older population vary geographically by ward. Areas of white show wards that have an average age and sex smoothed standardised admission ratios given the population profile when compared to the whole of London. Standardised admission ratios (SARs) below what would be expected for wards are shown in increasing shades of blue as the number of standard deviations below the mean increase. SARs above what would be expected for wards are shown in increasing shades of red as the number of standard deviations above the mean increase. It is the wards showing in pink and particularly red that are of the most concern.

In London there are areas of greater than expected smoothed standardised admission ratios directly to the south of the city of London, north to north east London and a

small area in the west. Many of these wards had smoothed standardised admission ratios over 2.5 standard deviations above what would be expected. It is also particularly evident that areas around the more affluent suburbs on the edge of London, and the affluent wards of West London, where there are higher concentrations of older people, had lower smoothed standardised admission ratios than would be expected given the population profile for London. Some of the wards with greater smoothed standardised admission ratios are in areas where a hospital is present, but this is not always the case. The pattern of admissions shows some resemblance to that of the population density for older people, however previous studies (reviewed in chapter 3) suggest that the picture is far more complex. In particular, there is strong evidence to suggest proximity to hospital beds, deprivation and ethnicity may be associated with standardised admission ratios. Equally it was argued that social fragmentation might be important for 'potentially avoidable' emergency hospital admissions for the older population.

4.4.1 Spatial Proximity to Hospital Beds, Deprivation, Ethnicity and Social Fragmentation Effects

Figure 4.4 shows the geographic distribution of spatial proximity to hospital beds, Income Deprivation Affecting Older Peoples Index (IDAOPI), the percentage of older people from an ethnic minority background and the social fragmentation index (by quintiles) for each ward in London.

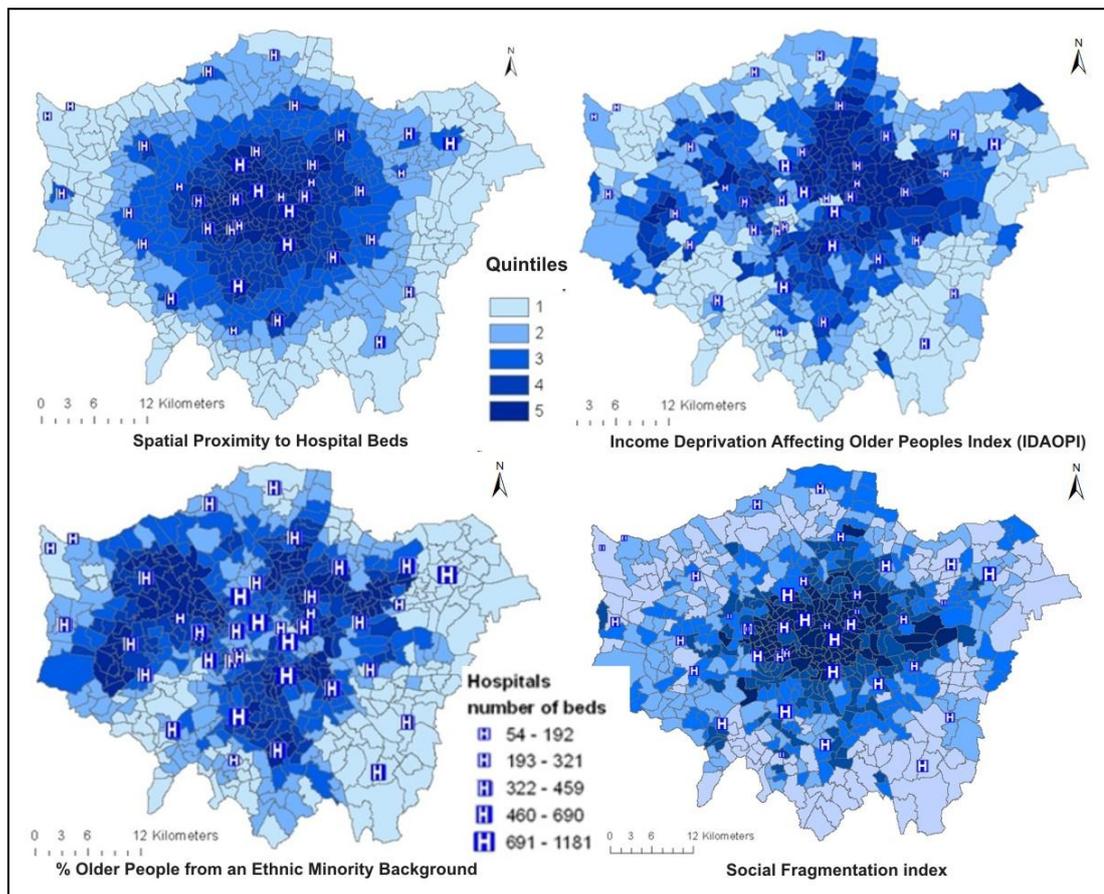


Figure 4.4: Spatial Proximity to Hospital Beds, IDAOPI, Ethnicity & Social Fragmentation Location of Hospitals by Bed Availability

For each map (excluding maps of standardised admission ratios), the lighter the colour the lower the quintile, as quintiles increase, the colours become darker. The geographic position of hospitals scaled by the number of available beds is included in each map. Hospitals outside the boundaries of London have not been included as there were very few within 10km of these boundaries due to most of this area being rural greenbelt land.

Within London, it is clear that where there are higher concentrations of hospitals combined with higher numbers of beds available towards the centre of London where access scores are higher. This shows a similar pattern to the population density map for older population shown in figure 4.03 where there are higher

densities of older people in the more central wards of London. There are some similarities with the map showing smoothed ‘potentially avoidable’ emergency admission ratios for the older population of London (figure 4.03), with higher access scores directly to the west and to the north/north-east of the City of London where admission ratios are also seen to be higher. However, there are also areas to the west of the City of London with higher access scores but significantly below the expected admission ratios. Equally, to the very north-north east of London where access to hospital beds is seen to be much lower, admission ratios are over 2.5 standard deviations above what would be expected given the population profile.

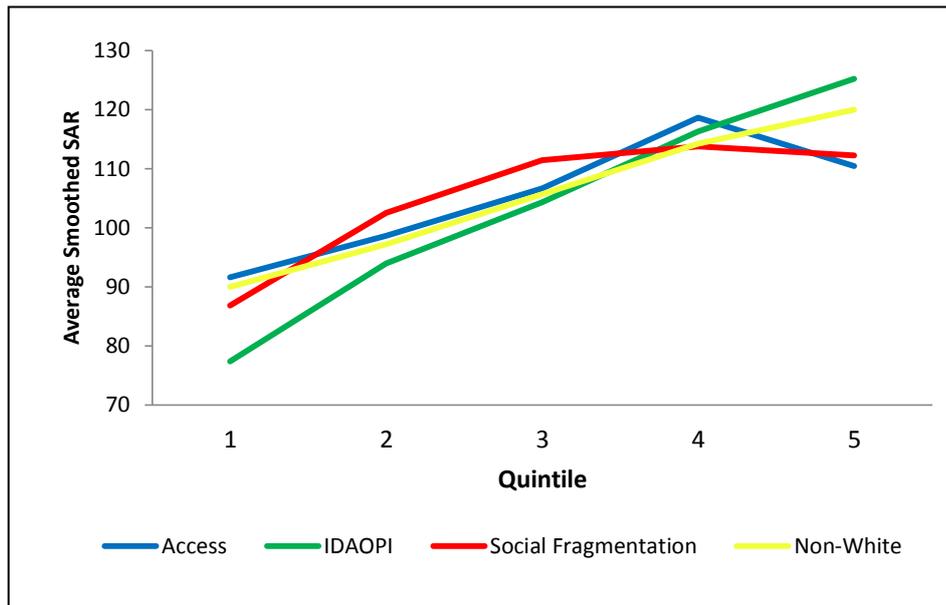
As discussed in chapter 3, deprivation can be measured in a number of ways. The most commonly used deprivation score is the Index of Multiple Deprivation (IMD) score. However a subset of the IMD score, the Income Deprivation Affecting Older People Index (IDAOPI) is available that is specific to the older population and has therefore been chosen for use in this study. The wards to the north/north east of the City of London are more deprived than other areas of London, with some pockets of deprivation to the south of the city too. Generally wards around the periphery of London are more affluent, although there are some relatively deprived wards towards North West London. Many of the hospitals are located in more deprived areas. This stems from their historical development as chapter 3 explained. The pattern of ‘potentially avoidable’ emergency admissions for the older population of London shows a similar pattern to that of deprivation, with significantly higher than average admission ratios in wards to the north and north east of the City of London, where levels of deprivation are seen to be higher, suggesting there may be some correlation

between the two variables. There is also some similarity with the population density of older population shown in figure 4.03.

Older people from ethnic minority backgrounds are concentrated to the north and northeast of London, to the west and the central-south areas. Most of the peripheries of London have much lower concentrations of older people from ethnic minority backgrounds. The map shows little similarity to that of the average smoothed standardised admission rate for older people of London shown in figure 4.03.

Whereas the map showing the average smoothed standardised admission rate (figure 4.03) shows higher than average admission ratios to the north and northeast of the city, it is the west of the city that is more socially fragmented, despite being more affluent. However, social fragmentation does not appear uniformly associated with affluence, and in fact there are wide areas of lower social fragmentation around the outskirts of London which are also affluent areas. However the pattern seen does reflect the pattern seen in the maps of the percentage of older people living alone and the percentage of older people living in rented accommodation shown in figure 4.9, but this may be reflecting the inclusion of these two variable in the social fragmentation index.

Bivariate plots have been used to explore the association of spatial proximity to hospital beds, the IDAOPI, the percentage of older people from an ethnic minority background and the social fragmentation index in quintiles with 'potentially avoidable' emergency admission ratios for the older population of the variables (Figure 4.5).



**significant at the 95% Confidence Level (p=0.01 or less)*

Figure 4.5: Bivariate Plots of Average Smoothed Standardised Admission Ratios and Access, Deprivation Ethnicity and Social Fragmentation by Quintile for London

As can be seen, for each of the dependant variable (spatial proximity to hospital beds, the IDAOPI, the percentage of older people from an ethnic minority background and the social fragmentation index) there are mostly strong monotonic gradients to the lines for the majority of the variables. The strongest association appears to be with the IDAOPI. With the IDAOPI, ‘potentially avoidable’ emergency admissions for the older population consistently increase as the derivation quintiles increase. In each case the results were significant to at least 0.01 using f-tests.

Bivariate linear regression shows the strength of associations between dependant variables and the ‘potentially avoidable’ hospital admissions for the older population of London. In each case the linear slope (how strong the association is), p value

(significance) and R² values (how much of the variation is explained by the variable) are included. Where the significance is greater than 0.0001 it has been denoted as 0.000. Table 4.2 shows the bivariate regression results for the first set of dependant variables.

Variable	Linear Slope	P Value	R ²
Spatial Proximity to Hospital Beds	7.42	0.000	0.08
IDAOPi	16.17	0.000	0.36
Non White	10.71	0.000	0.16
Social Fragmentation	8.32	0.000	0.10

Table 4.2: Bivariate Analysis of HES data on ‘Potentially Avoidable’ Hospital Admissions for the Older Populations of London and Dependand Variables

The strongest association between ‘potentially avoidable’ emergency admissions for the older population of London and the chosen dependant variables is with the Income Deprivation Affecting Older Peoples Index, showing a strong linear slope value of 16.17 and explaining 36 per cent of variation in admission ratios. This is followed by proportion of non-whites, explaining 16 per cent of variation, the social fragmentation index, explaining 10 per cent of variation and spatial proximity explaining only 8 per cent of variation.

Although individually each variable has shown some association with ‘potentially avoidable’ emergency admissions it is also possible that combinations of variables can have a joint impact on ‘potentially avoidable’ emergency admissions for the older population. Table 4.03 shows the joint impact of ethnicity, social fragmentation and spatial proximity to hospital beds with the IDAOPi (the strongest individual effect) on ‘potentially avoidable’ emergency admissions for the older

populations of London. For each table, the variables are shown by tertiles with 1 being the lowest, rising to 3 for the highest.

		Non-Whites					Social Fragmentation Index		
		1	2	3			1	2	3
IDAOP1	1	83	79	91	IDAOP1	1	81	94	66
	2	104	102	101		2	100	106	97
	3	113	121	126		3	107	123	125

		Spatial Proximity to Hospital Beds		
		1	2	3
IDAOP1	1	81	89	72
	2	105	101	102
	3	121	113	131

Table 4.3: Joint Impact of Ethnicity, Social Fragmentation & Spatial Proximity to Hospital Beds and Deprivation on ‘Potentially Avoidable’ Hospital Admissions Ratios for the Older Population

The joint impact of the IDAOP1 and the percentage of older people from an ethnic minority background shows that when both effects are raised, hospital admissions for ‘avoidable’ conditions are at their highest. Equally the combination of the lowest tertiles for both effects leads to ‘avoidable’ admission rates below what would be expected given the population profile. The higher than expected ‘avoidable’ admission ratio in all ethnic minority origin tertiles when the IDAOP1 tertile is at its highest, and equally the lower than expected admission ratios in all ethnic minority origin tertiles when the IDAOP1 tertile is at its lowest shows that the IDAOP1 has a stronger effect on ‘potentially avoidable’ emergency admission ratios for the older population than the ethnic origin of patients. Similar effects are seen in the joint effects of spatial proximity to hospital beds and the IDAOP1 showing the IDAOP1 has a much stronger impact on admission ratios than closeness to hospitals. Equally

similar effects are seen with the joint effects of the IDAOPI and the social fragmentation index on admission ratios. In fact far lower than expected ‘avoidable’ admission ratios are seen when social fragmentation is at its highest but the IDAOPI is lowest. This could in part be reflecting some of the individual elements of the social fragmentation index such as living conditions, or variables missing from the IDAOPI such as living alone; these elements will be explored in the following section.

4.4.2 Living Conditions

Previous studies have shown strong associations between ‘potentially avoidable’ emergency admissions for the older population and living alone and living in rented accommodation, therefore although these variables are incorporated in the social fragmentation index, there are worthy of exploration independently of the social fragmentation index. The IDAOPI does not include any information on living conditions for older people, however the Index of Multiple Deprivation (IMD) has a sub-index on poor housing (Index of Multiple Deprivation Poor Housing Index), and although not specific to the older population, is also worthy of investigation. Little evidence on the association of households lacking amenities with admissions exists and so this variable has been included. Figure 4.6 shows the geographic distribution of living conditions for the older population of London by quintile.

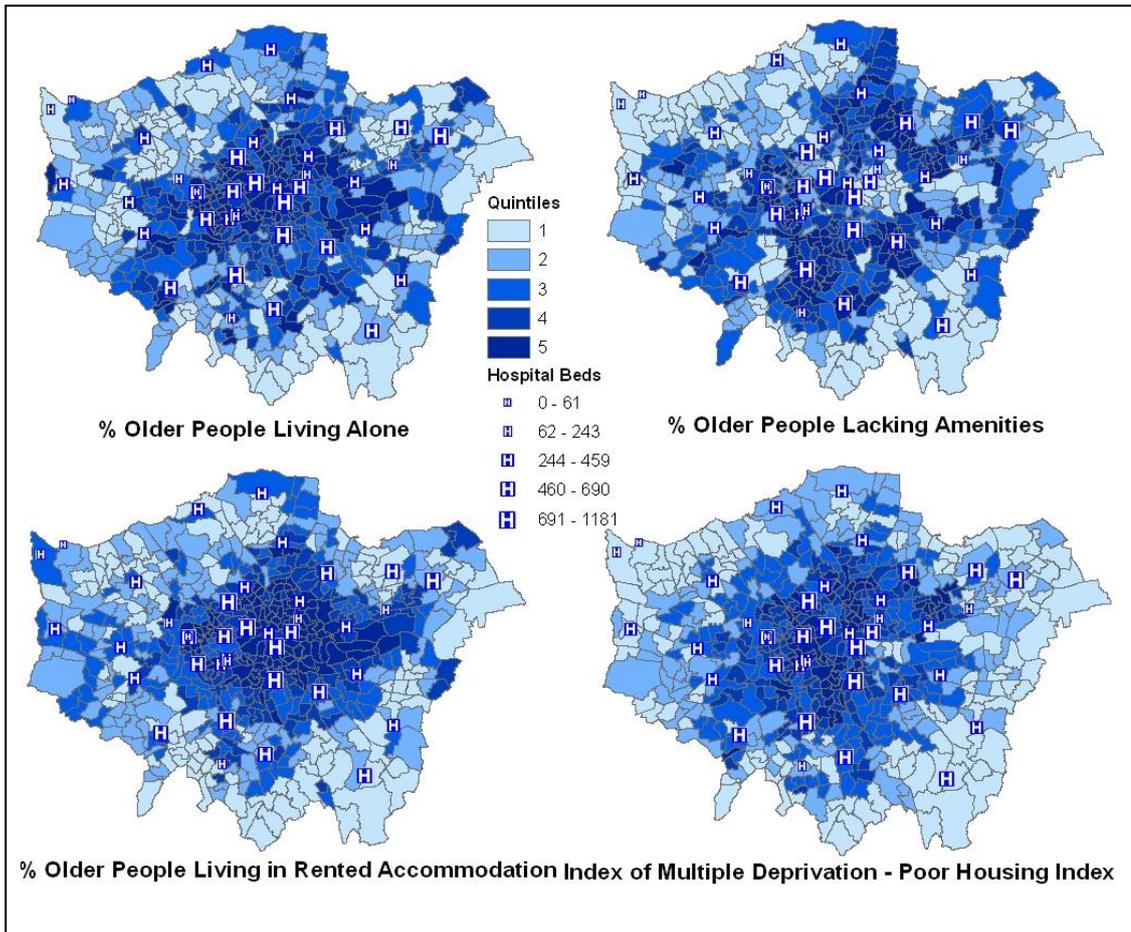
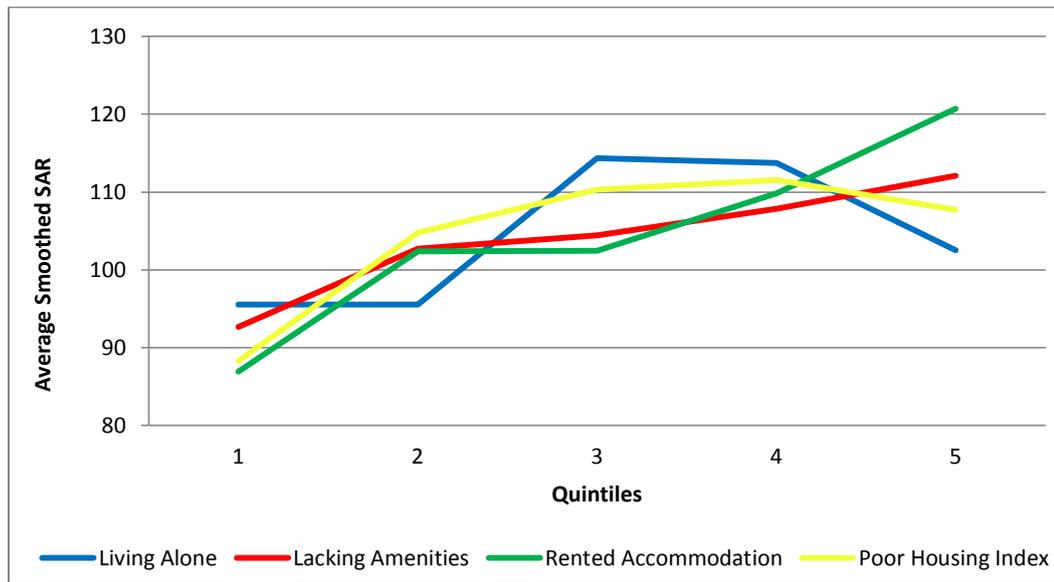


Figure 4.6: Living Conditions of the Older Population by ward in London, UK

The pattern of the percentage of older people who live alone is similar to that of the population density of older people shown in figure 4.3 with higher concentrations of older people living alone in inner London. Many more of the older people in inner London also live in rented accommodation and in poor housing conditions. The pattern of older people who lack amenities (central heating or a bath or shower) differs slightly to that of rented accommodation, with less people lacking amenities in the east of the city. This may be reflecting higher concentrations of social housing rather than rented accommodation in these areas, which tend to be of higher quality than some privately rented accommodation. The pattern of ‘potentially avoidable’ emergency admissions to hospital for the older population of London seen in figure

4.03 appears to be closest to the pattern of older people living in rented accommodation, although it shows some similarities with each map of living conditions.

Figure 4.7 shows the relationship between older people living alone and housing conditions and ‘potentially avoidable’ admissions for the older population of London using bivariate plots.



**significant at the 95% Confidence Level (p=0.01 or less)*

Figure 4.7: Bivariate Plots of Average Smoothed Standardised Admission Ratios and Older People Living Alone and Housing Variables by Quintile for London

There appears to be a fairly strong relationship between the percentage of older people living in rented accommodation and standardised admission ratios. A slightly weaker relationship between the percentage of older people lacking amenities and the poor housing index with standardised admission ratios is shown, however this may be a function of deprivation where more deprived populations tend to live in poorer housing conditions. There appears to be no relationship between the percentage of older people living alone and standardised admission ratios, which is

unexpected given the literature. In each case the results were significant to at least 0.01 using f-tests. Table 4.4 further tests the association of the housing variables with standardised admission ratios by exploring their strength and significance.

Variable	Linear Slope	P Value	R ²
Living Alone	3.48	0.001	0.02
Lacking Amenities	7.26	0.000	0.07
Rented Accommodation	12.12	0.000	0.20
IMD Poor Housing Index	6.7	0.000	0.06

Table 4.4: Bivariate Analysis of HES data on ‘Potentially Avoidable’ Hospital Admissions for the Older Populations of London and Living Conditions

Living alone has a weak linear slope value of 3.48 and accounts for very little (2 per cent) of the variation in ‘potentially avoidable’ emergency admission rates for the older population, though the p value suggests a significant (but possibly non-linear relationship). The percentage of the older population living in rented accommodation showed a greater linear slope value of 12.12 and accounted for 20 per cent of variations in ‘potentially avoidable’ emergency admission rates for the older population, a much stronger association although still less than that of deprivation (the IDAOPI). The percentage of older households lacking amenities and the IMD poor housing index accounted for 7 per cent and 6 per cent of variation in ‘potentially avoidable’ emergency admission rates for the older population in London respectively and the linear curve reduced for both.

Table 4.5 shows the joint impact of the four living condition variables individually with the IDAOPI (the strongest individual effect) on ‘potentially avoidable’ emergency admissions for the older populations of London.

		Living Alone		
		1	2	3
IDAOPI	1	80	90	80
	2	100	108	97
	3	127	127	121

		Lacking Amenities		
		1	2	3
IDAOPI	1	77	89	93
	2	96	104	107
	3	145	114	122

		Rented Accommodation		
		1	2	3
IDAOPI	1	82	84	62
	2	101	105	101
	3	128	120	126

		IMD - Poor Housing		
		1	2	3
IDAOPI	1	80	94	75
	2	103	104	99
	3	118	129	122

Table 4.5: Joint Impact of Deprivation and Living Conditions

Despite the percentage of older people living in rented accommodation being moderately associated with ‘potentially avoidable’ emergency admissions for the older population of London when examined independently, when the joint effect with the IDAOPI on admission ratios is explored, the effect is much weaker. In fact, for every rented accommodation tertile, the effect of the IDAOPI gets stronger as the IDAOPI tertiles increase. The same can be seen for all the living condition variables, suggesting the effects of deprivation on ‘potentially avoidable’ emergency admissions for the older population is stronger than any of the living condition variables introduced. However it may be that the strong association of deprivation with ‘potentially avoidable’ emergency admissions for the older people of London is reflecting the poorer health of deprived populations, leading to a higher demand for hospital care.

4.4.3 Morbidity

It has been well documented that older people are frailer thus more prone to ill health and therefore may require the use of hospital services more (see chapter 2). As well as having a long-term limiting illness, a number of factors may reflect a higher demand for care, some of which are included in the morbidity index (see chapter 3

for details of how this was constructed). Although living in nursing or residential homes should ensure care is provided for older people, it is also possible that they may require greater amounts of hospital care as explained in chapter 2. Figure 4.8 shows the geographic distribution of the potential demand for secondary care amongst the older people.

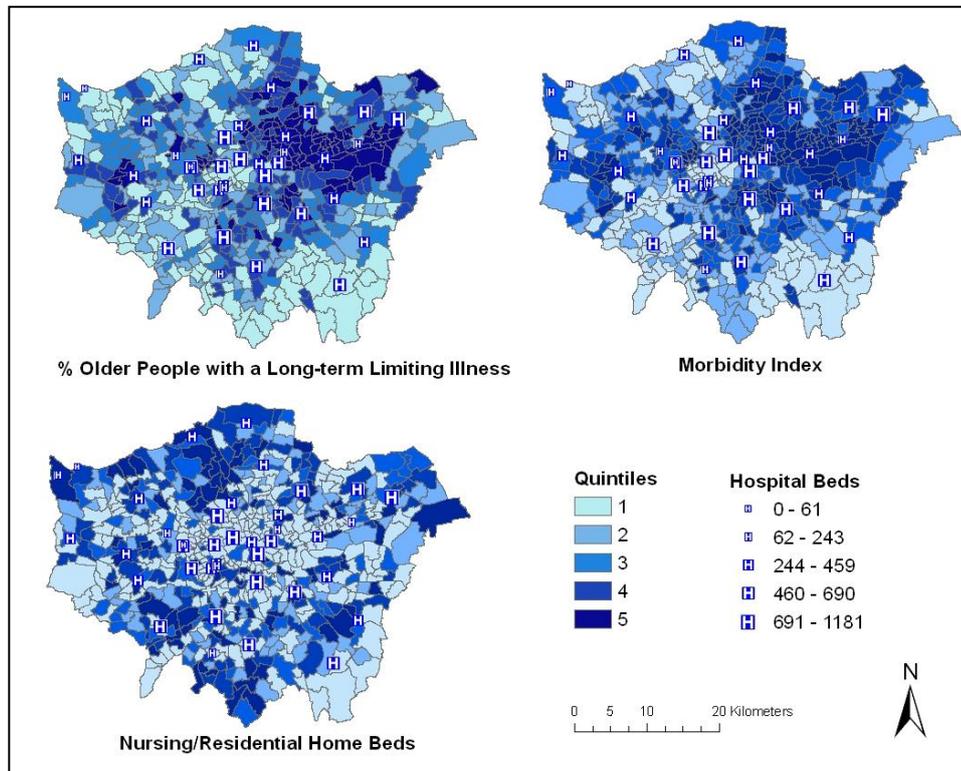


Figure 4.8: Potential Demand for Secondary Care

It is clear that there are higher concentrations of older people with a long-term limiting illness and a high morbidity index in the wards to the northeast and west of London and far less around the outskirts of London. There are also a few wards to the west and south of London that have higher concentrations of older people with a long-term limiting illness. The pattern is relatively similar to that of ‘potentially avoidable’ emergency admissions to hospital (figure 4.03) and to the map of deprivation (figure 4.4). As expected there are very few nursing or residential home

beds within inner London and the pattern reflects the concentrations of older population seen in figure 4.3. The pattern shows little resemblance to the pattern of standardised admission ratios for ‘potentially avoidable’ emergency admissions for the older population as seen in figure 4.3. Nursing and residential homes tend to be placed in outer London where property is of a larger size and often cheaper than in inner London.

Figure 4.9 explores the bivariate relationship between morbidity and ‘potentially avoidable’ emergency admissions for the older population of London. Nursing and residential care provision is not included in this graph as it cannot be represented in quintiles due to many of the Wards of London having no nursing/residential home beds at all.

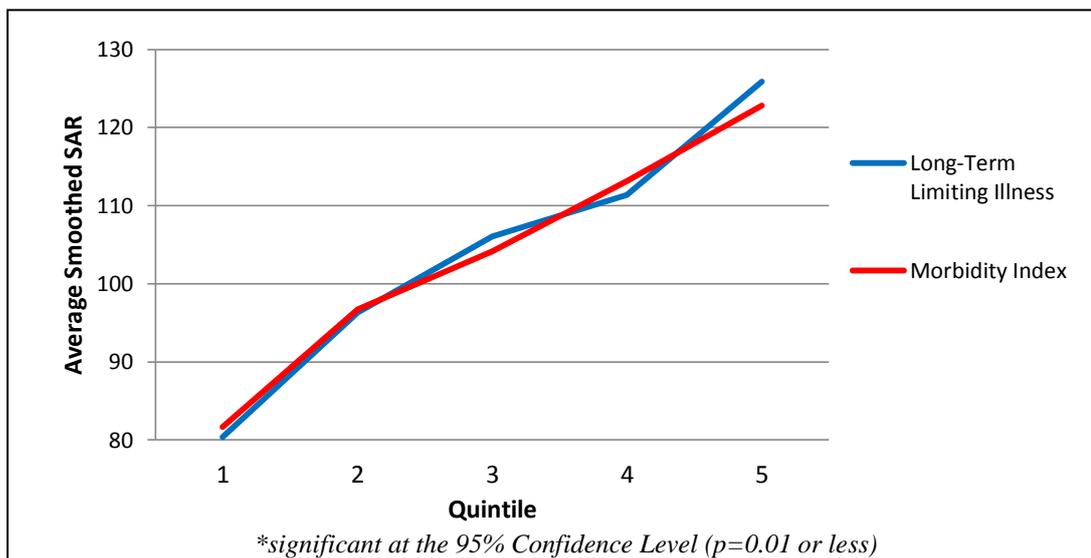


Figure 4.9: Bivariate Plots of Average Smoothed Standardised Admission Ratios and Morbidity Variables by Quintile

There is a clear strong relationship between older people with a long-term limiting illness and the morbidity index (of which long-term limiting illness is a factor of) and ‘potentially avoidable’ emergency admissions for the older population of

London shown by a strong monotonic positive gradient line. In both cases the results were significant to at least 0.01 using f-tests. Table 4.6 tests the association of the morbidity variables and the availability of nursing/residential home beds with standardised admission ratios by exploring their strength and significance.

Variable	Linear	P-Value	R ²
	Slope		
Long-term Limiting Illness	15.16	0.000	0.32
Morbidity Index	14.52	0.000	0.21
Nursing/Residential Home	-0.3	0.79	0

Table 4.6: Bivariate Analysis of HES data on ‘Potentially Avoidable’ Hospital Admissions for the Older Populations of London and Morbidity

The strongest individual association with ‘potentially avoidable’ emergency admissions for the older population is with the percentage of older people with a long-term limiting illness, having a strong linear slope value of 15.16 (significant to below 0.001) and accounting for 32 per cent of the variation in admissions. This is closely followed by a strong association with the morbidity index, showing a linear slope value of 14.52 (significant to below 0.001) and accounting for 21 per cent of the variations in ‘potentially avoidable’ emergency admissions for the older population. No association is seen between the provision of nursing/residential homes and ‘potentially avoidable’ emergency admissions for the older population.

Table 4.7 shows the joint impact of each of the morbidity variables and the IDAOPI on ‘potentially avoidable’ emergency admissions for the older population of London.

		Long-Term Limiting Illness		
		1	2	3
IDAOPi	1	78	93	89
	2	91	104	109
	3	114	118	126

		Morbidity Index		
		1	2	3
IDAOPi	1	78	87	97
	2	98	103	106
	3	125	117	127

		Nursing/Residential Home		
		1	2	3
IDAOPi	1	82	80	84
	2	102	105	103
	3	122	119	130

Table 4.7: Joint Impact of Morbidity and Deprivation on ‘Potentially Avoidable’ Hospital Admissions Ratios for the Older Population

It is clear deprivation has a stronger effect on ‘potentially avoidable’ emergency admissions for the older population than the percentage of older people with a long-term limiting illness, the morbidity index and the number of nursing/residential homes. In each case, when the IDAOPi is high, admission ratios are also high even when each of the morbidity variable tertiles is low. The opposite is also seen to be true when the pattern is reversed and the IDAOPi tertiles are low. It therefore appears that although the percentage of older people with a long-term limiting illness and the morbidity index have been shown to account for some of the variation in ‘potentially avoidable’ emergency admissions for the older population of London, the IDAOPi has a much stronger effect.

It is possible that the effect of morbidity on hospital admissions for the older population is counteracted by the provision of unpaid care. Unpaid care is care provided by members of the public, often family members, free of charge. The amount of care given can vary (possibly due to varying demand) from 5 hours a week to over 50 hours a week. This variation may have an effect on ‘potentially

avoidable' emergency admissions for the older population. Figure 4.10 shows the geographic distribution by ward of the percentage of the population who provide unpaid care to any member of the adult population (not just the over 65s) by quintile.

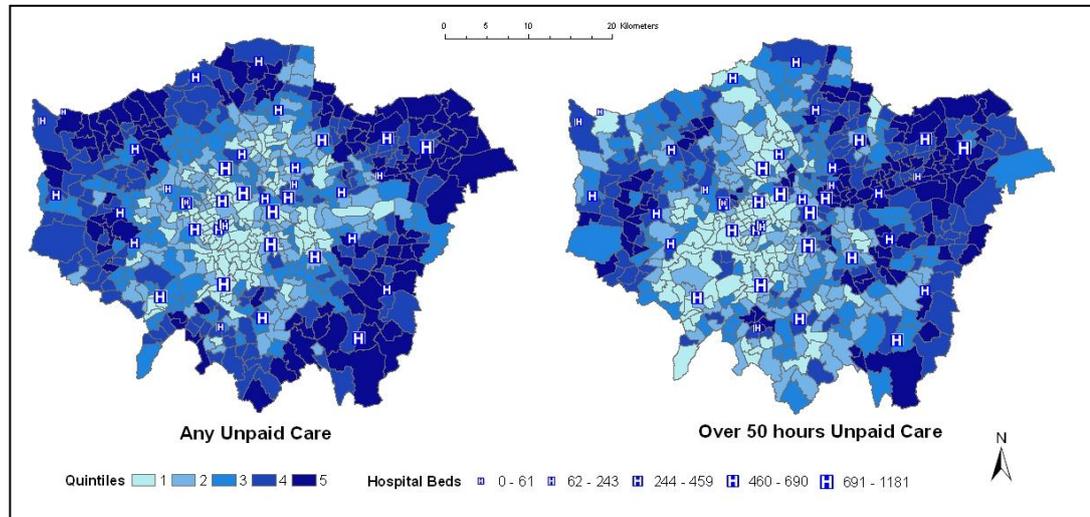


Figure 4.10: Percentage of Population Providing Unpaid Care by Quintile

The percentage of the population providing any unpaid care varies from 5 per cent to 12 per cent. A much smaller percentage of the population (0.47 per cent to 3.53 per cent) provide over 50 hours of unpaid care per week. In general there are less people providing any amount of unpaid care in inner London than in outer London. The pattern appears to be the reverse of that shown with standardised admission ratios for 'potentially avoidable' emergency admissions for the older population as seen in figure 4.04 but does reflect the map showing the distribution of the older population in figure 4.03. The greatest percentages of the population providing over 50 hours of unpaid care per week is concentrated in the wards to the east and northeast of the city and the far west. This distribution is similar to the pattern of 'potentially avoidable' emergency admissions for the older population as seen in figure 4.04, suggesting that the population in these areas are sicker and possibly require greater community support to relieve the burden of the unpaid carers.

Figure 4.11 explores the bivariate relationship between morbidity and ‘potentially avoidable’ emergency admissions for the older population of London.

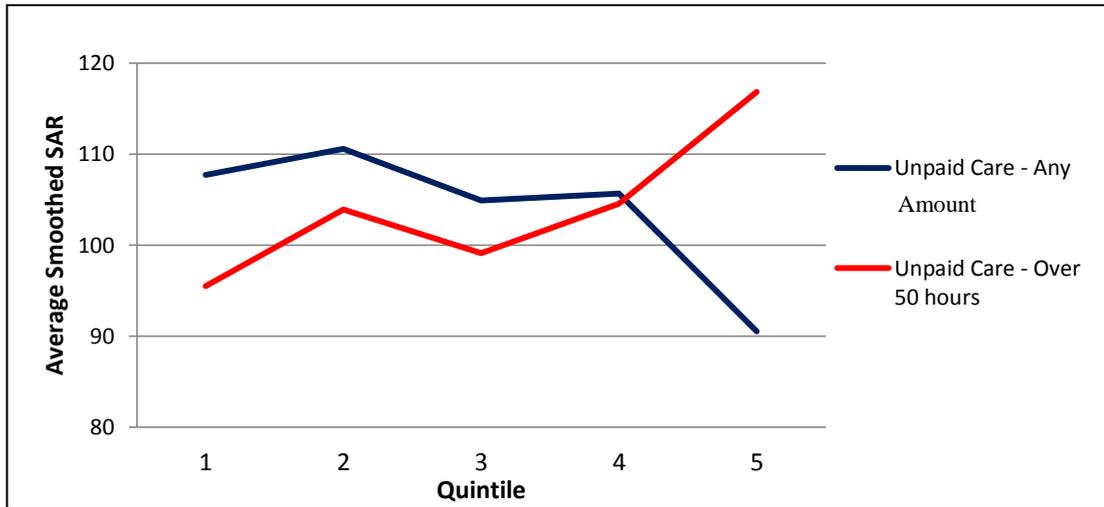


Figure 4.11: Bivariate Plots of Average Smoothed Standardised Admission Ratios and the Provision of Unpaid Care by Quintile

For the provision of unpaid care, the amount of care provided has opposing effects. Where any amount of unpaid care provided is over 50 hours per week there is a negative relationship with ‘potentially avoidable’ admissions, although the relationship is not uniform. In contrast where the amount of unpaid care provided is over 50 hours, ‘potentially avoidable’ admissions increase as the amount of provision increase. Although for both all unpaid care and over 50 hours of unpaid care the line is not completely monotonic, it does suggest some association is happening between the provision of unpaid care and ‘potentially avoidable’ admissions for the older population of London. In each case the results were significant to at least 0.01 using f-tests. The opposing effects of the amount of unpaid care can clearly be seen when linear regression is performed (table 4.8).

Variable	Linear Slope	P-Value	R ²
Provision of Any Amount of Unpaid Care	-6.36	0.000	0.06
Provision of Over 50 Hours of Unpaid Care	6.36	0.000	0.06

Table 4.8: Bivariate Plots of Average Smoothed Standardised Admission Ratios and the Provision of Unpaid Care by Quintile

The provision of unpaid care in London shows very interesting results. Where any amount of care is provided (1 hour or more per week) there is a negative association with ‘potentially avoidable’ emergency admission rates for the older population in London explaining 6 per cent of the variation in admission rates. However where over 50 hours of unpaid care per week is provided, the exact inverse, a positive association with ‘potentially avoidable’ emergency admission rates for the older population in London occurs, also explaining 6 per cent of the variation in admission rates.

The fact that intensive provision of unpaid care (over 50 hours per week) shows a positive association with ‘potentially avoidable’ admissions may be related to the morbidity of the population it is serving, i.e. the people who require a lot of unpaid care are much sicker and so admission to hospital may be inevitable. Equally, poor health is associated with deprivation, and deprivation has shown to have a stronger effect on ‘potentially avoidable’ emergency admissions for the older population of London. Table 4.9 shows the deprivation effects of the IDAOPI additional to the percentage of the population providing any amount of unpaid care for London and the percentage of the population providing over 50 hours of unpaid care.

		Unpaid Care Any Amount		
		1	2	3
IDAOP1	1	81	89	80
	2	103	101	104
	3	122	121	138

		Unpaid Care Over 50 Hours		
		1	2	3
IDAOP1	1	82	79	88
	2	100	102	105
	3	125	120	126

Table 4.9: Joint Impact of the Percentage of the Population Providing Unpaid Care and IDAOP1 on Smoothed Standardised ‘Potentially Avoidable’ Hospital Admissions Ratios for the Older Population of London

It is clear that deprivation has a stronger effect on ‘potentially avoidable’ admissions than the provision of any amount of unpaid care, with an increase in admissions as deprivation increases with each unpaid care tertile. The same pattern can be seen for the provision of over 50 hours of unpaid care and deprivation, suggesting deprivation has an overall greater impact on whether older people in London will be admitted to hospital with a ‘potentially avoidable’ condition.

A number of the socio-economic variables had now been discounted from further analysis however many of the variables show similar correlations with ‘potentially avoidable’ emergency admissions to hospital for the older population. A correlation matrix was the created with the variables that were most highly associated with ‘potentially avoidable’ hospital admissions for the older population of London (Table 4.10).

		Spatial Proximity to Hospital	Deprivation (IDAOPI)	% Older People Living Alone	% Older People in Rented Accom.	Social Fragmentation Index	% Older People with a LTLI	% Older People Non White	Provision of Unpaid Care - Any Amount	Provision of Unpaid Care - Over 50 Hours	Nursing or Residential Home Provision
Spatial Proximity to Hospital Beds	Pearson Correl. Sig. (2-tailed) N	1 0 625	.467** 0 625	.618** 0 625	.721** 0 625	.799** 0 625	.133** 0.001 625	.258** 0 625	-.605** 0 625	-.288** 0 625	-.289** 0 625
Deprivation (IDAOPI)	Pearson Correl. Sig. (2-tailed) N	.467** 0 625	1 0 625	.309** 0 625	.733** 0 625	.588** 0 625	.768** 0 625	.669** 0 625	-.375** 0 625	.307** 0 625	-.220** 0 625
% Older People Living Alone	Pearson Correl. Sig. (2-tailed) N	.618** 0 625	.309** 0 625	1 0 625	.729** 0 625	.849** 0 625	.148** 0 625	-.087* 0.029 625	-.661** 0 625	-.305** 0 625	-.234** 0 625
% Older People in Rented Accom.	Pearson Correl. Sig. (2-tailed) N	.721** 0 625	.733** 0 625	.729** 0 625	1 0 625	.895** 0 625	.512** 0 625	.264** 0 625	-.608** 0 625	0.045 0.258 625	-.340** 0 625
Social Fragmentation Index	Pearson Correl. Sig. (2-tailed) N	.799** 0 625	.588** 0 625	.849** 0 625	.895** 0 625	1 0 625	.299** 0 625	.211** 0 625	-.644** 0 625	-.158** 0 625	-.329** 0 625
% Older People with a Long-term Illness	Pearson Correl. Sig. (2-tailed) N	.133** 0.001 625	.768** 0 625	.148** 0 625	.512** 0 625	.299** 0 625	1 0 625	.461** 0 625	-.169** 0 625	.504** 0 625	0.02 0.622 625
% Older People Non-White	Pearson Correl. Sig. (2-tailed) N	.258** 0 625	.669** 0 625	-.087* 0.029 625	.264** 0 625	.211** 0 625	.461** 0 625	1 0 625	-.222** 0 625	.094* 0.019 625	-.149** 0 625
Provision of Unpaid Care - Any Amount	Pearson Correl. Sig. (2-tailed) N	-.605** 0 625	-.375** 0 625	-.661** 0 625	-.608** 0 625	-.644** 0 625	-.169** 0 625	-.222** 0 625	1 0 625	.540** 0 625	.192** 0 625
Provision of Unpaid Care - Over 50 Hours	Pearson Correl. Sig. (2-tailed) N	-.288** 0 625	.307** 0 625	-.305** 0 625	0.045 0.258 625	-.158** 0 625	.504** 0 625	.094* 0.019 625	-.540** 0 625	1 0 625	-0.043 0.281 625
Nursing or Residential Home	Pearson Correl. Sig. (2-tailed) N	-.289** 0 625	-.220** 0 625	-.234** 0 625	-.340** 0 625	-.329** 0 625	0.02 0.622 625	-.149** 0 625	.192** 0 625	-0.043 0.281 625	1 0 625

** . Correlation is significant at the 0.01 level (2-tailed). * . Correlation is significant at the 0.05 level (2-tailed).

Table 4.10: Correlation Matrix for Socio-economic Variables in London

Many of the variables are correlated. For example within London the percentage of older people living in alone is highly correlated with the percentage of older people living in rented accommodation, the social fragmentation index and (although a slightly lower correlation) the percentage of the population providing any amount of unpaid care. In order to overcome the problems of highly correlated variables, principal components analysis was performed.

Table 4.11 shows the results of the factor analysis using Eigen values over 1.

Component Matrix			
	Component		
	1	2	3
IDAOP1	0.72	0.59	0.08
Spatial Proximity to Hospital Beds	0.82	-0.24	0.01
% Older People Living Alone	0.79	-0.39	-0.17
% Older People Living in Rented Accommodation	0.93	0.08	-0.14
Social Fragmentation Index	0.94	-0.15	-0.12
% Older People from an Ethnic Minority Background	0.39	0.53	0.33
% Older People with a Long-term limiting illness	0.45	0.73	0.20
Presence of a Nursing/Residential Home	-0.23	0.00	0.81
% Population Providing Any Unpaid Care	-0.75	0.38	-0.30
% Population Providing Over 50 Hours Unpaid Care	-0.14	0.82	-0.41

Extraction Method: Principal Component Analysis.
a. 3 components extracted.

Table 4.11: Results of Factor Analysis using Principal Component Analysis

The factor analysis showed a number of distinct groups of variables although two groups of variables clearly stood out:

- Group 1: IDAOP1, spatial proximity to hospital beds, the percentage of older people living alone, the percentage of older people living in rented accommodation and the social fragmentation index.
- Group 2: the percentage older people with a long-term limiting illness and the percentage of the population providing over 50 hours unpaid care

The percentage of the older people from an ethnic minority background, the percentage of the population providing any unpaid care and the presence of a

nursing/residential home were independent of the other variables. As the social fragmentation index already includes variables on the percentage of older people living in rented accommodation and the percentage of older people living alone, the social fragmentation index was chosen to represent these 3 variables. Although IDAOPI, spatial proximity to hospital beds, and the social fragmentation index are highly correlated, they were placed in the models as separate variables. This was because they are distinct from each other, and theoretical evidence suggests each of these variables are important independently. Spatial proximity to hospital beds may be highly correlated with the IDAOPI due to the historical nature of hospital provision in London, where hospitals (see section 4.2).

A new index was created to include a composite score of the percentage of older people with long term limiting illness and the percentage of the population providing over 50 hours of unpaid care (known as the high demand index) to reflect the high demand for care these people may require. The percentage of older people from an ethnic minority background, the percentage of the population providing any amount of unpaid care and nursing/residential home availability were kept independent.

To establish further how these relationships interact with each other, multiple regression was performed.

4.4.3.1 MULTIPLE REGRESSION MODELS FOR LONDON ‘POTENTIALLY AVOIDABLE’ HOSPITAL ADMISSIONS FOR THE OLDER POPULATION: HES DATA

Table 4.12 shows the results of the multiple regression models. Results shown in red are where positive associations occur, and results in blue show negative associations.

Models	Variables	mean	sd	val2.5pc	val97.5pc	DIC	Number of Wards with Significant Structured Residual Effects	Number of Wards with Significant Unstructured Residual Effects
Model 1	Spatial Proximity to Hospital Beds (Access)	0.3978	0.1883	0.07	0.82	5260.5	294	0
Model 2	Spatial Proximity to Hospital Beds (Access) Income Deprivation Affecting Older People Index	-0.2376 0.3691	0.1396 0.0216	-0.54 0.33	-0.01 0.41	5206.5	284	0
Model 3	Income Deprivation Affecting Older People Index Social Fragmentation	0.3969 -0.0615	0.0262 0.0292	0.35 -0.12	0.45 0.00	5208.5	273	0
Model 4	Income Deprivation Affecting Older People Index Social Fragmentation High Demand For Care	0.3479 -0.0574 0.0367	0.0320 0.0286 0.0141	0.29 -0.11 0.01	0.41 0.00 0.06	5203.2	282	0
Model 5	Income Deprivation Affecting Older People Index High Demand For Care % older people from ethnic minority background	0.2923 0.1632 0.0135	0.0307 0.0474 0.0126	0.23 0.08 -0.01	0.35 0.27 0.04	5204.94	272	0
Model 6	Income Deprivation Affecting Older People Index High Demand For Care all unpaid care	0.3108 0.1478 0.0013	0.0328 0.0542 0.0136	0.25 0.05 -0.03	0.37 0.26 0.03	5206.5	277	0
Model 7	Income Deprivation Affecting Older People Index High Demand For Care Presence of Nursing/Residential Home	0.3032 0.1655 0.0098	0.0287 0.0507 0.0141	0.25 0.06 -0.02	0.36 0.27 0.04	5204.4	255	0

Table 4.12: Multiple Regression Results for ‘Potentially Avoidable’ Emergency Admission to Hospital for the Older Population of London and Socio-Economic and Care Provision Variables

When modelled independently of the other variables, spatial proximity to hospital beds (access) is positively associated with ‘potentially avoidable’ emergency admission ratios for the older population (model 1) but leaves a significant residual effect in just below half (294) of the wards of London therefore explaining only 53 per cent of the variations in admissions.

When the IDAOPI is introduced as in model 2, the association between hospital admissions and spatial proximity to hospital beds is no longer positive. Instead the IDAOPI is positively associated with admissions showing that the IDAOPI has a stronger association with ‘potentially avoidable’ emergency admissions for the older people of London than spatial proximity to hospital beds and is therefore more important in explaining these variations. The model ‘fit’ (DIC) has improved greatly, and the number of wards with significant structured random effects present has decreased. Model 2 therefore explains the variation in ‘potentially avoidable’ emergency admissions to hospital for the older population of London better than spatial proximity to hospital beds (model 1), now explaining 55 per cent of the variation. It is most likely that the previous independent positive association seen with spatial proximity to hospital beds is in fact reflecting the historical nature of hospitals in London being built in more deprived areas as explained in chapter 2.

Model 3 introduces the social fragmentation index. A negative association between the social fragmentation index and ‘potentially avoidable’ admissions was present after controlling for the IDAOPI. The model ‘fit’ and the number of wards showing a significant structured random effect did not improve. Although there is no correlation between the IDAOPI and the social fragmentation index, it is possible the negative effect shown between hospital admissions and social fragmentation could

be showing the residuals in the social fragmentation index after the strong effect of the IDAOPI. This theory is supported by the positive association shown between the social fragmentation index and hospital admissions when modelled independently of the IDAOPI as shown in figure 4.02 and also the stronger effect of deprivation shown in the joint effect models in 4.03.

Model 4 introduced the high demand index (percentage of the older population with a long-term limiting illness and the percentage of the general population providing more than 50 hours of unpaid care) and so reflects areas where the burden of illness is greater and could therefore lead to more admissions for ‘potentially avoidable’ conditions. A positive association was seen after controlling for deprivation and social fragmentation which continue to show a positive and negative association with hospital admissions respectively. This suggests that the high demand index is an important variable in explaining ‘potentially avoidable’ admission ratios even after controlling for the effects of deprivation. The DIC (model ‘fit’) improves, although the number of wards with a significant residual effect rises. The continued negative association of the social fragmentation index further suggests that deprivation is by far the more important variable in explaining variations in hospital admission ratios compared with social fragmentation; therefore the social fragmentation index was dropped from further models.

Model 5 then introduces the percentage of the older population from an ethnic minority background. No association was seen with ‘potentially avoidable’ admissions after controlling for the IDAOPI and the high demand index. The model ‘fit’ decreases as did the number of wards with significant structured residual effects. The percentage of the older population from an ethnic minority background was not

significant in explaining the variation in ‘potentially avoidable’ emergency admissions in London for the older population and so was omitted from further models.

Model 6 introduced the percentage of the population providing any amount of unpaid care (over 5 hours per week). No association with ‘potentially avoidable’ admissions was seen after controlling for the effects of deprivation and social fragmentation so the percentage of the population providing any unpaid care was omitted from further models.

The final model (model 7) introduced whether a nursing or residential home was present within the ward (reflecting potential greater workload for GPs). Again no association was seen with ‘potentially avoidable’ emergency admissions in London for the older population.

In summary, the most significant variables in explaining the variations in ‘potentially avoidable’ emergency admissions for the older population of London are the IDAOPI, and the high demand index. This reflects the importance of deprivation and ill health (and demand for care in the community) reflected in the literature. Some of the variation in ‘potentially avoidable’ emergency admissions to hospital for the older population may be explained by certain individual patients having frequent admissions (i.e. having more than 1 admission per year). The next section explores this hypothesis.

4.4.4 Frequent 'Potentially Avoidable' Emergency Admissions to Hospital for the Older Population of London

Frequent 'potentially avoidable' emergency admission for the older population include those patients who have been admitted more than once in any one year from the first admission. As figure 4.12 shows, frequent admissions to hospital have consistently accounted for over 50 per cent of all admissions between the financial years 2001/02 and 2004/05.

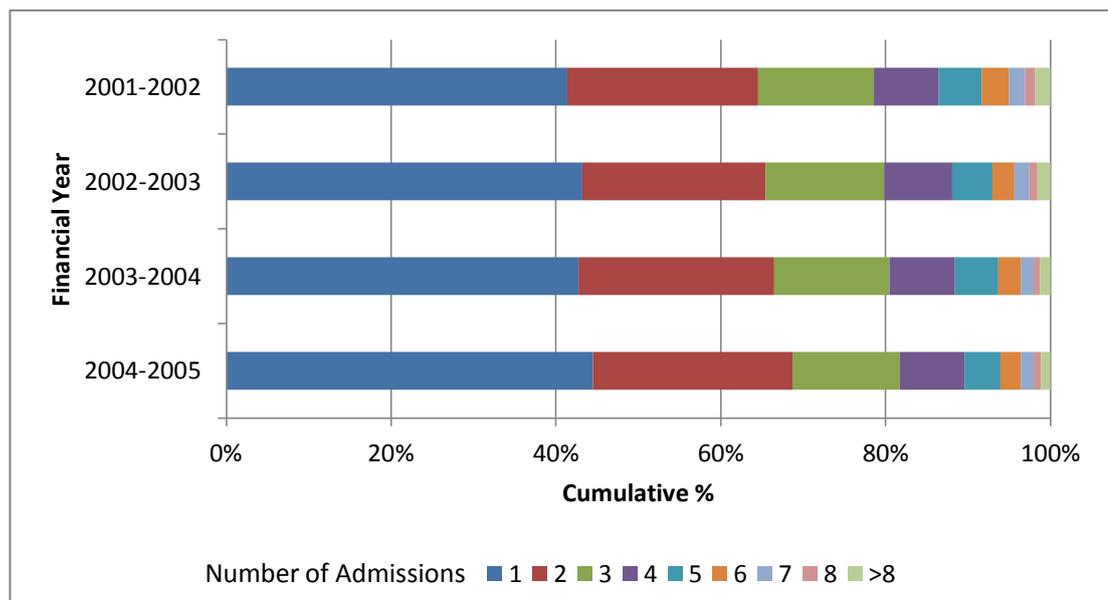


Figure 4.12: Cumulative Percentage of 'Potentially Avoidable' Emergency Admissions for the Older People of London by Frequency of Admissions

Although the percentage of 'potentially avoidable' emergency admissions that are frequent admissions has decreased slightly over time, they still account for a significant percentage of admissions, with 2 and 3 admissions in any one year being common, and rising to over 8 admissions in any one year for a small percentage of patients. In fact, the highest number of admissions in any one year rose to 23 in 2003/04 and every year had at least 1 patient with 17 admissions.

Although the percentage of ‘potentially avoidable’ emergency admissions for the older population that are due to frequent admissions for the same person is decreasing slightly year on year, when the number of frequent admissions per 1,000 population between the financial years of 2001/2002 and 2004/2005 is examined they are in fact slightly increasing as figure 4.13 shows.

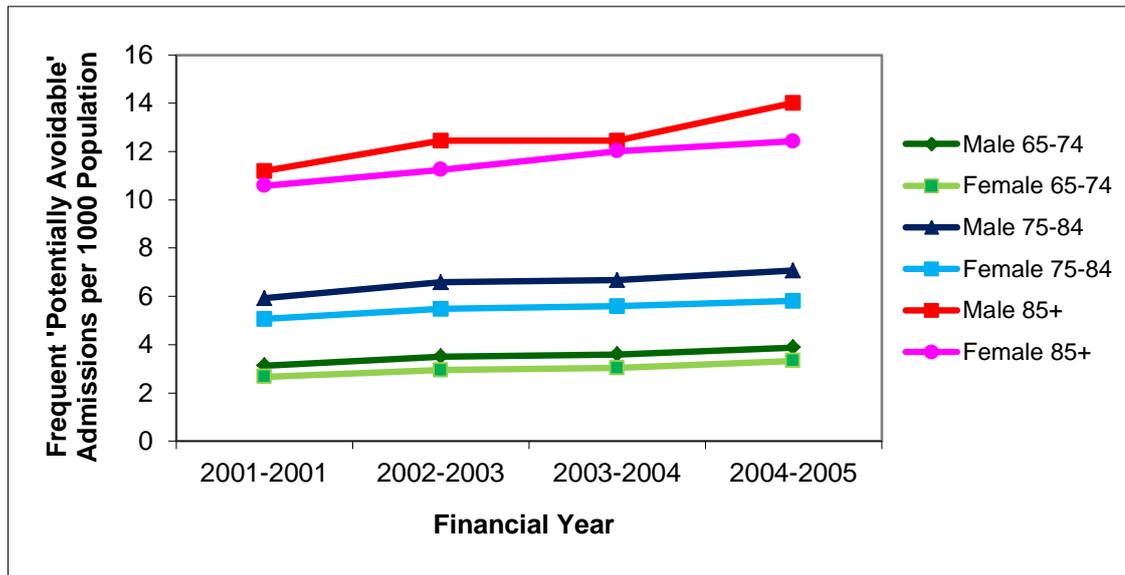


Figure 4.13: Frequent ‘Potentially Avoidable’ Emergency Admissions Rates per 1000 Older Population in London (01/02-04/05)

Frequent ‘potentially avoidable’ emergency admissions increase with age, with the over 85 age band having the highest level of frequent admissions. Males also consistently have higher frequent ‘potentially avoidable’ admission rates than females across all age bands.

The overall pattern to frequent ‘potentially avoidable’ admissions per 1000 older population is similar to that seen in figure 4.2 for all ‘potentially avoidable’ admissions (figure 4.14).

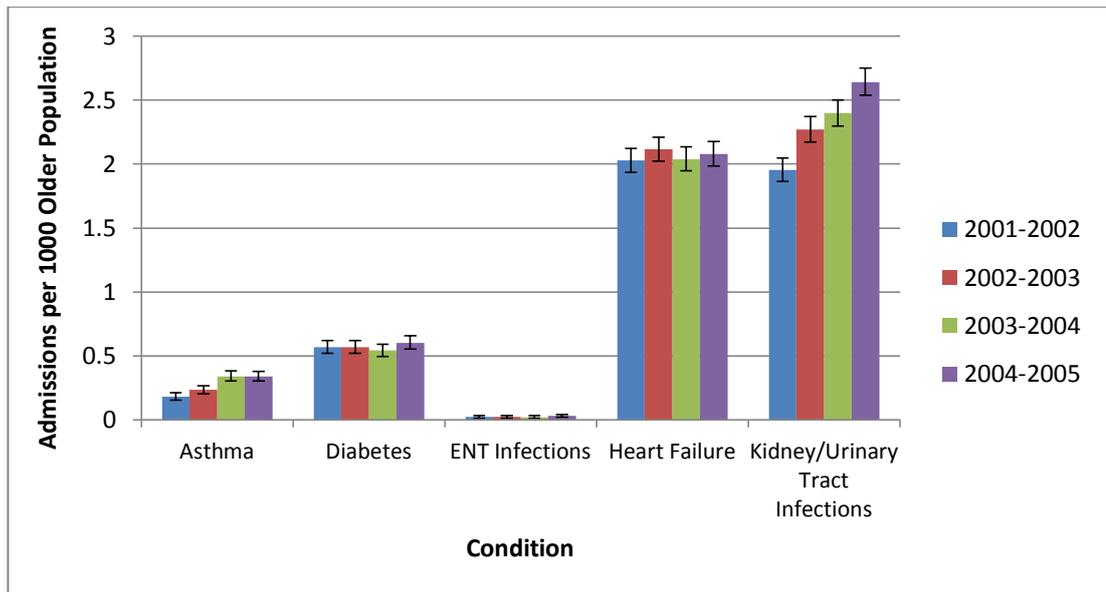


Figure 4.14: ‘Potentially Avoidable’ Frequent Hospital Admissions per 1000 Population by Condition per Financial Year (2001/02–2004/05)

As with all ‘potentially avoidable’ admissions, there are higher numbers of admissions for kidney and urinary tract infections, rising annually. There are also high levels of frequent admissions for heart failure, although these change little over time. Frequent admissions for ENT problems are negligible. Admissions for diabetes remain stable over time and account show around 0.5 admissions per 1000 older population. Admissions for asthma however are also showing an increase annually and although remain fairly low, are cause for concern.

When looking at the breakdown of the percentage of admissions by condition and financial year that are frequent admissions however a different pattern is seen as in figure 4.15.

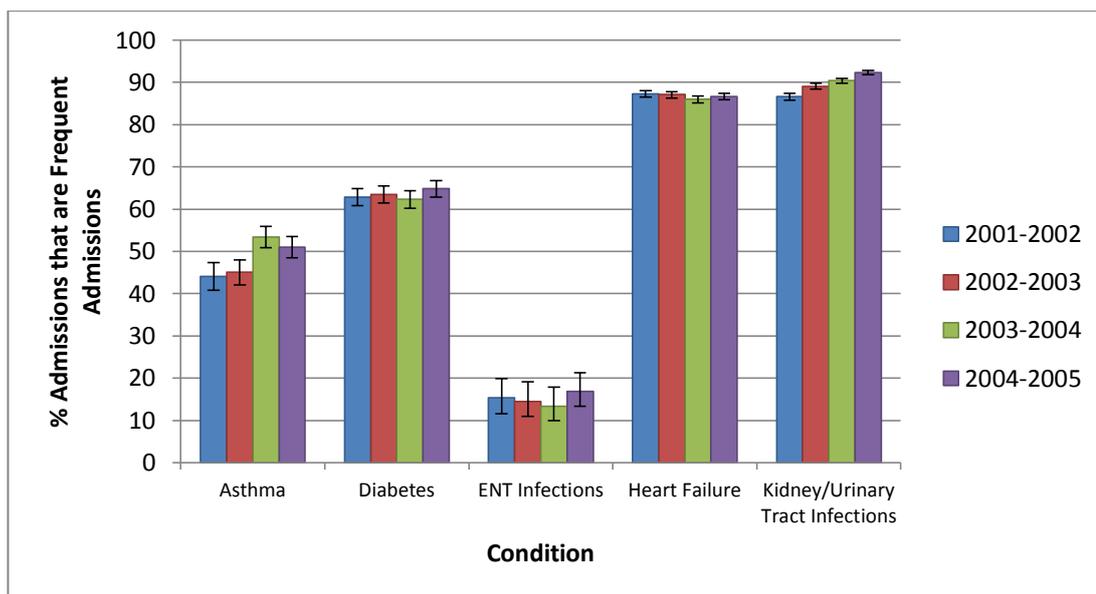


Figure 4.15: Percentage of Frequent ‘Potentially Avoidable’ Emergency Admissions for the Older People of London by Condition and Financial Year

Frequent ‘potentially avoidable’ emergency admissions for the older population accounted for 87 per cent of all admissions for kidney and urinary tract infections in 2001/02 and has risen over time to 2 per cent of admissions in 2004/05. Frequent ‘potentially avoidable’ emergency admissions also accounted for a high per cent (87 per cent) of all admissions for heart failure and remained constant over time. Although admissions per 1000 older population for diabetes were lower overall compared with urinary tract/renal infections and heart failure, frequent admissions made up over 60 per cent of these admissions. Equally frequent admissions for asthma accounted for over 40 per cent of admissions and is showing an overall upward trend. Admissions for ENT conditions have the fewest frequent returns at around 15 per cent annually.

The geographic pattern of smoothed standardized *frequent* ‘potentially avoidable’ emergency admissions to hospital for the older populations of London varies as shown in figure 4.16.

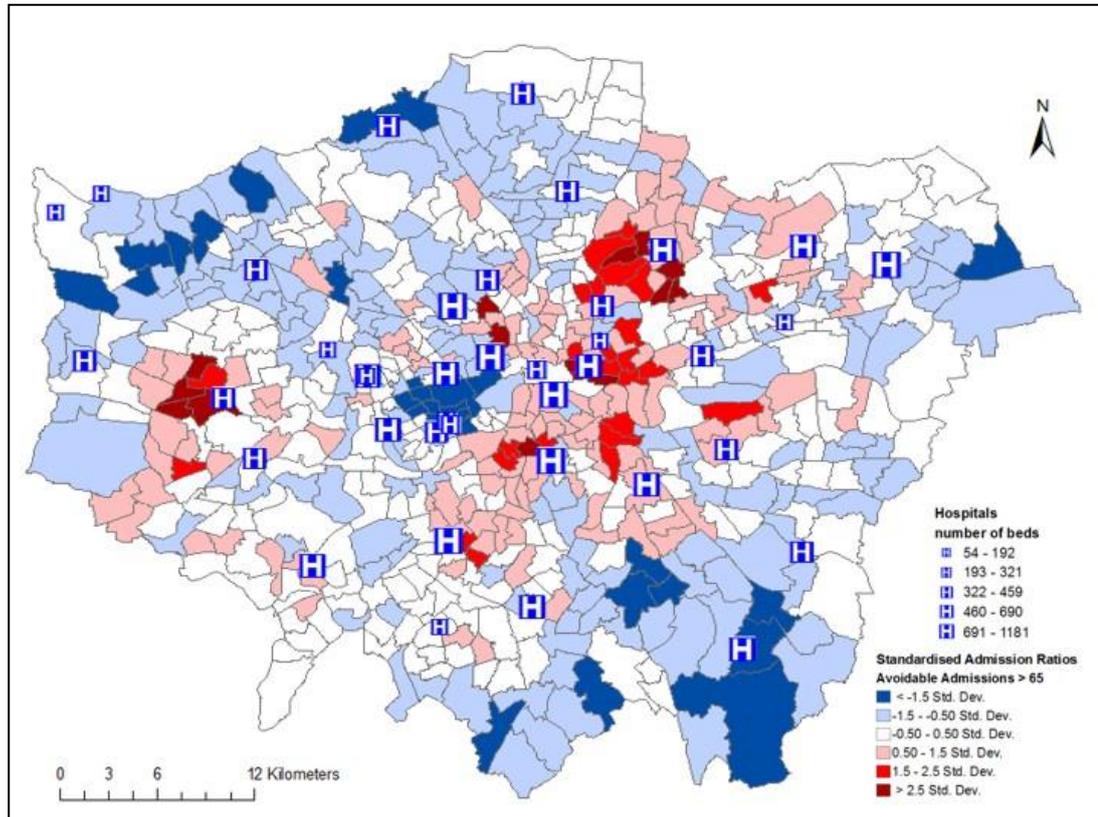


Figure 4.16: Smoothed Standardised Frequent ‘Potentially Avoidable’ Emergency Admission Ratios for the Older Population of London

Within London, there is now a very clear pattern emerging with ‘above expected’ frequent ‘potentially avoidable’ admission rates in wards to the immediate north east of London, where deprivation is high. There are also a number of wards with higher than expected frequent ‘potentially avoidable’ admissions in wards to the west of London. It is very evident that wards to the around outer London, particularly to the north west and south east have lower than expected frequent ‘potentially avoidable’ admissions. These wards are much more affluent. So it appears that for London, there may be an association between deprivation and frequent ‘potentially avoidable’

admissions for the older population. The pattern is similar to that seen for *all* ‘potentially avoidable’ admissions to hospital for the older population (figure 4.03) particularly for admission ratios above what would be expected given the population profile.

As with *all* ‘potentially avoidable’ emergency admissions, simple bivariate plots of the variables were produced to test the association of frequent ‘potentially avoidable’ emergency admissions for the older population of London with socio-economic conditions, however only for those variables seen to be associated with *all* ‘potentially avoidable’ admissions have been included (figure 4.17).

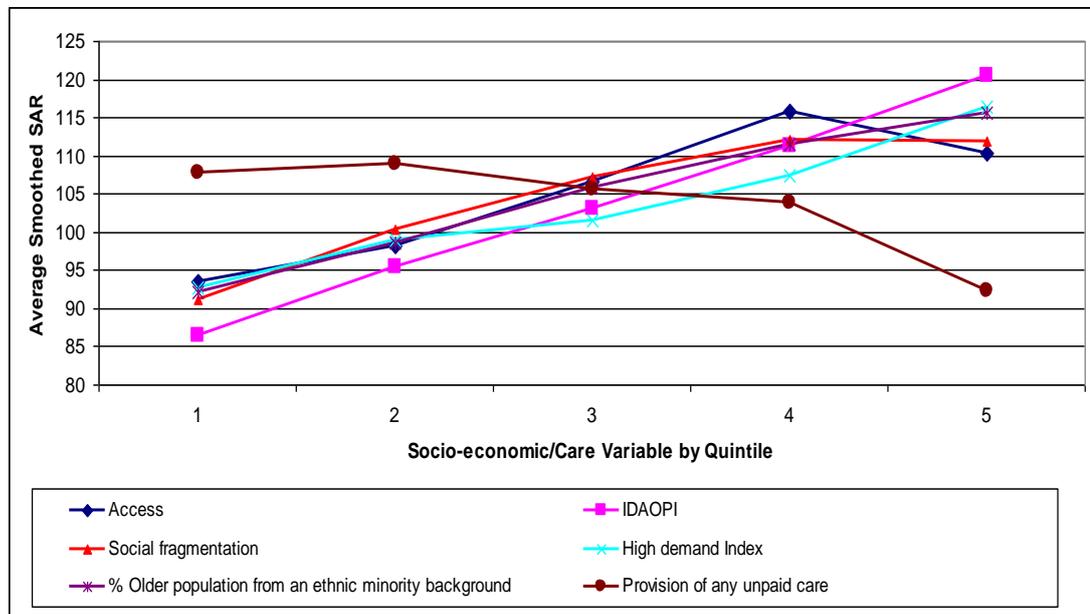


Figure 4.17: Bivariate Plots of Average Smoothed Frequent Standardised Admission Ratios and Socio Economic Variables by Quintile for London

For each of the dependant variable (spatial proximity to hospital beds and socio-economic variables) there are strong monotonic gradients to the lines for all the variables. In each case the average smoothed *frequent* ‘potentially avoidable’ emergency admission standardized admission ratio increases as the socio-economic

variable increases. The exception is for the percentage of the population providing any amount of unpaid care where the gradient of the line is negative. In each case the results were significant to at least 0.01 using f-tests.

Bivariate regression was then performed on the standardised *frequent* ‘potentially avoidable’ data for each of the variables using the standardised data (z-scores) to allow for comparisons between the variables. Table 4.13 shows the results of bivariate regression results of the HES data on *frequent* ‘potentially avoidable’ hospital admissions for the older population of London and socio-economic variables.

Variable	Linear Slope	P Value	R²
Spatial Proximity to Hospital Beds	6.60	0.000	0.14
IDAOPi	11.72	0.000	0.45
social fragmentation index	7.22	0.000	0.18
High Demand	7.90	0.000	0.21
Ethnic background	7.80	0.000	0.20
Provision of Any Unpaid Care	-5.67	0.000	0.11

Table 4.13: Summary of Bivariate Analysis of Frequent ‘Potentially Avoidable’ Hospital Admissions for the Older Populations and Socio-economic Variables

Spatial proximity to hospital beds now has a lower linear slope than for all ‘potentially avoidable’ admissions however accounts for a higher percentage of frequent ‘potentially avoidable’ admissions at 14 per cent. Equally, the linear slope for the IDAOPi is lower for frequent admissions than for all admissions at 11.27 however now accounts for 45 per cent of the variation in frequent admissions. For each of the remaining associations between frequent ‘potentially avoidable’ emergency admissions for the older population and socioeconomic conditions a similar pattern is to that of all ‘potentially avoidable’ admissions.

So it appears that there are some associations between socio-economic variables and smoothed standardized *frequent* ‘potentially avoidable’ admission ratios within London. To establish further how these relationships interact with each other, multiple regressions were then performed.

4.4.5 Multiple Regression Models for Frequent ‘Potentially Avoidable’ Hospital Admissions for the Older Population of London: Individual Patient Data

As with *all* ‘potentially avoidable’ hospital admissions for the older population, multiple regression models for *frequent* ‘potentially avoidable’ hospital admissions for the older population were executed using a similar model structure. Table 4.16 shows the results of multilevel modelling for *frequent* ‘potentially avoidable’ hospital admissions for the older population in London. As with *all* ‘potentially avoidable’ hospital admissions for the older population results shown in red show where a positive association was achieved, and results in blue a negative association. Results in black are where no association was present.

Models	Variables	mean	sd	val2.5pc	val97.5pc	DIC	Number of Wards with Significant Structured Residual Effects	Number of Wards with Significant Unstructured Residual Effects
Model 1	Spatial Proximity to Hospital Beds (Access)	0.7526	0.1572	0.46	1.06	4037	166	0
Model 2	Spatial Proximity to Hospital Beds (Access) IDAOP1	0.1129 0.3604	0.1866 0.0248	-0.26 0.31	0.46 0.41	3908	135	0
Model 3	IDAOP1 Social Fragmentation Index	0.4125 -0.0911	0.0289 0.0323	0.36 -0.15	0.41 -0.09	3903	146	0
Model 4	IDAOP1 Social Fragmentation Index High Demand Index	0.3928 -0.0873 0.0140	0.0382 0.0329 0.0167	0.32 -0.15 -0.02	0.47 -0.02 0.05	3901	147	0
Model 5	IDAOP1 Social Fragmentation Index % Population Providing any Unpaid Care	0.4123 -0.0930 -0.0011	0.0290 0.0357 0.0139	0.36 -0.16 -0.03	0.47 -0.02 0.03	3903	145	0
Model 6	IDAOP1 Social Fragmentation Index % Older People from an Ethnic Minority Background	0.3908 -0.0793 0.0153	0.0364 0.0339 0.0141	0.32 -0.15 -0.01	0.46 -0.01 0.04	3903	134	0

Table 4.14: Multiple Regression Results for Frequent ‘Potentially Avoidable’ Emergency Admission to Hospital for the Older Population of London and Socio-Economic and Care Provision Variables

As with *all* ‘potentially avoidable’ emergency admissions to hospital for the older population of London, regression results for *frequent* ‘potentially avoidable’ emergency admissions to hospital for the older population of London show that spatial proximity to hospital beds is positively associated with admission rates when explored independently. When the IDAOPI is included as in model 2, spatial proximity to hospital beds is no longer positive, The model ‘fit’ improves significantly, and the number of wards with a significant structured random effect decreases. It would seem that the IDAOPI is of greater importance in explaining the variance in ‘admission ratios after controlling for spatial proximity to hospital beds than spatial proximity to hospital beds alone, explaining 71 per cent of the variation in frequent ‘potentially avoidable’ admissions to hospital for the older population of London.

The IDAOPI continued to show apposite association with *frequent* ‘potentially avoidable’ emergency admissions to hospital for the older population of London as the models were built up further indicating that the IDAOPI does in fact explain much of the variation in ‘potentially avoidable’ emergency admissions to hospital for the older population of London for *all* avoidable admissions and for *frequent* avoidable admissions.

Model 3 then introduced the social fragmentation index. A negative association with *frequent* ‘potentially avoidable’ emergency admissions to hospital for the older population of London was seen after controlling for the effects of deprivation. Although the model ‘fit’ improved slightly, the number of wards with a significant structured random effect increased. As with all ‘potentially avoidable’ emergency admissions to hospital, deprivation continues to show a much stronger association

with frequent ‘potentially avoidable’ admissions than social fragmentation and changes the independent association between social fragmentation and admissions from positive to negative. The reason for this is unclear.

Model 4 introduced the high demand index. The regression models for *all* ‘potentially avoidable’ emergency admissions to hospital for the older population of London showed that there was a positive association with the high demand index (the percentage of older people with a long-term limiting illness and the percentage of the population providing over 50 hours of unpaid care per week) after controlling for spatial proximity to hospital beds and the IDAOPI, however, with *frequent* ‘potentially avoidable’ emergency admissions to hospital for the older population of London no association was seen. It is possible that with all ‘potentially avoidable’ emergency admissions the association with high demand is picking up initial admissions, however the lack of association with frequent ‘potentially avoidable’ admissions is reflecting better care within the community after an initial admission. The high demand index was removed from further models.

Model 5 introduced the percentage of the population providing any amount of unpaid care. No association with the percentage of the population providing any amount of unpaid care was seen and so was dropped from further models.

Model 6 introduced the percentage of the older population from an ethnic minority background. The high demand index continued to show an association with *frequent* ‘potentially avoidable’ emergency admissions to hospital for the older population of London, but no association was seen with the percentage of the older population from an ethnic minority background.

So it would appear that for London, for *frequent* 'potentially avoidable' emergency admissions to hospital for the older population of London, model 2 (the IDAOPI) best explains the variations in admission ratios, although spatial proximity to hospital beds does have some effect.

4.5 CONCLUSION

This chapter has shown that despite efforts to reduce 'potentially avoidable' emergency admissions for the older population in London little or no reduction has been seen between the years 2001/2002 and 2004/2005. Admission rates are particularly high for heart failure and urinary tract/renal infections. Early diagnosis is an important factor in reducing admissions for both of these conditions so difficulties in accessing primary care could explain this difference. One important factor in explaining the high admission rates may be patient education. Culp *et al* (2003.) noted how the incidence of urinary tract infections declined with increased fluid intake. Health education can play an important part in the reduction of urinary tract/renal infections for both the prevention of infections and the early recognition of symptoms.

In London, for *all* and *frequent* 'potentially avoidable' emergency admissions to hospital for the older population the effects of spatial proximity to hospital beds was seen when modelled alone, but this effect was counteracted when deprivation was introduced. Hospitals in London tend to be located within more deprived areas for historical reasons so the association with proximity to hospitals may be spurious and due to the relationship with deprivation. The pattern might be a reflection of the

poorer health of individuals seen in deprived populations, or indeed poorer access to primary care.

Social fragmentation showed a negative association with *all* ‘potentially avoidable’ emergency admissions to hospital for the older population after controlling for deprivation. This may be because many of the indicators included in the social fragmentation index are closely correlated to deprivation therefore model 3 is reflecting ‘residual’ associations with the fragmentation score component relating to household composition, indicative of older people who live alone and manage well.

High demand for care is also positively and significantly associated with *all* ‘potentially avoidable’ emergency admissions for the older population of London (model 4), even after controlling for the effects of deprivation. However, the effect of a high demand for care is no longer seen for *frequent* ‘potentially avoidable’ admissions after controlling for deprivation, and social fragmentation. One possible explanation may be that those patients admitted to hospital with a ‘potentially avoidable’ condition who have a long-term limiting illness and are receiving over 50 hours of unpaid care per week (the high demand index) are ‘needs’ tested and identified as requiring extra help within the community from within primary care, thus enabling them to avoid further admissions to hospital. It is possible that older people who require help at home may not be identified until they are admitted to hospital with a ‘potentially avoidable’ condition. Once that help is in place, this help along with close monitoring by the patients’ GP may help in avoiding future emergency admissions to hospital for ‘potentially avoidable’ conditions. Of course this is purely speculative and cannot be observed by the data provided.

The percentage of the population providing any amount of unpaid care has no association with either *all* or *frequent* ‘potentially avoidable’ emergency admissions to hospital for the older population of London. Since, however, large amounts of informal care do seem to relate to hospital admissions, it would therefore seem that the provision of some unpaid care has an effect of reducing ‘potentially avoidable’ emergency admissions to hospital for the older population of London, however it may be that patients who require greater amounts of unpaid care do not receive the additional formal care required until they are admitted to hospital. It could be that some of these patients were in fact at end-of-life stage and were admitted to hospital and consequently died on initial admission so had no further need for hospital admission.

No association between the percentage of the older population from an ethnic minority background and *all* or *frequent* ‘potentially avoidable’ emergency admissions to hospital for the older population was seen. This may be because the percentage of the older population from an ethnic minority background is closely correlated with deprivation.

It would appear that ‘potentially avoidable’ emergency admissions to hospital for the older population are positively and significantly associated with socio-economic conditions however this may be reflecting less effective provision of primary care in these areas. Chapter 5 explores this hypothesis.

CHAPTER 5 ‘Potentially Avoidable’ Admissions for the Older Population of London: Organizational and Community Factors

5.1 INTRODUCTION

Chapter 4 demonstrated that there were strong associations between local ‘potentially avoidable’ emergency admission rates and socio-economic conditions, and also with some proxy indicators for informal care. However, a significant part of SAR variation was unexplained by these and it is difficult at ward level to explore the relationships with formal health service provision. Equally, it is important that the patient is adequately supported within their own home by community services including social care (Bernabei *et al.*, 1998; Landi *et al.*, 2001). Thus it is appropriate to consider the provision of care, the quality of care and the financial resources allocated for health care at the local level. This chapter explores this issue in more depth, introducing analysis at the level of PCTs, the administrative units within which local health care is organized.

As explained in chapter 2, it is argued that early diagnosis and intervention in ‘avoidable’ conditions can reduce ‘potentially avoidable’ emergency admissions for the older population (Lewis and Dixon, 2004; NHS Executive, 1999, Audit Commission, 2007). For primary care to be effective it is important that adequate and appropriate primary medical care services are provided (NHSE, 2001).

The funding of this care is allocated to PCTs and Local Authorities (LAs) on the basis of the relative needs of the population using a weighted capitation formula. Older people use health services more than any other adult age group (Rogers *et al*, 1999) and this is adjusted for in the allocation formula. Financially, this equated to a difference of £1500 pounds per head of population between those aged 65-75 and 85 plus in 2001-2003 (table 5.01). The resource allocation formula is further weighted to adjust for the additional needs of income deprived populations (weighted at +0.225), the percentage of older people living alone (+0.026) and for a number of health conditions (varying weightings) (Department of Health, 2005). A similar allocation formula is used for providing Social services funding to LAs. It is then the responsibility of each PCT/LA to provide the health and social care services required to meet the needs of their local populations.

Although this funding method is intended to make it possible for each PCT to make equitable provision for the needs of its local population, the resources allocated may not perfectly match local needs. Furthermore each PCT/social service sector is responsible for using the allocated funding to meet the healthcare and social care needs of their local population, so there are likely to be differences in provision from one PCT to another. It would be expected however that PCTs and LAs could act upon some of the factors contributing to poor health, for some people in their local populations. However, not all the 'wider determinants' of poor health can be tackled by these services. Furthermore, greater spending on health and social care services does not always lead to better quality care, and the quality of care provided may also influence whether a patient is admitted to hospital for an 'avoidable' condition or not.

The availability of new data gathered on the Quality of Outcomes (QOF) data has made it possible to measure the overall quality of service provision and care provided by GP practices. This data is available at GP practice level and PCT level. A number of studies have explored the association of QOF scores with ‘potentially avoidable’ emergency admissions however these studies have either used admission rates aggregated to PCTs (Saxena *et al.*, 2006; Bottle *et al.*, 2008a) or aggregated to GP practises (Bottle *et al.*, 2008b). Using hospital admission data aggregated to PCTs may miss some of the variations that occur at a more local level. ‘Potentially avoidable’ emergency admissions for the older population of London may be associated with ward level deprivation independently of PCT health care provision, or it may be that some PCTs deal with the effects of deprivation more effectively than others. Also, these published studies explored age and sex standardised rates for the whole population of London, rather than just the older population. As older people are an important component in the construction of the resource allocation formula and use health care services more than any other age group, using the whole age range of the population may miss some important differences in healthcare provision for this important group of people.

This chapter explores the associations of ward level ‘potentially avoidable’ emergency admissions for the older population of London with PCT and Social services funding and care provision at PCT level. It then continues to explore whether associations with socioeconomic conditions on ‘potentially avoidable’ emergency admissions for the older population of London at ward level are still apparent after controlling for PCT and Social services provision of care. Multilevel models, using ‘potentially avoidable’ emergency admission ratios and

socioeconomic conditions at ward level and PCT/Social services provision at PCT level, are used to explain these relationships.

With an increasing emphasis on integrated care for older people (Department of Health, 1990; NHS Executive, 2001; Department of Health, 2002a), it is surprising that very few studies have explored the association of Social services care provision as well as primary care provision on emergency hospital admissions. This study therefore fills the gap in this literature and explores the association of ‘potentially avoidable’ emergency admissions for the older population with Social services care provision at PCT level.

The final part of the analysis in this chapter concentrates on *frequent* ‘potentially avoidable’ emergency admissions for the older population of London, again using multilevel models to explore whether differences in patients using hospital services for ‘avoidable’ conditions on multiple occasions are associated with provision of care at PCT level after controlling for socioeconomic conditions.

5.2 METHODS

5.2.1 Data

‘Potentially Avoidable’ Hospital Admissions

Full details and justification of the data and methods used here were presented in Chapter 3. This section summarises the main methodological issues pertaining to the analysis presented in this chapter. As with chapter 4, ‘potentially avoidable’ emergency admissions for the older population of London are presented as ‘smoothed’ standardised admission ratios by ward. Data is standardised by age band

and sex, then the average moved towards the average of neighbouring wards to avoid potential boundary effects

Frequent (or multiple) admissions include admissions for people who have had more than one admission in any one financial year. In Chapter 4 analysis was presented suggesting that differences in hospital admission ratios are partly related to patients who are admitted to hospital on multiple occasions. These patients may be more reliant on good quality primary care and the support of Social services to help them remain at home.

PCT Level Data

As noted in section 5.3, PCT funding is weighted according to need, therefore it would be expected that more deprived PCTs with a higher proportion of older people living alone would have higher funding. It is important that older people have adequate access to a GP. In this chapter, PCT funding has been weighted according to the standard European population as explained in chapter 3.

One might expect that the greater the numbers of GPs, the better the access should be, although this may not always be the case. Numbers of GPs are presented here as GPs per 10,000 population by PCT.

Equally given the discussion above (section 5.2) one might also expect higher admission ratios where there are more single-handed GP practices. Single-handed practices are presented as a proportion of all practices within each PCT that are single-handed.

GP practice performance may have an influence over whether older people are admitted to hospital for ‘avoidable’ conditions. GP practices that give a higher quality service or perform to a higher standard should be able to monitor patients more effectively and intervene quicker should a patient become unwell. Overall GP practice performance and quality of care is measured as part of the Quality and Outcomes Framework (QOF). The domains included are total QOF scores; organisational; patient experience; disease; additional services; holistic care; access; and depth of quality (see section 3.5.13 for more details). Many of the QOF domains are correlated for the PCTs of London as table 5.1 shows.

QOF Domain	Total Points	Disease Domain	Organisational Domain	Patient Experience	Additional Services	Holistic Care	Quality of Practice	Access
Total Points	1							
Disease Domain	0.96	1						
Organisational Domain	0.88	0.75	1					
Patient Experience	0.87	0.76	0.81	1				
Additional Services	0.77	0.66	0.73	0.73	1			
Holistic Care	0.95	0.99	0.73	0.72	0.69	1		
Quality of Practice	0.89	0.77	0.91	0.87	0.88	0.75	1	
Access	0.53	0.37	0.52	0.53	0.45	0.38	0.56	1

Table 5.1: Correlation between QOF Domains

To avoid covariance in the statistical models, not all of the QOF variables can be included in a single regression model. To provide an overall indicator of performance within GP practices for each PCT, the QOF total points variable was chosen.

Social Services Data

A number of social service variables were available specific to the older population. These included Social services spending on older people, services provision of

homecare per 1,000 older people and Social services provision of intensive homecare per 1,000 older people. The data was provided at LA level. LA boundaries differ slightly to PCT boundaries, therefore the data was weighted according to the older population of each lower super output areas and converted to the relevant PCT boundaries.

Socioeconomic Conditions

Chapter 4 demonstrated a significant positive association between 'potentially avoidable' emergency admissions for the older population of London and deprivation at ward level. A high demand for care was also found to show an association with admission ratios. Although social fragmentation showed a significant negative association with admissions after controlling for the effects of deprivation, which was considered to reflect the residual SARs variation associated with certain components of the social fragmentation score. These three variables have therefore been included in the analysis presented in this chapter.

5.2.2 Statistical Methods

This chapter firstly explores the provision of care by GP practices at PCT level, showing the geographic variations in NHS funding to PCTs (referred to below as 'PCT funding'), numbers of GPs per 10,000 older population, the proportion of GP practices that are single-handed practices and the Quality and Outcome Frameworks (QOF) total care. For each of these variables, the variance with PCT level deprivation is shown using graphs. The Income Deprivation Affecting Older People Index (IDAOPI) is used to represent deprivation, rather than the overall deprivation

score, as this is specific to the older population. It was also shown in chapter 4 to have a greater association with admission ratios at ward level.

To test the association between PCT care provision variables and ward level 'potentially avoidable' emergency admissions for the older population of London, and the effects on both between and within PCTs, while controlling for the effects of socioeconomic conditions, multilevel models were used.

Multilevel modelling allows for an explanation of whether the level and quality of NHS and social care provision at the PCT level may influence the tendency for socioeconomic conditions at the local level to 'drive up' SARs in some small areas. The models include cross level interactions of PCT care provision and socioeconomic conditions to test whether wards across London with similar socioeconomic conditions have different levels of admissions according to the services provided in the PCT where they are located.

The association between Social services care, including Social services spending on older people, Social services provision of homecare and Social services provision of intensive homecare and 'potentially avoidable' emergency admissions for the older population of London was then explored along with socioeconomic conditions. PCT level care conditions were then introduced and included NHS service data to see whether social care made a difference in the models in addition to NHS services.

The final part of this chapter then uses *frequent* (i.e. multiple) 'potentially avoidable' emergency admissions to hospital for the older population of London as the outcome variable to test how this relates to socioeconomic conditions and service/care provision.

5.3 RESULTS

5.3.1 PCT Funding, GP per Head, Single-Handed GPs and QOF

PCTs funding, the number of GPs per head of population, the proportion of GP practices that are single-handed and QOF total scores all vary geographically by PCT for London (Figure 5.1).

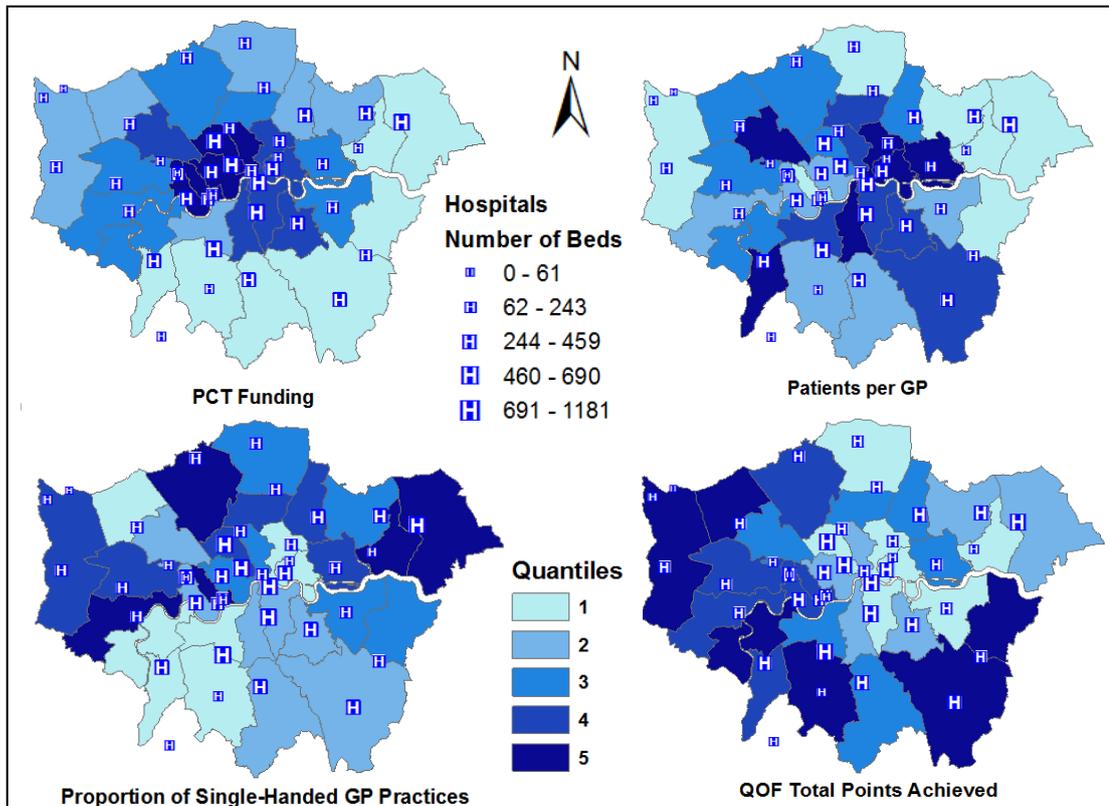


Figure 5.1: GP Funding (Weighted), GPs per 1000 Population, Proportion of GP Practices that are Single-Handed and QOF Total Points by Quintile for London PCTs

Under NHS funding schemes, PCTs in inner London have higher PCT funding than those in outer London. Generally, as figure 4.03 showed in Chapter 4, there are higher densities of older people living within these PCTs and higher percentages of older people living alone (figure 4.05). Equally, PCTs to the south and south east, which are generally more affluent and have fewer older people living alone receive

less funding. The relationship between PCT funding and overall PCT level deprivation can be seen clearly in the graph in with higher Figure 5.2 where PCT funding is shown ranked by the deprivation score for each PCT.

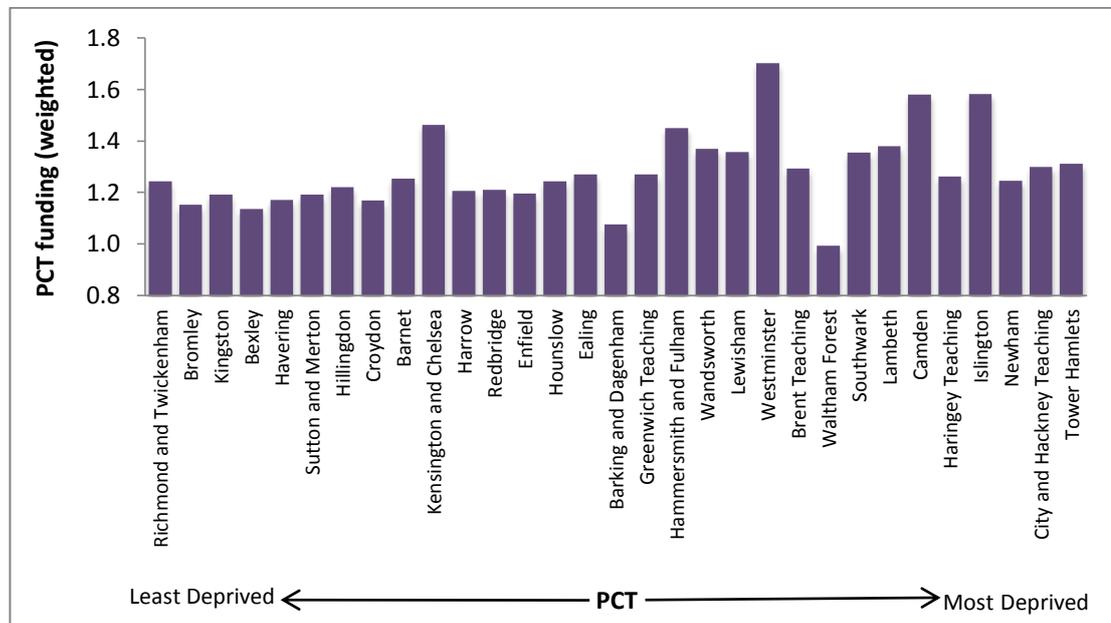


Figure 5.2: GP Funding (Weighted) by Deprivation Score for London PCTs

Generally, the more deprived PCTs receive more funding, however some of the moderately deprived PCTs get more weighted per capita funding per head of population than the more deprived PCTs. This may be reflecting other measures included in the funding allocation formula (which uses a deprivation measure for the whole population not just for elderly people, as well as indicators of disease burden, the percentage of the population living alone and the proportion of the population over the age of 65).

Some of the more deprived areas to the north east of London also appear to have higher numbers of GPs per head of population despite having more average funding, and have high admission ratios in many of their wards as seen in chapter 4 figure 4.3.

The number of GPs per 10,000 population also varies according to the PCT deprivation (IDAOPI) score of individual PCTs (Figure 5.3).

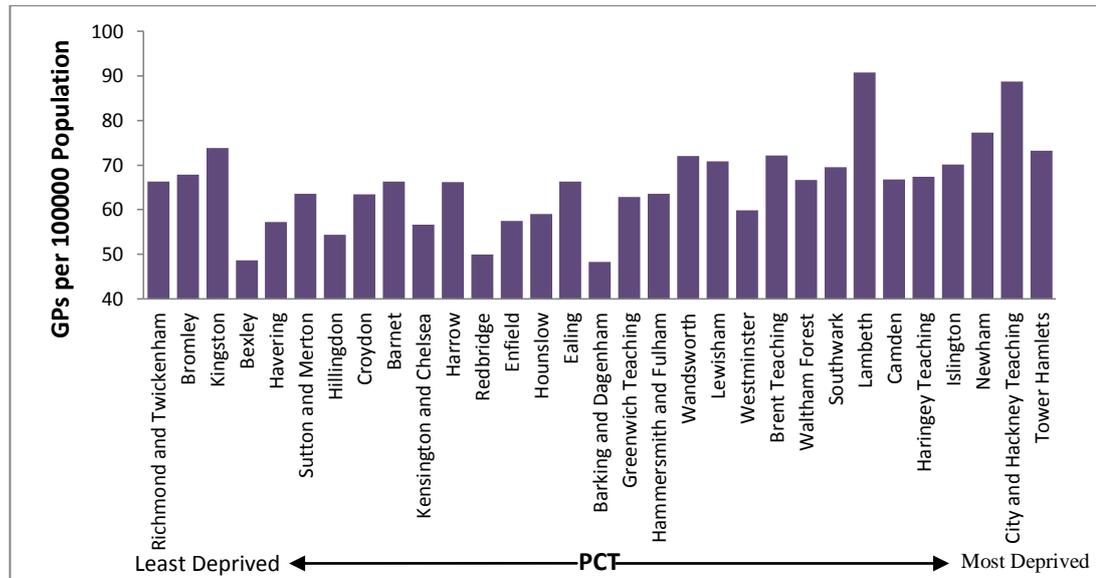


Figure 5.3: GPs per 10,000 population by PCT in order of PCT Deprivation

Generally there are more GPs per head of population in more deprived PCTs. This would be expected given greater demand for GPs in more deprived PCTs. However the association with deprivation is not consistent across all PCTs. The 3 least deprived PCTs have the same number of GPs per head of population as some of the most deprived PCTs.

As the maps in figure 5.1 show, the distribution of GPs per head of population do not appear to reflect the distribution of PCT funding, so PCT funding and GP per capital indicator are indicators reflecting different aspects of level s of health care provision locally. When comparing GPs per head of population by deprivation (figure 5.3) with PCT funding by deprivation (figure 5.2) it can be seen that that more deprived PCTs of Lambeth, City & Hackney, Newham and Tower Hamlets all have high numbers of GPs per head of population but average PCT funding.

Difficulties of recruitment and replacement of GPs may limit their numbers in deprived areas. As older GPs retire, there are increasing problems in recruiting replacements, particularly in more deprived areas (Government Statistical Service, 2002). As Gavin and Esmail (2002) explain, many of the GPs in more deprived areas were recruited some time ago from South Asian medical schools and now two thirds of those are due for retirement. A change in how doctors are now licensed has meant that further recruitment from South Asia is much more difficult. Recruitment is further compounded by the poorer health of patients in deprived areas, coupled with social problems and often confounded by language barriers, this has meant higher workloads and longer consultations in GP practices in deprived areas which may result in more pressure on GPs and a poorer service (European Union of General Practitioners, 2007).

Some researchers have noted that single-handed GP practices have higher hospital admission ratios than practices with more GPs available. It has been suggested this may in part be due to lack of services within the practice, therefore leading to a reliance on hospital services (Hippisley-Cox, 1997). Figure 5.1 shows that there are geographic variations in the proportion of GP practices that are single-handed practices by PCT. It is particularly noticeable that PCTs in the north of London have higher rates of single-handed GP practices when compared to the south of London. Figure 5.4 shows the percentage of GP practices that are single-handed practice by PCT level deprivation scores.

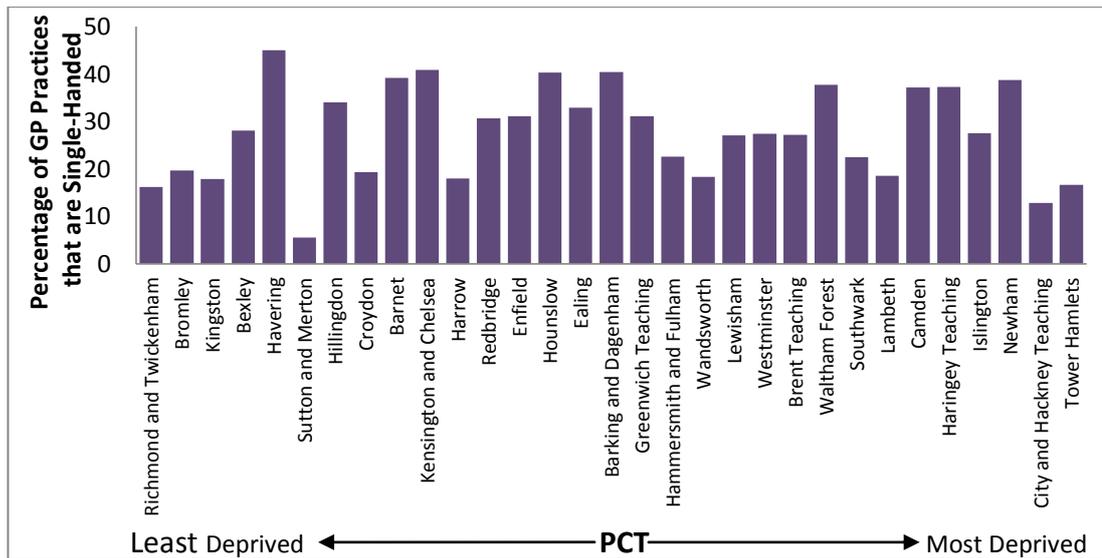


Figure 5.4: Percentage of GP practices that are Single-Handed Practices by PCT in order of PCT Deprivation

No clear pattern is seen between single-handed GP practices and PCT level deprivation. Some of the least deprived PCTs have low levels of single-handed GP practices yet also some of the most deprived PCTs also have low levels of single-handed GP practices.

The outer London PCTs to the south and west have higher QOF total points overall. PCTs to the south and west have fewer older people living alone - a factor shown in the previous chapter to relate strongly to ‘potentially avoidable’ emergency admissions for the older population. PCTs to the south generally have fewer older patients per GP, so the higher QOF points could be reflecting less demand for GP services. As Rogers *et al* (1999) note, older people also use GP services more than most other age groups (excluding the very young). It may therefore be that the total numbers of QOF points achieved is inversely related to a greater demand for services from older people living alone.

PCTs to the south also have fewer single-handed GP practice. GP practice size may be related to higher QOF total scores as larger are able to give a wider range of services, and benefit from shared knowledge between GPs and other health care staff, thus relying on hospital services less.

The PCTs with higher QOF total scores are also PCTs that generally receive less funding, reflecting lower deprivation scores. PCTs to the north east of London, which are generally more deprived, clearly gain fewer QOF total points.

Figure 5.5 shows how the least deprived PCTs gain high QOF total points (as a percentage of overall points available).

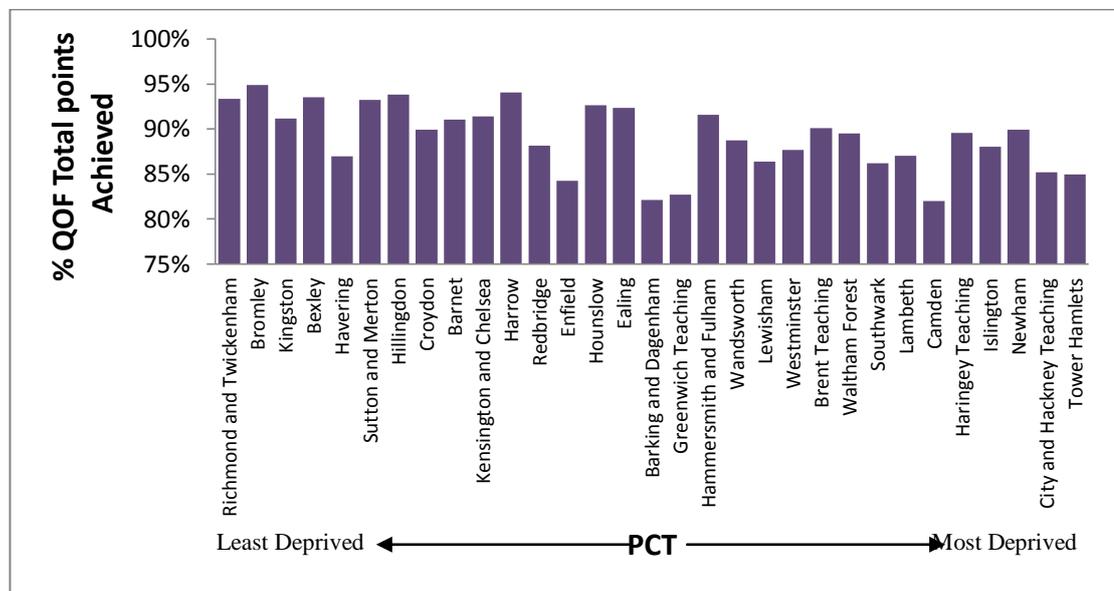


Figure 5.5: QOF Total Points by PCT in order of PCT Deprivation

Given that the QOF total is made up of the components explored above it is not at all surprising to see the least deprived PCTs performing better than more deprived PCTs overall.

To test the association between 'potentially avoidable' emergency admissions for the older population of London at ward level, deprivation and PCT level variables,

multilevel models were performed as explained above and in Chapter 3. Modelling progressed in stages. The first model (model 1) shows the amount of variance between and within PCTs. Model 2 then introduces the socioeconomic variables at both ward and PCT level to try to explain some of the variance found. To allow the effects of within PCT effects to be explored; i.e. is there an effect of ward level deprivation on 'potentially avoidable' emergency admissions within different PCTs, the ward level socioeconomic variables were centred around the mean of the PCTs (known as mean centred). This can now be compared to the between PCT effects, to see how much of the difference in 'potentially avoidable' emergency admissions for the older population of London is explained by within PCT effects and how much of the variation can be explained by between PCT effects. If the model is explaining any of the variation in SARs, then it would be expected that the residual effects between PCTs would reduce (reported as PCT level variance), there would be fewer random effects (reported as Residual variance) and the model fit would improve. Results are shown in Table 5.2.

Fixed Effects	Model 1 (Empty)		Model 2 Socioeconomic conditions	
	Mean	St.Error	Mean	St.Error
Constant (Smoothed SAR)	104.4	3.6	103.6	2.9
PCT IDAOPI			19.0	3.7
Mean centred IDAOPI			18.2	1.2
PCT high demand for care			1.3	4.0
Mean centred high demand for care			0.2	0.9
PCT social fragmentation index			-0.7	1.6
Mean centred social fragmentation index			-0.1	1.2
PCT level variance	377.5	100.5	251.4	67.0
Residual variance	354.2	20.6	215.0	12.5
Model fit	5544.4		5247.1	

Table 5.2: Results of Multilevel Models for Partition of Variance and Socioeconomic conditions

Model 1 partitions the variance between PCTs and wards. The intercept or average SAR is 104.43 (due to the smoothing of the scores to the average of surrounding wards). The between PCT correlation coefficient is equal to $\frac{377.5}{(377.5+354.2)} = 0.52$.

Therefore 52 per cent of the variation in 'potentially avoidable' emergency admissions for the older population of London is attributable to variations at PCT level.

Model 2 shows that there is a strong positive association between 'potentially avoidable' emergency admissions for the older population of London and deprivation (IDAOP) both between PCTs and within PCTs. The average SAR for older people who live in more deprived wards within PCTs raises by 18.0 for each unit increase in deprivation. Simultaneously, the average SAR for older people in PCTs raises by 19 for each unit increase in PCT level deprivation. Deprivation at PCT level shows an additional independent association with the rate of admission. Deprived wards located in deprived areas will have particularly high rates of admission.

The high demand for care and the social fragmentation index show no association with 'potentially avoidable' emergency admissions for the older population of London either between or within PCTs. Overall the model 'fit' improves and the amount of variance at both within and between PCTs decreases, suggesting variations in deprivation at both PCT and ward level explain some of the variance in 'potentially avoidable' emergency admissions for the older population of London. The lack of association between the high demand for care and the social fragmentation index with 'potentially avoidable' emergency admissions for the older population of London is likely to be explained by the strong effects of PCT and ward

level deprivation swamping any associations seen at ward level alone that was demonstrated in chapter 4, reflecting a correlation between ill health, social fragmentation and deprivation. The social fragmentation index and high demand for care variables were removed from further models.

Models 3 to 6 introduce the effects of PCT provision and quality of care on 'potentially avoidable' emergency admissions for the older population of London whilst controlling for the effects of PCT mean centred deprivation and PCT overall deprivation. Each variable is introduced separately, the coefficient is labelled 'model variable', and the variable name is included in the model title to enable models to be compared. In each model, both the intercept and slope terms were allowed to randomly vary across PCTs, and their covariance was freely estimated. The models include cross level interactions: the interaction of mean centred deprivation with PCT level deprivation (reported as Mean centred IDAOPI x PCT IDAOPI); and the interaction of each of the variables with mean centred deprivation and PCT deprivation (reported as Variable x (Mean centred IDAOPI x PCT IDAOPI). This allows the exploration of whether the effect of ward level deprivation on SARs is stronger in more deprived PCTs. The second part then explores whether the effects of ward level deprivation on SARs is stronger in more deprived PCTs with higher PCT funding (for instance).

As well as reporting the amount of residual and random effects at PCT level as previously, the models now also include a value for the amount of residual variation at ward level, within PCTs (reported as the Mean centred IDAOPI variance). If a significant reduction in the variance within and between PCTs results from adding a

new predictor variable, this variable may be seen to be ‘explaining’ some of the variance.

Mean centred IDAOPI variance’ refers to the residual variance attributable to ward differences within PCTs, ‘PCT level variance’ tells us how much residual variation is between PCTs, and ‘Covariance between Wards and PCTs’ expresses the variance attributable to the unexplained variance interaction between ward and PCT level disparities. A negative covariance would indicate, for instance, that higher than average ward level deprivation is paired with lower than average PCT level deprivation. Results are reported in Table 5.3.

Fixed Effects	Model 3 PCT Funding		Model 4 GPs per 10,000 Pop		Model 5 Single Handed Practices		Model 6 QOF total points	
	Mean	St.Error	Mean	St.Error	Mean	St.Error	Mean	St.Error
Constant (Smoothed SAR)	105.5	2.6	105.7	2.9	105.7	2.7	105.4	2.9
PCT IDAOPI	14.9	3.1	19.3	3.6	18.4	3.2	16.8	3.4
Model Variable	-6.6	2.4	3.8	2.9	7.8	2.6	1.8	2.5
Mean centred IDAOPI	18.9	1.5	18.3	1.8	19.5	1.5	18.1	1.8
Mean centred IDAOPI x PCT IDAOPI	0.3	1.4	1.2	1.5	1.2	1.4	1.1	1.5
Variable x (Mean centred IDAOPI x PCT IDAOPI)	-2.5	1.4	-1.6	1.7	1.7	1.0	-2.0	1.7
Random Effects	Estimate	St.error	Estimate	St.error	Estimate	St.error	Estimate	St.error
Mean centred IDAOPI variance	37.3	14.5	43.6	17.0	39.9	15.3	45.3	17.4
PCT level variance	145.3	49.5	183.9	57.9	160.7	50.7	192.0	59.9
Covariance between Wards and PCTs	32.1	19.5	57.1	24.7	51.6	21.4	56.7	25.4
Residual variance	192.6	11.4	193.0	11.4	193.0	11.4	192.5	11.4
Model fit	5197		5202		5197		5203	

Table 5.3: Association of PCT Care Provision and Socioeconomic Conditions with 'Potentially Avoidable' Emergency Admissions for the Older Population of London

Model 3 introduces PCT funding, PCT deprivation and the PCT mean centred deprivation score as a predictor of 'potentially avoidable' emergency admissions for the older population of London. PCT funding has a significant negative effect on

variations in 'potentially avoidable' emergency admissions for the older population of London between PCTs. The average SAR reduces by -6.6 for every unit increase in PCT funding. However PCT funding is not enough to counteract the effects of deprivation. PCT level deprivation continues to show a significant positive association with the variation in SARs between PCTs, with the average SAR increasing by 14.9 for each unit increase in PCT deprivation. There is also a significant positive association between ward level deprivation and the variation in SARs, with the average SAR increasing by 18.9 for every unit rise in ward level deprivation.

There is no significant variance in SARs attributable to covariance at ward and PCT level, either between levels of deprivation, or when PCT funding is included, suggesting the effects are all independent of each other. There continues to be a significant amount of residual effects variance at PCT level, although this has reduced considerably compared with models 1 and 2. There is also a significant amount of residual variance within PCTs (i.e. at ward level). The model fit has improved considerably compared to models 1 and 2. These findings suggest that patients living in more deprived wards are more likely to be admitted to hospital for a 'potentially avoidable' condition. These effects are also more acute when the overall deprivation score for the PCT is higher, however, PCT funding does go some way to reduce the effect in more deprived PCTs.

Model 4 introduces the effects of GPs per 10,000 population. Despite the literature suggesting that the more GPs per head of population, the less admissions experienced (Gulliford *et al*, 2004; Jarman *et al*, 1999; Reeves and Baker, 2003), model 4 shows the number of GPs per 10,000 population is not associated with

SARs. However, after controlling for the effects of GPs per 10,000 population, there is a strong positive association between both within and between PCT deprivation effects and 'potentially avoidable' emergency admissions for the older population of London, increasing SARs by 18.3 and 19.3 respectively for each unit increase in deprivation. Again there is no interaction present between ward and PCT deprivation effects. Equally there is no interaction present between ward and PCT deprivation and the number of GPs per 10,000 population. Overall the amount of random effects variance between and within PCTs is higher than in previous models, as is the model fit, suggesting this model is not as useful in 'explaining' variations in 'potentially avoidable' emergency admissions.

Model 5 introduces the proportion of GP practices that are single-handed, with PCT deprivation and the PCT mean centred deprivation score as a predictor of 'potentially avoidable' emergency admissions for the older population of London. The proportion of GP practices that are single-handed shows a significant positive association with variation in SARs between PCTs, increasing the average SAR by 7.8 for every unit increase in the proportion of single-handed GP practices. PCT level deprivation now has a stronger effect than with PCT funding in model 3, showing a significant positive effect on variations in SARs between PCTs and increasing the average SAR by 18.4 for each unit increase in PCT deprivation. The effect of ward level deprivation on variations in SARs also continues to be significantly positive, increasing the average SAR by 19.5 for every unit rise in deprivation.

There is no significant variance in SARs attributable to an interaction between ward and PCT level deprivation, or when the proportion of GP practices that are single-handed is included, suggesting the effects are all independent of each other. There

remains significant residual variance at PCT level, although this has reduced considerably compared with models 1 and 2 but is higher than for model 3. There is also significant variance remaining within PCTs. The model fit has not improved from model 3. It would seem that patients in wards that are deprived are more likely to be admitted to hospital if the PCT is deprived and the proportion of GP practices that are single-handed is high, although this model explains the variations seen less satisfactorily than model 3 (PCT funding).

In model 6, the proportion of QOF Total Points achieved as a proportion of points available by PCT shows no association with 'potentially avoidable' emergency admissions for the older population of London, reiterating the findings in the literature (Saxena *et al*, 2006; Downing *et al*, 2007). There continues to be significant effects of deprivation both within and between PCTs, showing QOF total points has no association with 'potentially avoidable' emergency admissions for the older population of London.

Overall, patients living in deprived wards are more likely to be admitted to hospital as an emergency for a 'potentially avoidable' condition. This effect is exacerbated if the PCT is deprived overall and if there is a high proportion of GP practices that are single-handed. However, PCT funding does reduce some of the variation in SARs between PCTs, reducing the effect of deprivation in the more deprived PCTs (which are the PCTs that receive more funding). However admission rates still remain higher (although reduced) in more deprived PCTs. Furthermore, PCT funding does not reduce the effects of deprivation within PCTs, and SARs remain high in more deprived wards. Including PCT funding in the model reduces the overall residual variation in SARs at both PCT and ward level. This suggests poorer health in older

populations living in more deprived communities may be driving 'potentially avoidable' emergency admission rates for the older population of London, for which PCT funding is unable to compensate for. It is possible that the provision of care from Social services may account for some of the unexplained variation within and between PCTs.

5.3.2 Social Services Spending and Homecare Provision for Older People

Very few studies have explored the relationship between spending and provision of services for older people and hospital admissions, despite the provision of homecare being important in helping older people to remain in their own homes. Figure 5.7 shows how Social services spending on homecare per 1000 older people, the number of older people helped to live at home per 10,000 older people and the number of older people provided with intensive homecare (over 10 hours per week) per 10,000 older people vary geographically. The maps show quintiles for the PCTs of London.

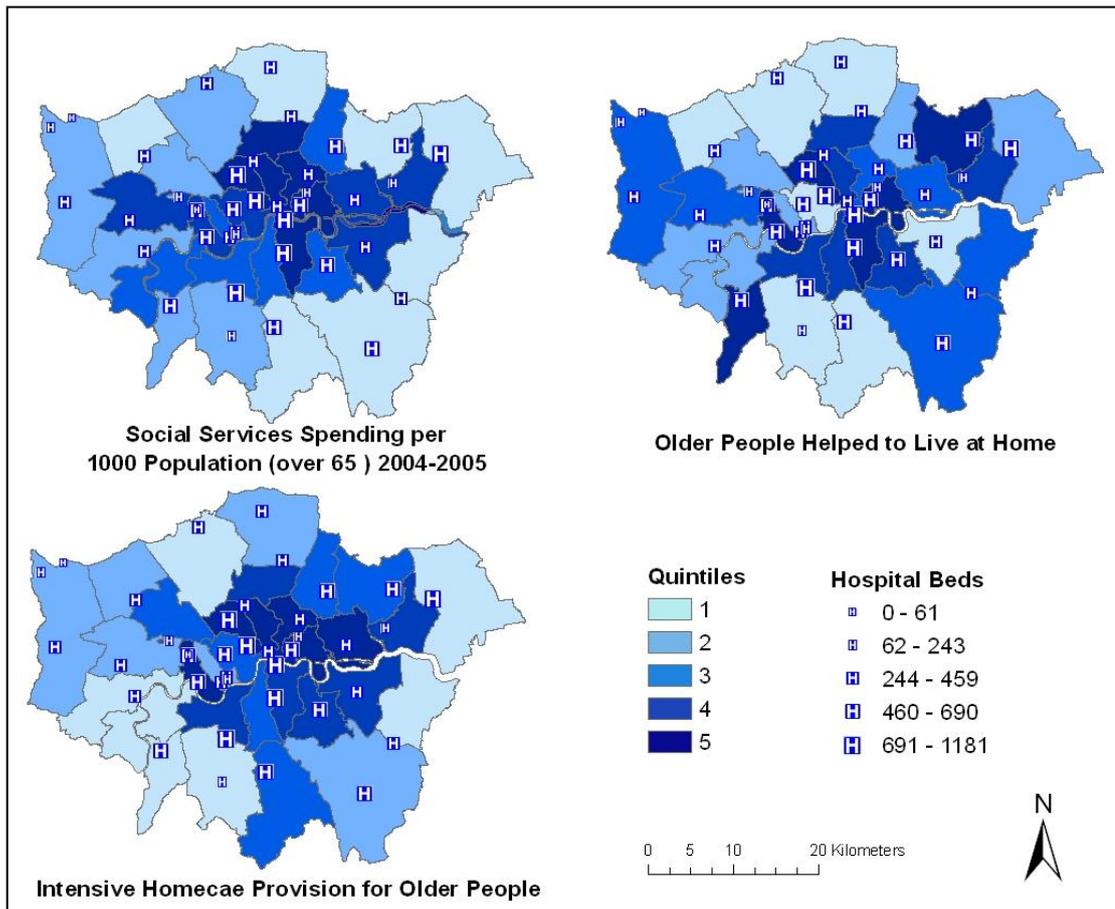


Figure 5.6: Spending on Older People and Provision of Homecare by PCT

It is clear that higher spending on older people occurs in PCTs in central London, where as Figure 4.6 (Chapter 4) showed, there is a higher proportion of older people who live alone. However spending on older people includes funding nursing and residential care home beds, not just providing care within the patients' own home. There is actually a higher rates of older people are helped to live at home (per ,000 older people) in PCTs to the east and northeast of the city of London, with some PCTs that have much lower spending on older people providing a high rate of help to live at home. The rate of intensive homecare (over 10 hours per week) per 1,000 older persons is also higher in PCTs to the northeast and east of London. It is unclear from visual inspections of the maps as to whether a relationship with 'potentially avoidable' emergency admissions exists for the social services data when compared

to the geographic representation of SARs by ward in Figure 4.3, Chapter 4. In some cases more provision is provided in PCTs with average or below average ward level SARs whilst in others there are higher than expected SARs.

The relationship between Social services spending on older people and deprivation (IDAOPi) by PCTs in order of deprivation is shown graphically in Figure 5.7.

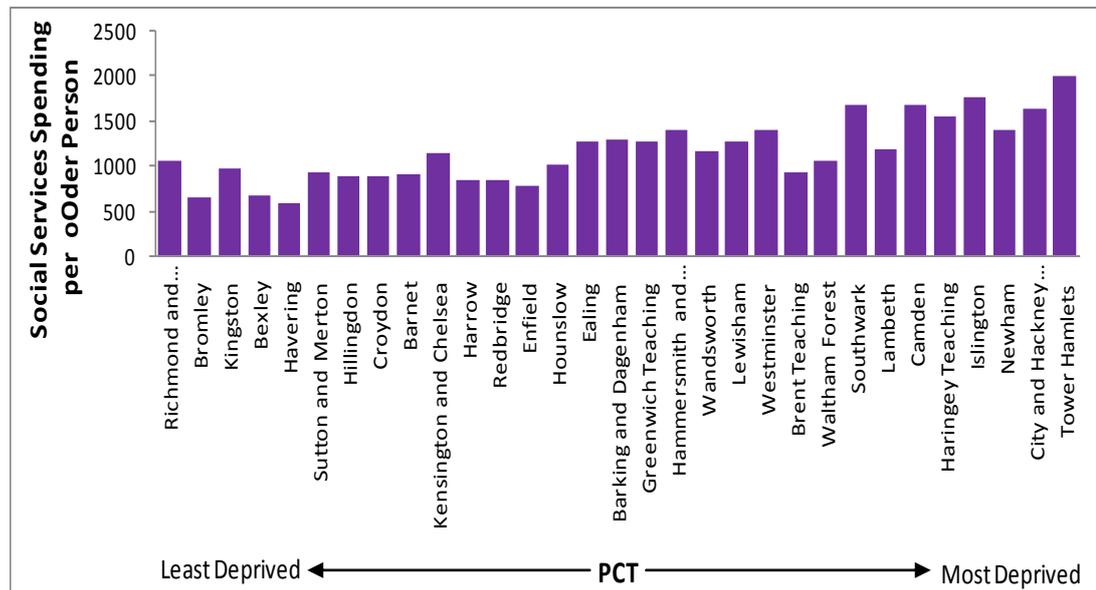


Figure 5.7: Social Services Spending on Older People by PCT in order of PCT Deprivation

Social services’ spending on older people clearly increases as deprivation increases. There are some anomalies, such as Richmond & Twickenham and Kingston which are the least deprived of all the PCTs in London yet have relatively large rates of spending on Social services care for older people. In fact, in these two boroughs, the rate of spending on Social services care per 1,000 older people is equal to that of Brent, which is in the lowest third of deprived PCTs in London. This may however be reflecting how monies are spent, and whether homecare for the older population is a priority.

The relationship between older people helped to live in their own homes and deprivation (IDAOPI) by PCT in order of deprivation is shown in Figure 5.8.

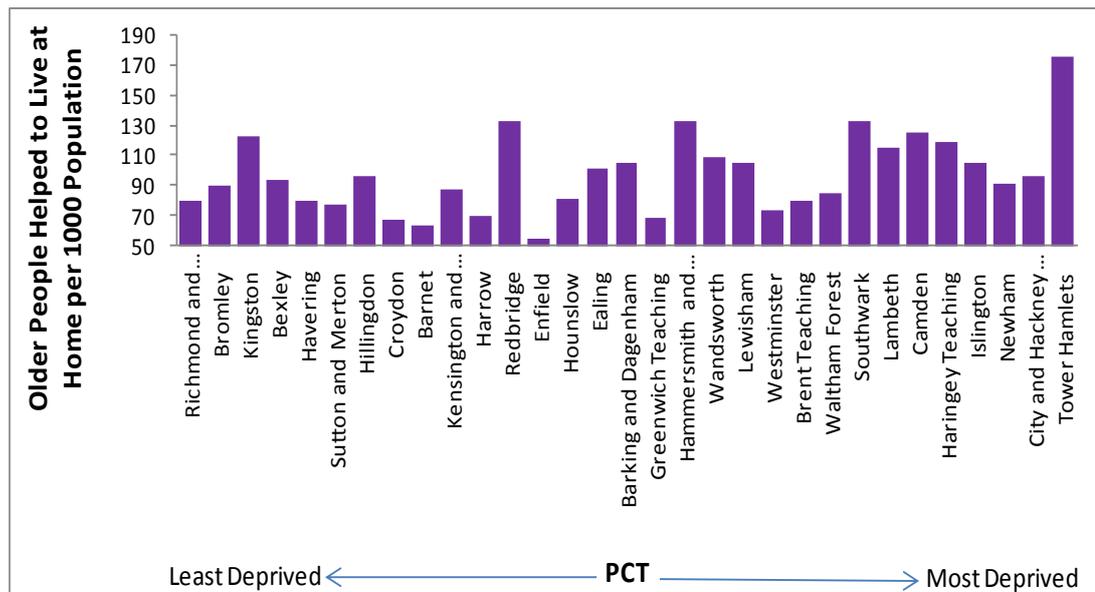


Figure 5.8: Older People Helped to live at Home by PCT in order of PCT Deprivation

The pattern overall is very variable and the relationship of deprivation with levels of home help is not consistent. The help to live at home received by older people includes a number of services ranging from meals on wheels to homecare provision. Homecare can be as little as half an hour per week up to more intensive care (over 10 hours per week). The older people helped to live at home graph may be reflecting more provision of less intensive services or cheaper services such as meals on wheels. It is now clear that Richmond & Twickenham and Kingston both provide a higher rate of help to live at home than Brent, which may be reflecting a higher number of older people in those PCTs compared to Brent. More intensive homecare services cost more and are likely to be provided to older people in highly deprived areas where living conditions are poorer, there is a higher percentage of older people

living alone and a higher percentage of older people with a long-term limiting illness.

Figure 5.9 shows how the provision of intensive homecare provision per 1000 older population varies by PCT deprivation (IDAOPi).

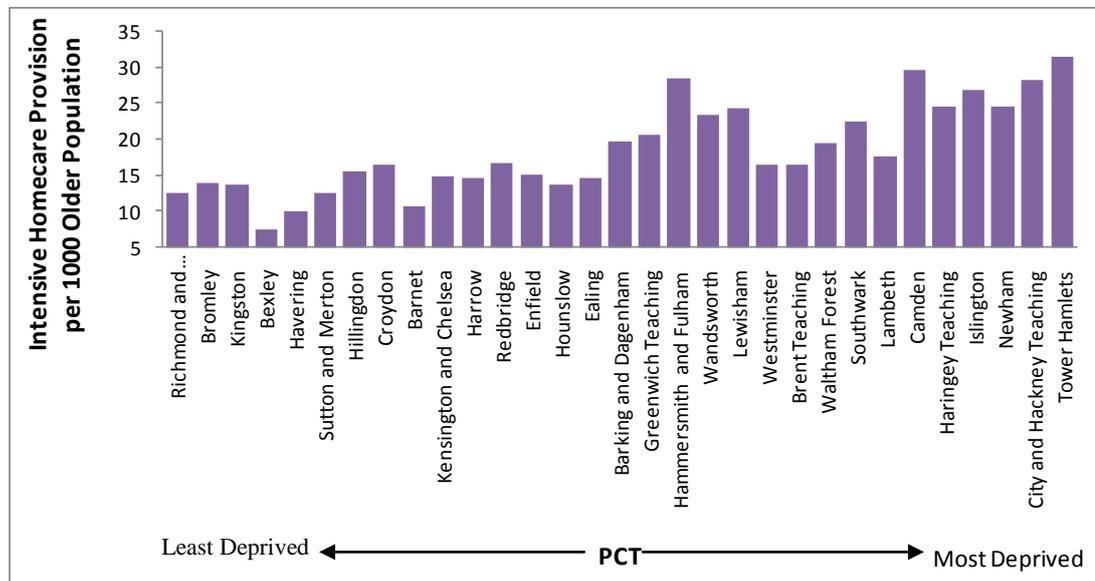


Figure 5.9: Intensive Homecare Provision per 1000 Older Population by PCT in order of PCT Deprivation

More deprived PCTs have greater provision of intensive homecare per 1000 older people than less deprived PCTs, reflecting greater need for services. However some of the PCTs in slightly less deprived PCTs (the third quarter) also have high provision of intensive homecare. Thus intensive homecare provision is reflecting a greater need for services for the older population in more deprived PCTs, where there is a higher percentage of people with a long-term limiting illness, however it is unclear as to whether this would have an effect on ‘potentially avoidable’ emergency admissions. It may be expected that admission ratios decrease where more intensive homecare is provided as older people already have help at home in place. However, with Social services budgets overstretched combined with a shortage of

homecare providers, and a growing and increasing ageing older population it may be that services are unable to meet needs effectively despite higher funding. It is also possible that older people who are more closely ‘monitored’ by service agencies are more likely to be identified as needing admission. In these conditions, areas with higher levels of social provision may also be those with higher ‘potential avoidable’ admission rates.

Table 5.4 shows the results of multilevel models for the Social services variables.

Fixed Effects	Model 7 Social Services spending on Older People		Model 8 Older People Helped to Live at Home per 1,000 Older People		Model 9 Intensive Homecare per 1,000 Older People	
	Mean	St.Error	Mean	St.Error	Mean	St.Error
Constant (Smoothed SAR)	116	9.6	106	3	107	2.9
PCT IDAOPI	12.8	4.9	16.6	3.4	17.3	3.3
Model Variable	-5	4.6	2.4	3.4	2.2	3.4
Mean centred IDAOPI	19.8	1.9	19.1	1.6	18.9	1.5
Mean centred IDAOPI x PCT IDAOPI	-0.5	2.7	1	1.6	1.6	1.5
Variable x (Within PCT IDAOPI x PCT IDAOPI)	0.9	1.3	0.3	0.9	0.0	0.9
Random Effects	Estimate	St.Error	Estimate	St.Error	Estimate	St.Error
Ward level variance	42.9	16.2	43.2	16.4	45.3	16.8
PCT level variance	196.3	61.8	195.7	61.2	210.8	59.4
Covariance between Wards and PCTs	53.2	24.4	53.8	24.3	55.4	23.5
Residual variance	192.4	11.4	192.8	11.4	194.6	11.7
Model fit	5203		5204		5232	

Table 5.4: Association of Social Services Spending and Provision of Care and Deprivation with 'Potentially Avoidable' Emergency Admissions for the Older Population of London

Model 7 introduces Social services spending on older people. There is no association between Social services spending on older people and 'potentially avoidable' emergency admissions for the older population of London. However, the effects of PCT level deprivation on variations in SARs between PCTs has reduced compared to model 3 (PCT funding). Although there is still a significant positive association, a

1 unit increase in PCT level deprivation now increase SARs by 12.8 as opposed to a 14.8 increase in SARs with PCT funding. There still continues to be a significant positive effect of ward level deprivation, with a 1 unit increase above the average PCT level deprivation score increasing SARs by 19.8, similar to the result in model 3. There is no significant variation in SARs attributable to interactions in PCT or ward level deprivation, or when PCT funding is included, suggesting the effects are all independent of each other.

Overall the amount of residual variance between and within PCTs is higher than in model 3 (PCT funding), and the model 'fit' deteriorates, suggesting this model is not as useful in 'explaining' variations in 'potentially avoidable' emergency admissions as the previous model showing PCT funding (model 3).

Model 8 introduces older people helped to live at home per 1,000 population. Again there is no significant association between older people helped to live at home per 1,000 population and 'potentially avoidable' emergency admissions for the older population of London. There is some effect on reducing SARs in more deprived PCTs, however SARs are still significantly higher in PCTs that are more deprived. There is no effect on ward level deprivation, with continued significantly higher SARs in wards that have a higher deprivation score than the average for the PCT.

There is still a significant amount of residual variation both within and between PCTs and this has not improved from the previous model. The model 'fit' also does not improve from the previous model. Overall the rate of older people helped to live at home per 1,000 older people is likely highly correlated to Social services spending on older people, so no significant improvement in explaining variations in

'potentially avoidable' emergency admissions for the older population of London between PCTs is found compared to the model of Social services spending. It is more probable that the rate of intensive homecare provision per 1,000 older people will explain the variations in 'potentially avoidable' emergency admissions for the older population of London between PCTs if admissions are related to ill health.

Model 9 introduces the effects of intensive homecare per 1,000 older people. Again no significant association with 'potentially avoidable' emergency admissions for the older population of London is seen. SARs increase significantly as ward level deprivation increases above the mean deprivation score for the PCT and as PCT level deprivation increases, however there is no interaction between them. The amount of residual variation within and between wards has increased compared to model 7 and the model fit also does not improve from the previous models.

So overall, although social services' spending on older people reduces the effects of deprivation both between and within PCTs, none of the Social services variables are significantly associated with 'potentially avoidable' emergency admissions for the older population of London themselves. It would seem that spending may be related to provision of nursing home care and other services rather than homecare, as there is no relationship between the older people helped to live at home or intensive homecare variables and 'potentially avoidable' emergency admissions for the older population of London.

PCT funding does have a significant negative association with 'potentially avoidable' emergency admissions for the older population of London, and reduces the effects of PCT level deprivation, however does not overcome deprivation effects completely.

The proportion of GP practices that are single-handed is significantly and positively associated with 'potentially avoidable' emergency admissions for the older population of London, and may be reflecting a lack of available services within these practices. However, a significant amount of residual variability remained both within and between PCTs across all the models tested. It is possible that this is reflecting a frail increasingly ageing older population who may not be able to avoid admission to hospital. If this is the case, it may be explained further by examining *frequent* 'potentially avoidable' emergency admissions for the older population of London.

5.3.3 Frequent 'Potentially Avoidable' Emergency Admissions

Frequent 'potentially avoidable' emergency admission for the older population include only those patients who have been admitted more than once in any one year from the first admission. In total 42 per cent of the people admitted were multiple users of hospital services, accounting for 82 per cent of 'potentially avoidable' admissions for the older population of London. This section explores whether socioeconomic conditions, PCT and Social services input may explain variations in *frequent* 'avoidable' admissions, i.e. are single patients being admitted to hospital frequently. The data included here includes all admissions from those patients admitted to hospital *frequently* for 'potentially avoidable' admissions i.e. excludes single hospital admissions and are presented as 'smoothed' Standardised Admission Ratios (SARs).

The proportion of admissions that are frequent admissions varies by PCT (Figure 5.10).

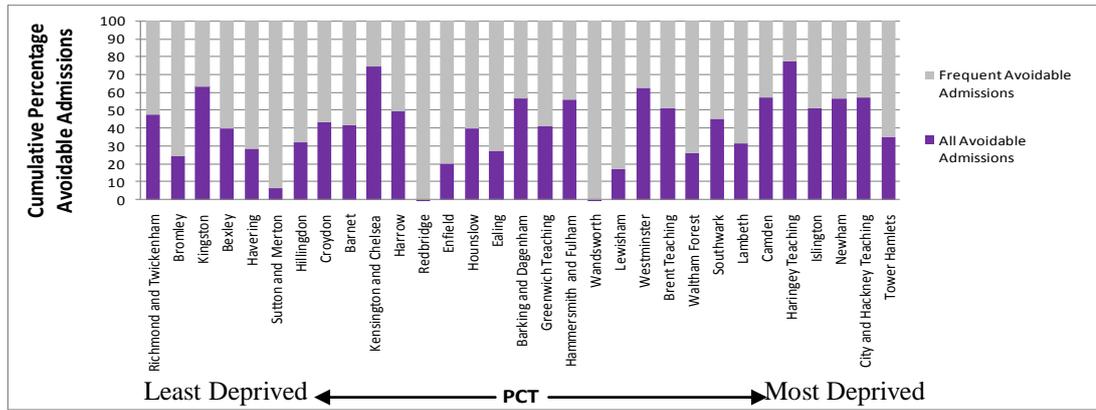


Figure 5.10: Percentage of Patients who are Frequent Admissions in Order of PCT Deprivation

Overall, there appears to be little correlation between PCT deprivation and the proportion of admissions that are frequent admissions. What is particularly noticeable is there are two PCTs (Redbridge and Wandsworth) that have average deprivation yet nearly all the older people admitted to hospital in the period 2001/02 to 2004/05 had multiple admissions. Some of the less deprived PCTs have a lower proportion of frequent SARs.

Figure 5.11 shows frequent standardised admission ratios for London PCTs in order of PCT deprivation.

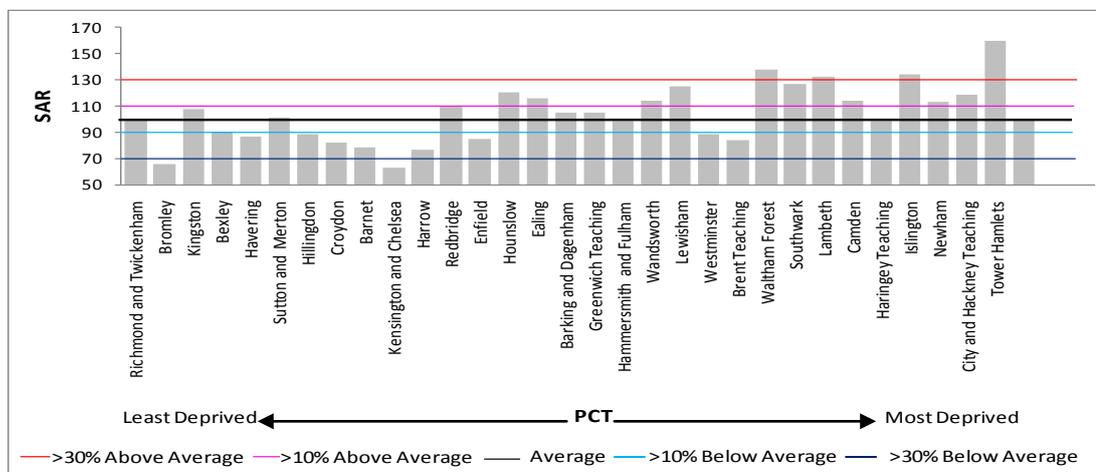


Figure 5.11: Frequent Admissions Standardised Admission Ratios by PCT Deprivation

Many of the most deprived PCTs have higher than average standardised admissions ratios for ‘potentially avoidable’ conditions. The opposite can be seen for the less deprived PCTs suggesting that there may be an association between ‘potentially avoidable’ emergency admissions for the older population of London and deprivation. This may be due to provision of care at PCT level, or Social services care provision, or may just be that more deprived populations tend to have poorer health overall. Table 5.5 presents a model in which rates of ‘frequent avoidable admissions’ is the outcome variable and explores how much of the variance in frequent ‘potentially avoidable’ emergency admissions for the older population of London is explained by between PCT variations, and how much is explained by within PCT variations. Model 10 then introduces the socioeconomic variables PCT level and explores within PCT effects of socioeconomic conditions.

Fixed Effects	Model 10 (Empty)		Model 11 Socioeconomic conditions	
	Mean	St.Error	Mean	St.Error
Constant (Smoothed SAR)	103.9	2.6	103.5	1.7
PCT IDAOPI			5.4	2.1
Within PCT deviation from the Mean IDAOPI			9.6	0.7
PCT high demand for care			2.8	2.3
Within PCT deviation from the Mean high demand for care			-0.4	0.5
PCT social fragmentation index			1.6	0.9
Within PCT deviation from the Mean social fragmentation index			1.3	0.7
Random Effects	Estimate	St.Error	Estimate	St.Error
PCT level variance	202.1	52.7	87.0	23.1
Residual variance	105.9	6.1	66.5	3.9
Model fit	4807.5		4517.5	

Table 5.5: Association of Social Services, PCT and Ward Level Variables with Frequent ‘Potentially Avoidable’ Emergency Admissions for the Older Population of London

Model 10 partitions the variance between and within PCTs, with 66 per cent of the variation in *frequent* 'potentially avoidable' emergency admissions for the older population of London being explained by variations between. There is a much larger proportion of the variance explained by variations between PCT variations than for all avoidable admissions.

Model 11 introduces the effects of deprivation both within and between PCTs. Between PCTs a 1 unit rise in deprivation scores increases the average *frequent* SAR by 5.4, and within PCTs a 1 unit rise from the average PCT deprivation score increases the average *frequent* SAR by 9.6. This suggests that older people living in more deprived wards are more likely to be *frequently* admitted to hospital with an 'avoidable' condition, and this effect is stronger in PCTs that are more deprived overall.

A high demand for care and the social fragmentation index were not associated with *frequent* 'potentially avoidable' emergency admissions for the older population of London either between or within PCTs. The model fit improves with the introduction of socioeconomic conditions, and the amount of residual variance both between and within PCTs decreases, suggesting that deprivation explains much of the variance in *frequent* 'potentially avoidable' emergency admissions for the older population of London. However there continues to be some variance that is unexplained, which may be attributed to variations in PCT funding and care provision.

Table 5.6 introduces the PCT provision and quality of care variables.

Fixed Effects	Model 12 PCT Funding		Model 13 GPs per 10,000 Pop		Model 14 Single Handed Practices		Model 15 QOF total points	
	Mean	St.Error	Mean	St.Error	Mean	St.Error	Mean	St.Error
Constant (Smoothed SAR)	105.7	1.8	105.7	1.9	105.7	2.7	105.4	2.9
PCT IDAOPi	3.6	2.1	6.1	2.3	18.4	3.2	16.8	3.4
Model Variable	-3.2	1.7	2.8	2.1	7.8	2.6	1.8	2.5
Within PCT deviation from the Mean IDAOPi	10.2	0.9	9.9	1.2	19.5	1.5	18.1	1.8
Within PCT IDAOPi x PCT IDAOPi	0.7	1.0	1.4	1.0	1.2	1.4	1.1	1.5
Variable x (Within PCT IDAOPi x PCT IDAOPi)	-2.4	0.9	-0.6	1.2	1.7	1.0	-2.0	1.7
Random Effects	Estimate	St.Error	Estimate	St.Error	Estimate	St.Error	Estimate	St.Error
Ward level variance	18.1	6.6	24.7	8.4	39.9	15.3	45.3	17.4
PCT level variance	77.8	24.5	83.0	26.0	160.7	50.7	192.0	59.9
Covariance within and between wards	0.9	9.2	14.4	11.4	51.6	21.4	56.7	25.4
Residual variance	54.6	3.3	54.7	3.3	193.0	11.4	192.5	11.4
Model fit	4440.0		4446.8		5196.8		5202.8	

Table 5.6: Association of PCT Care Provision and Socioeconomic Conditions with *Frequent* 'Potentially Avoidable' Emergency Admissions for the Older Population of London

Model 12 introduces the effects of PCT funding along with within (wards) and between (PCTs) PCT level deprivation on the variation in *frequent* 'potentially avoidable' emergency admissions for the older population of London between PCTs. The fixed effect of PCT funding shows no association with the variation in *frequent* 'potentially avoidable' emergency admissions for the older population of London. This differs to what was found for *all* 'potentially avoidable' emergency admissions for the older population of London in earlier models, where a significant negative association was found with PCT funding.

With PCT funding level funding in the models, PCT level deprivation shows no significant association with variations in *frequent* 'potentially avoidable' emergency admissions between PCTs. Again this is in contrast with all 'potentially avoidable' emergency admissions, where there continued to be a significant positive association between PCT level deprivation and the variation in admissions between PCTs after controlling for the effects of PCT funding.

Within PCTs, the effects of deprivation, although continuing to have a significant positive association with variations in *frequent* SARs between PCTs, is reduced; now a 1 unit rise in ward level deprivation raises *frequent* SARs by 10.02, compared to a 18.9 rise in *all* SARs seen in model 9.

The amount of residual variance is significantly reduced between PCTs, although there is no reduction in ward level residual variations. The model fit also improves compared to models 10 and 11.

There is no significant variance attributable to cross level effects of deprivation between wards and PCTs levels. However, when PCT funding is included with the cross level deprivation effects, there is a significant negative effect on the variation in frequent 'potentially avoidable' emergency admissions for the older population of London, showing that PCT funding has a cross level effect of reducing 'potentially avoidable' emergency admissions for the older population of London when combined with the effects of deprivation.

There remains significant residual variance at PCT level, although this has reduced considerably compared with model 11. There is also significant variance remaining within PCTs although this is relatively low. The overall residual variance remains reduced compared to model 1. The model fit has improved significantly. So overall, although PCT funding does not show an association with *frequent* 'potentially avoidable' emergency admissions for the older population of London as a fixed level effect, it does have a cross level effect when combined with deprivation, reducing *frequent* admissions to hospital, particularly in more deprived areas.

Model 13 introduces the number of GPs per 1,000 population. As with *all* 'potentially avoidable' emergency admissions for the older population of London, there is no association between the number of GPs per 10,000 population. The same is seen with the introduction of QOF total points and *frequent* 'potentially avoidable' emergency admissions for the older population of London in model 15. With each of these variables, deprivation continues to have a significant effect on within PCT and between PCT SARs. There also remains a significant amount of residual variance remaining both between and within PCTs.

Model 14 introduces the proportion of GP practices that are single-handed. There is a strong positive association with *frequent* 'potentially avoidable' emergency admissions for the older population of London. *Frequent* SARs increase by 7.8 with each unit increase in the proportion of single-handed GP practices. The effects of deprivation also increase, with average *frequent* SARs increasing by 18.4 with every unit increase in deprivation between PCTs and by 19.5 from the PCT average deprivation score within PCTs. There is no significant residual variance attributable to covariance at ward and PCT level, either between levels of deprivation, or when PCT funding is included, suggesting the effects are all independent of each other.

There is significant residual variance at PCT level and at ward level, and the amount of residual variance is higher than for model 12. The model fit has also deteriorated when compared to model 12. These findings may suggest that although the proportion of GP practices that are single-handed is significantly and positively associated with frequent 'potentially avoidable' emergency admissions for the older population of London, it has a poor model fit and leaves more residual variation at ward and PCT level than PCT funding shown in model 12.

It is possible that the cross level associations of PCT funding and deprivation with *frequent* 'potentially avoidable' emergency admissions for the older population of London is reflecting poor health in more deprived areas, where funding has some effect on reducing multiple admissions. However, it may be that Social services spending on and provision of care for older people is helping this reduction. Table 5.7 shows the association of Social services care provision, including Social services spending on older people, older people helped to live at home per 1,000 population and intensive homecare provision per 1,000 older people, whilst controlling for the effects of deprivation both within and between PCTs with *frequent* 'potentially avoidable' emergency admissions for the older population of London.

Fixed Effects	Model 16 SS spending on Older People		Model 17 Older People Helped to Live at Home per 1,000 Older People		Model 18 Intensive Homecare per 1,000 Older People	
	Mean	St.Error	Mean	St.Error	Mean	St.Error
Constant (Smoothed SAR)	106.5	6.7	105.9	1.9	106.5	6.7
PCT IDAOPi	4.0	3.3	4.1	2.1	4.0	3.3
Model Variable	-0.3	3.2	2.2	2.2	-0.3	3.2
Within PCT deviation from the Mean IDAOPi	11.1	1.3	10.2	1.1	11.1	1.3
Within PCT IDAOPi x PCT IDAOPi Variable x (Within PCT IDAOPi x PCT IDAOPi)	-0.9	2.1	1.3	1.1	-0.9	2.1
	1.2	1.0	0.1	0.7	1.2	1.0
Random Effects	Estimate	St.Error	Estimate	St.Error	Estimate	St.Error
Ward level variance	24.3	8.2	24.9	8.3	24.3	8.2
PCT level variance	91.8	28.0	87.0	26.7	91.8	28.0
Covariance within and between wards	13.0	11.2	11.1	10.9	13.0	11.2
Residual variance	54.5	3.3	54.5	3.3	54.5	3.3
Model fit	4447.4		4447.7		4447.4	

Table 5.7: Association of Social Services Spending and Provision of Care and Deprivation with *Frequent* 'Potentially Avoidable' Emergency Admissions for the Older Population of London

None of the social care variables (spending on older people, older people helped to live at home and intensive homecare provision) show a significant association with *frequent* 'potentially avoidable' emergency admissions for the older population of London. In all three models (models 16 to 18), PCT level deprivation is no longer

associated with *frequent* 'potentially avoidable' emergency admissions for the older population of London after controlling for the effects of Social services spending and provision of care. Within PCTs, the effects of deprivation, although continuing to show a significant positive effect on *frequent* SARs, the effect is much reduced. There is no interaction between wards and PCTs in any of the three models. There also remains a significant amount of unexplained residual variance at PCT level and at ward level within PCTs in all three models. Overall, controlling for the effects of Social services spending and provision of care removes any deprivation effects between PCTs, and significantly reduces the effects of ward level deprivation on *frequent* 'potentially avoidable' emergency admissions for the older population of London.

5.4 CONCLUSION

This chapter has been shown there are complex relationships between socioeconomic conditions, PCT funding and care provision, and Social services spending and care provision for older people and how they are associated with *all* and *frequent* 'potentially avoidable' emergency admissions for the older population. It is difficult to unravel these complexities.

Quality of care from GP practices (measured as QOF points as a percentage of total points available over the PCT) showed no association with 'potentially avoidable' emergency admissions for the older population of London. This might be because the quality of care is better in less deprived areas so that the 'deprivation' variable in the models also stands for this variation in quality of care. Equally, it is possible that the overall effect of GP performance within PCTs is averaged out, with some PCTs

performing better than other. Examining the effects of individual GP practice performance on individual level admissions may help unravel these complexities.

PCT funding was seen to be positively associated with *all* 'potentially avoidable' emergency admissions for the older population of London even after controlling for the effects of deprivation. Variations between PCTs were reduced but still remained, and deprivation effects within PCTs remained high across all PCTs regardless of PCT funding. However, when examining *frequent* 'potentially avoidable' emergency admissions for the older population of London, no association was seen with PCT funding alone, but there is significant negative cross level interactions in operation, which may be reflecting greater health care needs within more deprived wards. It is likely there is poorer health overall within this group of patients, however if this was the case then it would be expected that an association between *frequent* 'potentially avoidable' emergency admissions for the older population of London and a high demand for care would be seen (which it was not), although at ward level alone (shown in chapter 4), a strong association was seen.

The number of GPs per 10,000 population had no association with *all* or *frequent* 'potentially avoidable' emergency admissions for the older population of London after controlling for the effects of deprivation. There are more GPs per 10,000 population in more deprived areas, so this may be a function of deprivation, where patients tend to be more unwell.

Some of the literature on the association between hospital admissions and single-handed GP practices suggested that they had more hospital admissions than larger practices, however the evidence was mixed, with some authors suggesting that more

personal care was available at single-handed GP practices and so hospital admissions could be avoided. This chapter has shown that at PCT level, the proportion of GP practices that are single-handed is associated with both *all* and *frequent* 'potentially avoidable' emergency admissions for the older population of London. This may be reflecting poorer performance overall in PCTs with a higher proportion of single-handed GP practice which may also be the more deprived PCTs. Studying individual level admissions registered with individual GP practices as in chapter 6 should confirm whether this is the case.

Given evidence from previous studies, it was expected that there might be no association between Social services care provision, or perhaps more generous Social services care provision would be associated with a reduction of admissions. This study confirmed this to be true. This brings into question whether the amount of support for older people is enough to help them avoid hospital admissions. However what Social services spending did do was reduce the overall effects of deprivation between PCTs. This was particularly apparent with *frequent* 'potentially avoidable' emergency admissions for the older population of London, where deprivation between PCTs no longer showed any significant association with SARs between PCTs. However these effects were not apparent when the provision of help to live at home and intensive homecare variables were examined, suggesting that spending on (and hence funding for) older people may not be adequate.

This chapter has shown similar results to those found by Saxena et al (2006) who studied PCT level 'avoidable' admissions. Research here has demonstrated that around half the variation in *all* 'potentially avoidable' emergency admissions for the older population of London was found to be attributable to variations between PCTs,

with similar populations having similar patterns of admissions, whilst half the variation is attributable to variations within PCTs (at ward level), with more affluent PCTs having fewer admissions.

However, it has also shown that more of the variation in *frequent* 'potentially avoidable' emergency admissions for the older population is attributable to between PCT effects. Deprivation explains much of the variation both between PCTs and within PCTs (at ward level) and although efforts by Social services and primary care to reduce these effects, they appear to be swamped by the effects of deprivation, particularly in local clusters (wards). This may be reflecting an increasingly frail older population that may not be able to avoid being admitted to hospital. Therefore it is wondered whether 'potentially avoidable' emergency admissions for older people should be categorised as 'potentially avoidable' at all, or whether these admissions are merely a consequence of old age.

It may however be that variances in 'potentially avoidable' emergency admissions for the older population cannot be attributed to differences in healthcare and Social services care provision at PCT level but in fact is related to care at the level of individual GP practices or the distribution of Social services at a finer level such as wards. Chapter 6 explores these relationships further.

CHAPTER 6 Admissions for the Older Population of Barking & Dagenham, Individual Patients and GP Practices

6.1 INTRODUCTION

Chapters 4 and 5 have shown that in an ecological analysis, deprivation is strongly associated with 'potentially avoidable' emergency admissions for the older population of London at both Primary Care Trust (PCT) and ward level. PCT funding showed a significant negative association with *all* 'potentially avoidable' emergency admissions for the older population of London, independently of the local level of deprivation. Analysis at the individual level, for people living in the most deprived parts of a PCT may help to clarify this relationship further.

The proportion of GP practices that are single-handed was also significantly and positively associated with both *all* and *frequent* 'potentially avoidable' emergency admissions for the older population of London even after controlling for deprivation effects, and it was clear that these effects are more evident in more deprived PCTs. Analysing individual level 'potentially avoidable' emergency admissions for the older population and the characteristics of the GP practice, including whether it is a single-handed practice may clarify the relationship between single-handed practice and risk of admission.

A high likely 'demand' for care, as measured by indicators of morbidity in the older population was associated with 'potentially avoidable' emergency admissions for the older population of London for wards, but in more complex models morbidity in the

population did not seem to have a separate relationship with admissions independent of the link with deprivation at the ward and PCT level. Also, the pattern of variation at the ecological level was different for all 'potentially avoidable' emergency admissions than it was for those which related to multiple, repeated admissions for some patients. At the individual level it would be easier to establish whether there are distinctive socio-economic conditions or patterns of service provision associated with patients with a history of multiple admissions.

Aggregating data on 'potentially avoidable' emergency admissions for the older population to small areas such as wards is useful to show how socioeconomic conditions or primary and Social services care provision can have an association with patterns of admissions at the population level. However this should not extend to making inferences about relationships existing at an individual level based on observations made on groups of people, giving rise to the potential problem of ecological fallacy. To understand individual level relationships, it is necessary to use individual 'potentially avoidable' emergency admissions for older people. In this analysis, these have been used together with very fine geographic scale socioeconomic conditions data (acting as a proxy for the patients' own socioeconomic position) and characteristics of the GP practice the patient is registered with. This may help to explain some of the complex relationships shown in the previous chapter.

For the PCT of Barking & Dagenham it was possible to obtain individual 'anonymised' data for the GP practice populations. Combined with GP practice characteristic and local socioeconomic conditions this allowed the exploration of

‘potentially avoidable’ emergency admissions with individuals as the unit of analysis and contextual variables that were much closer to their specific personal context.

Barking & Dagenham has a population of 170,000 people, 15 per cent of whom are aged 65 or over. Barking & Dagenham is a deprived borough in the northeast of London, with higher rates of long-term limiting illness and a lower life expectancy than the London average. Barking & Dagenham has been identified as one of the ‘spearhead’ local authorities – a group of 88 PCTs and 70 local authorities identified as having relatively high health inequalities and thus prioritized for Public Health initiatives (Department of Health, 2004b) (see chapter 3 for a more detailed explanation). The health inequalities are mirrored by socio-economic inequality; although overall Barking & Dagenham PCT is middle ranking among London PCTs according to the income deprivation affecting older peoples index, 14 of its’ 17 wards are within the top 20 per cent most deprived wards in the UK. It also has a relatively high percentage of older people and is ideal for a study of individual admissions to hospital for ‘potentially avoidable’ conditions.

The compositional patterns of ‘potentially avoidable’ admissions for the older population of Barking & Dagenham were firstly explored. Multilevel logistic regression modelling, using binary data on admission as the dependent variable, was then performed for the individual older people within GP practices in Barking & Dagenham during the period April 2001 to March 2005, exploring the association with the patient’s age and sex, spatial proximity of their home (at LSOA level) to hospital beds, socioeconomic conditions (at LSOA level), GP practice characteristics (at GP practice level) and whether the patient was receiving homecare (at an individual level).

This chapter then continues to explore *frequent* 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham, i.e. patients who have had more than 1 admission in the year following the first admission. Here only data on those people admitted to hospital for 'potentially avoidable' emergency admissions was used, with a binary response to indicate whether they had more than 1 admission.

6.2 METHODS

This chapter explores factors that are associated with individual anonymised 'potentially avoidable' emergency admissions for the financial years April 2001 to March 2005 for the older population (65 and over) of patients within Barking & Dagenham PCT boundaries and registered with the 34 GP practices in Barking & Dagenham that were open throughout the study period. For those registered with a Barking & Dagenham GP practice and living within the boundaries of Barking & Dagenham, GP individual data were available for the financial years (April to March) 2001/2002 to 2004/2005 and included information on which GP practice the patient was registered with, the age-band and sex of the patients and the patients' postcode. Individual Hospital Episode Statistics (HES) data were also available for the same individuals and time periods. The data included information on which GP practice the patient was registered with, the age-band and sex of the patients, and the patients' postcode. A binary variable represented whether or not an older person was admitted to hospital for a 'potentially avoidable' condition. Where patients had multiple admissions in one year prior to their last admission they were counted as having only one admission to allow the binary events to be easily represented. The HES data also included information on the primary medical condition giving rise to

the admission, admission method, discharge method (including if the patient died), and date of admission and discharge. For each of the individual anonymised patients, information on GP practice characteristics and quality of care, socioeconomic conditions of the LSOA the patient lives in and whether or not the patient receives home care or meals on wheels was attached. Each of the data sets containing information on individual patients had four attributes in common, the GP practice code, age-band, sex and patients' postcode. These attributes were joined together to make unique 'individual patients' within each of the data sets (see chapter 3 for a more detailed discussion of the details and accuracy of this method). Using the GP practice population data as the main data set it was then possible to join on the data set of individual hospital admissions using the new concatenated ID code of the patients and create a new data set showing whether or not a patient registered with and Barking & Dagenham GP was admitted to hospital for a 'potentially avoidable' condition within the study period.

Controlling for individuals' age and sex, the analysis examines associations with socioeconomic conditions in the person's immediate neighbourhood (at LSOA level) and at GP practice level, with proximity to hospitals, with GP practice quality and performance and whether they receive homecare or meals on wheels, (see chapter 3 for more details of the data included).

A variety of data were available for this part of the study and is summarised in table 6.1 below.

Data set	Variables included
GP Practice Population	GP practice code; 10 year age-band; Sex; Postcode of the Patient; Whether had a 'potentially avoidable' admission (as a binary response); whether patient received homecare; whether patient received meals on wheels and all information from the LSOA and GP practice characteristic data sets.
GP practice characteristics	GP practice code; Average number of patients per GP; Average number of older patients per GP; IDAOPI for the practice population served; Social fragmentation for the practice population served; Older people living alone for the practice population served; IDAOPI for the practice population served; Long-term limiting illness for the practice population served;
LSOA level	IDAOPi; Social fragmentation index; % older people living alone; % older people with a long-term limiting illness; Spatial proximity to hospital beds
HES 'potentially avoidable' admissions data	GP practice code; 10 year age-band; Sex; Postcode of the Patient; admission date; discharge date; condition; admission method; multiple admissions; discharge destination (including if died).
Homecare	GP practice code; 10 year age-band; Sex; Postcode of the Patient
MOW	GP practice code; 10 year age-band; Sex; Postcode of the Patient

Table 6.1: Summary of Data Sets and Variables Included (2001/2002-2004/2005)

The first part of the analysis is primarily descriptive and explores the data on 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham for the financial years 2001/2002 to 2004/2005 using a combination of tables and graphs. This part of the analysis looks at trends in admissions, source of admissions and whether there is variance at GP practice level.

Multilevel modelling was then performed using binary data for the Barking & Dagenham practice population from 2001 to 2005 where 1 is equal to a patient being admitted to hospital for an 'avoidable' admission at any point during the study

period and 0 is no 'potentially avoidable' admission. The first part of the model looks at whether there are variations in hospital admissions at GP practice level after controlling for age and sex of the patient by partitioning the variance. Models were then built up firstly to explore the effects of socioeconomic conditions. Information on GP practices (single-handed practices, number of patients per GP, number of older patients per GP and QOF data) were then included. Finally, the receipt of homecare and meals on wheels was included in the models.

The study then continues to explore whether among those older patients admitted to hospital as a 'potentially avoidable' emergency admission there are differences between *frequent* (i.e. admitted again within 1 year of previous admission) and *single* admissions to hospitals for individuals. This time, a person with *frequent* admissions has a score of 1 and a person with a single admission a score of 0. Only one model is run in this section, exploring the effects of homecare/meals and wheels and social fragmentation on 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham.

6.3 RESULTS

'Potentially avoidable' emergency admissions for the older population of Barking & Dagenham for the older population vary by 10-year age band and year across the GP practice population of Barking and Dagenham (Figure 6.1).

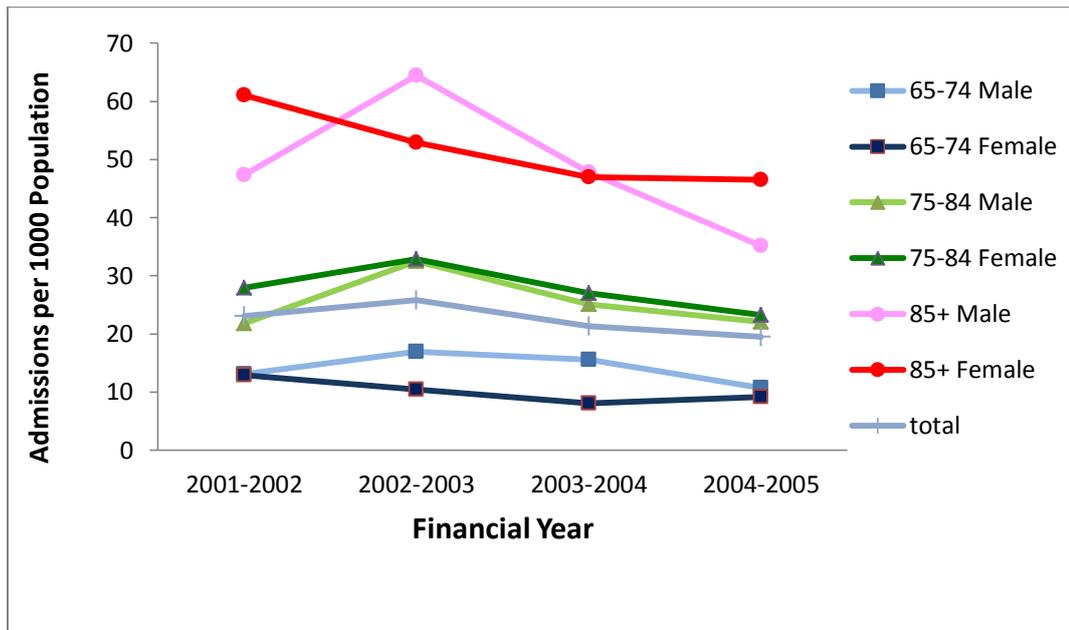


Figure 6.1: Variation in ‘Potentially Avoidable’ Emergency Admissions by Age Band and Year for Barking & Dagenham

The over 85 age group females have highest ‘potentially avoidable’ emergency admission rates per 1000 population. Rates of admission increase with age-band. For all age bands admission rates per 1000 are reducing over time, although not significantly so, with slight variations year on year. However the variations seen are not statistically significant. Despite efforts by GP services to reduce ‘potentially avoidable’ emergency admissions for the older population of Barking & Dagenham they are not statistically significantly decreasing over time.

‘Potentially avoidable’ emergency admissions for the older population of Barking & Dagenham also vary geographically (figure 6.2).

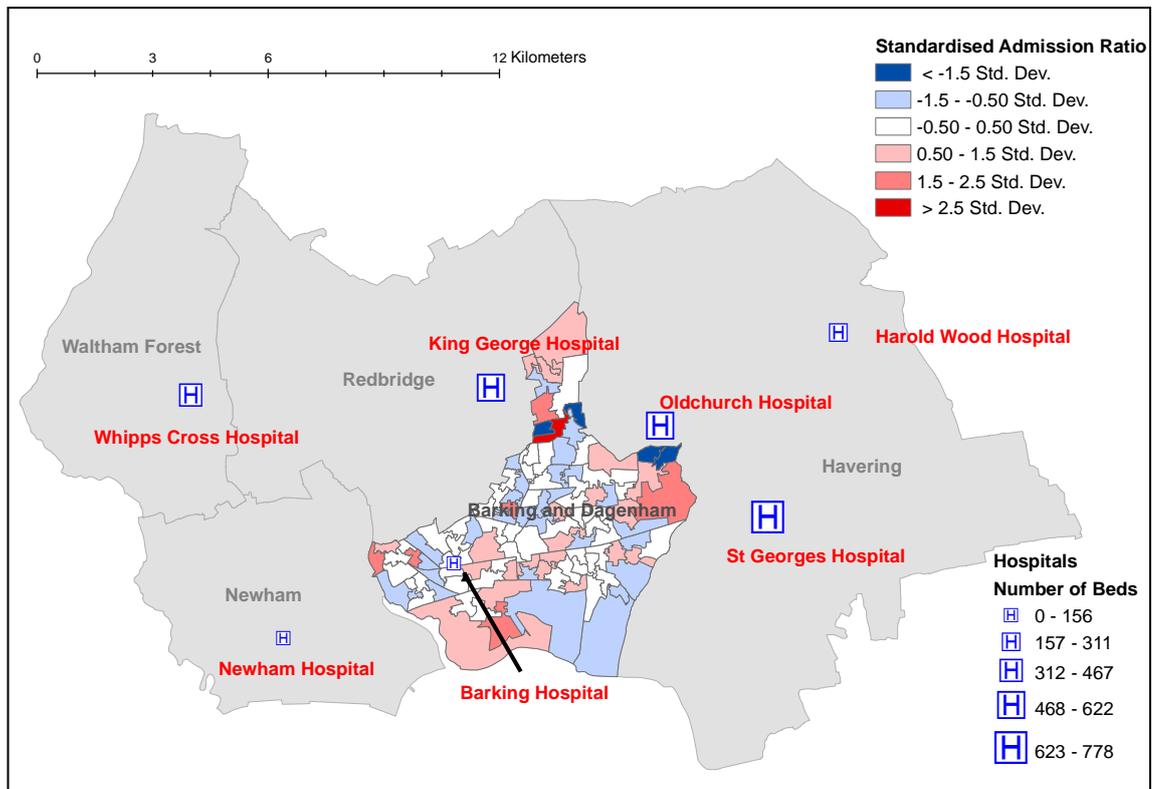


Figure 6.2: Variation in 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham by LSOA and the Location of Hospitals

There are a number of hospitals available to residents of Barking & Dagenham. However Barking Hospital is a cottage hospital so although it has beds for care of the elderly it does not have an A&E department. The main hospitals used by residents of Barking & Dagenham are Oldchurch hospital (now known as Queens hospital), and King Georges Hospital, however some patients are admitted further afield. Overall, there are more admissions in the south west of Barking & Dagenham and to the northeast.

Exploring the make-up of 'potentially avoidable' emergency admissions for the older population of Barking and Dagenham it can be seen that the pattern is a little more complex depending on the indicator considered (Table 6.2).

Year	Total Avoidable Admissions	Admissions per 1000 Population	Number of People Admitted	Individual Patient Admissions per 1000 Population	% Patients that have Frequent Admissions	% Admissions Accounted for by Frequent Patients
2001-2002	448	19.55	343	17.65	22.16	40.40
2002-2003	456	25.87	331	18.78	29.31	48.68
2003-2004	382	21.30	336	18.74	11.01	21.73
2004-2005	378	19.48	331	17.06	9.37	20.63

Table 6.2: Admission Patterns for the 65 and over Population of Barking & Dagenham (2001/2002 – 2004/2005)

After an initial increase in overall numbers of ‘potentially avoidable’ emergency admissions for the older population of Barking & Dagenham, admission rates per 1,000 population decreased yearly. However, the numbers of older *people* admitted each year per 1000 population has remained constant (ignoring frequent admissions by individuals). The people who *are* admitted are having fewer multiple (*frequent*) admissions over time; so there has been a reduction in the percentage of admissions due to people having *frequent* admissions.

It will therefore be interesting to investigate whether efforts to reduce ‘potentially avoidable’ emergency admissions for the older population within Barking & Dagenham are concentrated on helping older people once they have initially been admitted to hospital, thus reducing the need for further admission.

The conditions patients are admitted for vary (Figure 6.3).

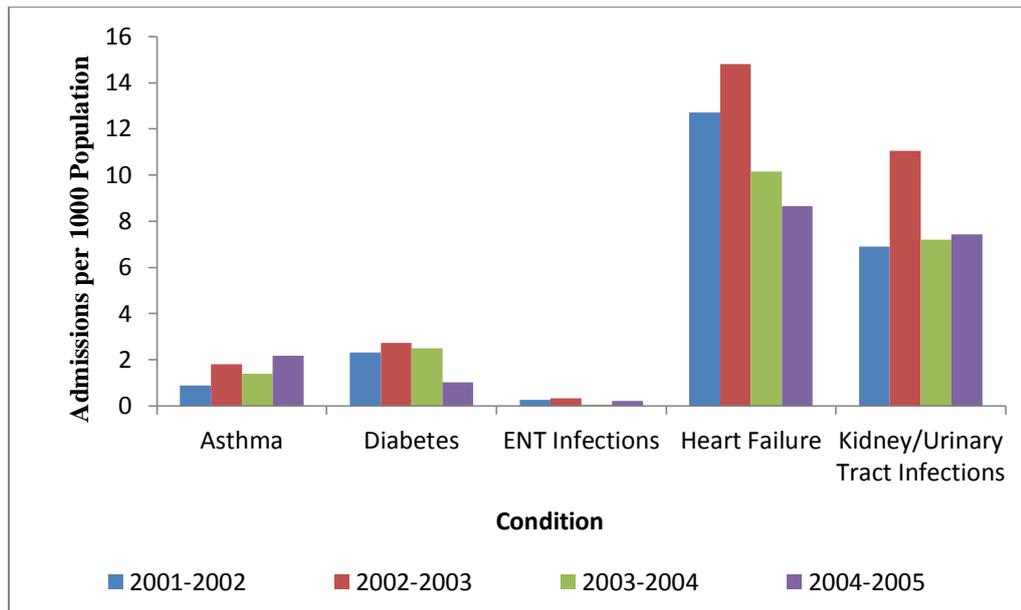


Figure 6.3: ‘Potentially Avoidable’ Emergency Admissions to Hospital for the Older Population of Barking & Dagenham by Condition and Financial Year

Heart Failure is the biggest cause of ‘potentially avoidable’ admission for the older population of Barking & Dagenham, although the graph suggests admissions are decreasing over time. Admissions for urinary tract/ kidney infections have remained high and the graph suggests admissions are increasing yearly (with a much larger spike in admissions in 2002 to 2003, although in fact the increase is not significant. Although having fewer admissions per year, admissions for asthma are also increasing yearly, but again this is not a significant increase. Admissions for diabetes are variable, and admissions for ENT infections are negligible.

As heart failure and urinary tract/renal infections are the highest cause for admission and are conditions particularly associated with increasing age (Ho *et al.*, 1993), the patterns for these two conditions are explored separately by financial year, sex and age-band (Figure 6.4).

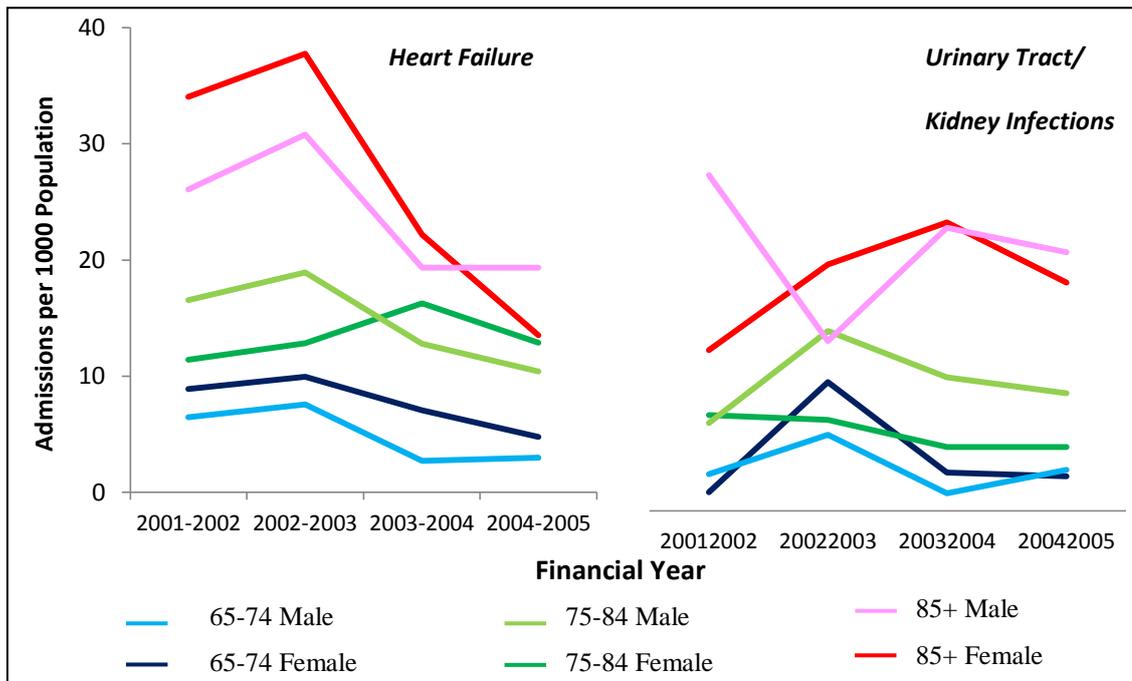


Figure 6.4: ‘Heart Failure and Urinary Tract/Renal Infection Admissions for the Older Population of Barking & Dagenham by Age, Sex and Financial Year

Although after an initial increase in admissions rates per 1000 population, admissions for heart failure decrease over time, although not significantly. Admission rates also increase with age. Admissions per 1000 population increase with age. There is no statistically significant pattern to admission rates per year across the age-bands. The pattern is a little less clear for urinary tract/renal infections which fluctuate by year across all the age bands. However, again admissions increase with age.

Admission ratios vary by GP practice as figure 6.5 shows.

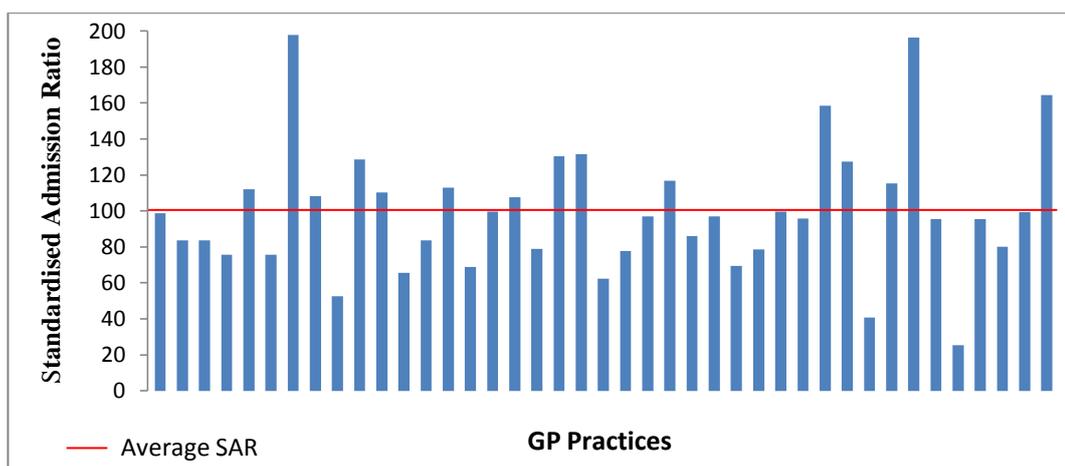


Figure 6.5: Standardised ‘Potentially Avoidable’ Emergency Admissions to Hospital GP Practice (2001/2002 – 2004/2005)

Some GP practices have admission ratios up to 90 per cent above the average for Barking & Dagenham, whilst other practices have admission ratios up to 22 per cent below the average. It may however be that patients are not visiting their GPs when unwell, and going straight to A&E.

Of those older patients admitted the vast majority were admitted via Accident and Emergency (A&E) rather than via their GP (Table 6.3).

Admission Method	65-74 Male	65-74 Female	75-84 Male	75-84 Female	85+ Male	85+ Female
Emergency - via A&E	94%	92%	87%	87%	94%	94%
Emergency - via GP	4%	4%	9%	9%	5%	5%

Table 6.3: Method of Admission for ‘Potentially Avoidable’ emergency Admissions for the Older Population of Barking & Dagenham

Although after an initial increase in admissions rates per 1000 population, admissions for heart failure decrease over time, although not significantly. Admission rates also increase with age. Admissions per 1000 population increase with age. There is no statistically significant pattern to admission rates per year

across the age-bands. The pattern is a little less clear for urinary tract/renal infections which fluctuate by year across all the age bands. However, again admissions increase with age.

Of those older patients admitted the vast majority were admitted via Accident and Emergency (A&E) rather than via their GP (Table 6.3).

Fixed Effects	Model 1 (Empty) GP Practices	
Avoidable admission	Mean	St. Error
Constant	4.598	0.077
Age 75-84	0.776	0.070
Age 85+	1.501	0.078
Female	-0.036	0.059
Random Effects		
GP practice level variance	0.248	0.044
Model fit	12250	

Table 6.4: Partition of the Variance in 'Potentially Avoidable' Emergency Admissions for the Older Population of Barking & Dagenham by GP Practice

Individual older people are twice as likely to be admitted to hospital as an emergency with a 'potentially avoidable' condition if they are between the age of 75 and 84 compared to being younger [Exp (0.770)]. They are 4 times as likely to be admitted to hospital if they are 85 or over, although this result is not significant (probably because of the relatively small numbers in this oldest group). Females are slightly less likely to be admitted than males although not significantly so. There is significant variation in 'potentially avoidable' emergency admissions for the older population across GP practices. To explain some of this variation at GP practice level, variables representing socioeconomic conditions, GP practice provision of care and the provision of homecare and meals on wheels and their associations with 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham were explored, commencing with the socioeconomic conditions.

6.3.1 Socioeconomic Conditions

The socioeconomic conditions of the LSOA where a person lives makes a good proxy for an individuals' socioeconomic status in the absence of actual data on the individual themselves. Evidence from the analysis in previous chapters suggested some of the LSOA level socioeconomic conditions may be highly correlated, potentially causing covariance within any multilevel models. Therefore a correlation matrix was produced to test this hypothesis (Table 6.5).

	Access	Unpaid care 50 hours +	Social fragmentation	Long term limiting illness	IDAOPi	Unpaid Care all	Living alone
Access	1						
Unpaid care over 50 hours	-0.204	1					
Social fragmentation	-0.081	-0.119	1				
Long term limiting illness	-0.238	0.183	0.494	1			
IDAOPi	-0.179	0.047	0.505	0.632	1		
Unpaid Care all	-0.017	0.584	-0.508	-0.258	-0.381	1	
Living alone	-0.064	-0.068	0.776	0.452	0.391	-0.377	1

Table 6.5: Correlation between Socioeconomic Variables for Barking & Dagenham LSOAs

Some of the socioeconomic variables are correlated: therefore factor analysis was performed on the socioeconomic variables to explore how they might be groups together (Table 6.6).

Variable	Factor1	Factor2	Uniqueness
Access	-0.193	-0.529	0.683
Social fragmentation	0.870	-0.057	0.240
Long term limiting illness	0.730	0.417	0.294
IDAOPi	0.751	0.240	0.379
Living alone	0.792	-0.009	0.372
Unpaid Care all	-0.661	0.577	0.231
Unpaid care over 50 hours	-0.169	0.877	0.203

Table 6.6: Factor Analysis for Socio Economic Variables

Now it is clear there are 3 potential variable groupings:

- Spatial proximity to hospital beds (Access);
- % of people providing any unpaid care and the % of people providing over 50 hours of care;
- the % of older people with a long-term limiting illness, the % older people living alone, the IDAOPI and the social fragmentation index.

As potentially any one of these combinations of variables could be associated with 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham, each variable was multilevel modelled separately. Separate models using random intercepts for individuals grouped by GP practices were run. This enabled exploration of whether any of the socioeconomic variables independently explained any of the variation in 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham at GP practice level. In each model age and sex is controlled for. Each model returns regression coefficients for fixed effects (mean and standard error). A mean at least twice the standard error indicates there is a significant association with individual 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham, with a negative mean value indicating a negative association and a positive mean value indicating a positive association. Each model also returns random effects values (estimate and standard error). The random effects value indicates whether any of the variance between GP practices level is explained by including the explanatory variable in each model. If the estimate is smaller than the empty model (or another comparator model), this suggests that the explanatory model is indeed explaining some of the variance in 'potentially avoidable' emergency admissions between GP practices. The 'model fit' indicates how well each overall model explains the variation in 'potentially

avoidable' emergency admissions between GP practices; a decrease in the model fit value compared to previous models (or the 'empty' model) indicates improved fit. This is less important where there is only one explanatory variable in the model, as with models 2 to 8, however becomes more important where there are a number of explanatory variables in the model (as in latter models), where the model fit indicates how well the combination of variables explains variations in admission rates between GP practices. The results of the socioeconomic explanatory variables are shown in Tables 6.7.

Individual level Variable Differences Between GP practices	Fixed Effects		Random Effects GP prac		Model Fit
	Mean	Std. Error	Estimate	Std. Error	
Model 2 Access	0.021	0.024	0.248	0.044	12251
Model 3 IDAOPI	0.082	0.038	0.176	0.046	12279
Model 4 Social fragmentation	0.086	0.037	0.175	0.046	12278
Model 5 Living alone	0.025	0.033	0.247	0.044	12252
Model 6 Long term limiting illness	0.069	0.034	0.237	0.044	12248
Model 7 Unpaid Care all	-0.060	0.034	0.252	0.045	12249
Model 8 Unpaid care over 50 hours	-0.029	0.031	0.251	0.045	12251

Table 6.7: Multilevel Model Results of Independent Socioeconomic Conditions at GP Practice Level and 'Potentially Avoidable' Emergency Admissions for the Older Population of Barking & Dagenham controlling for individual age and sex

After controlling for the effects of age and sex, the models for IDAOPI, social fragmentation index and the percentage of older people that have a long-term limiting illness all show a significant positive association with 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham at GP practice level. Compared to model 1, only the social fragmentation index and the IDAOPI show a reduction in the amount of variation at GP practice level (residual effects), suggesting these two variables explain some of the variation in 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham

between GP practices. As the amount of variation between GP practices was marginally improved with social fragmentation index as the explanatory variable compared to the IDAOPI, and deprivation and social fragmentation are inter-related (table 6.6), both having a probably causal effect on health, the social fragmentation index at LSOA level was chosen to represent the socioeconomic conditions of where an individual lives.

The following section explores whether GP practice provision of care has any significant effect on reducing 'potentially avoidable' emergency admissions for the individual older population within Barking & Dagenham after controlling for the effects of LSOA social fragmentation between and within GP practices.

6.3.2 GP Practice Provision of Care

There are large differences in the number of patients each GP practice covers, however different practices have different numbers of GPs working in them. Measuring the number of patients per GP (as whole time equivalents) gives an indication of workload within each practice. Figure 6.6 shows the variation in the number of patients per GP by practice.

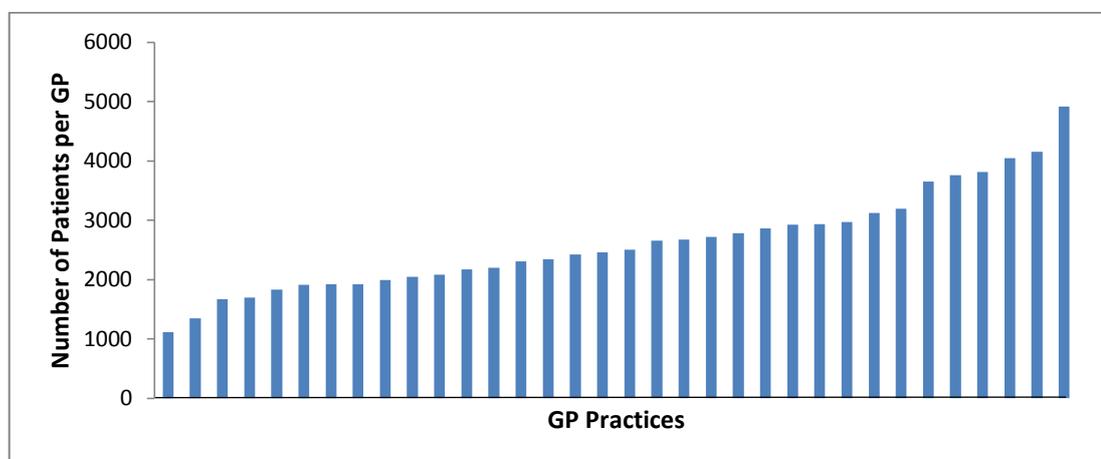


Figure 6.6: Number of Patients per GP by GP Practice in Barking & Dagenham (2004)

The number of patients per GP ranges from 1114 to 4917. Larger numbers per GP may influence the ability of the doctor to see patients promptly. Table 6.8 (model 9) shows the association between the number of patients per GP and 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham after controlling for the effects of social fragmentation at both the individual level and social fragmentation averaged across GP practices weighted by the number of older people from each practice living in each LSOA. This allows exploration of whether the social fragmentation index of where the individual lives, the average social fragmentation of the GP practice population or the number of patients per GP is associated with variations in 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham between GP practices. The age and sex of the individual is controlled for.

Fixed Effects	Model 9	
	Mean	St. Error
Avoidable Admissions - All		
Intercept	-4.597	0.077
Age 75-84	0.774	0.069
Age 85+	1.499	0.077
Female	-0.038	0.059
Social fragmentation - Individual level	0.088	0.034
GP practice mean social fragmentation	0.016	0.055
Patients per GP	0.065	0.053
Random Effects		
GP Practice level variance	0.174	0.348
Model fit	12247	

Table 6.8: Multilevel Model Results for the Effects of Numbers of Patients per GP and Social Fragmentation on Individual 'Potentially Avoidable' Emergency Admissions for the Older Population of Barking & Dagenham

In model 9, the average social fragmentation for patients in GP practices shows no association variations in individual level 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham between GP practices.

However, the social fragmentation index of where the individual lives shows a significant positive association with variation in individual level 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham between GP practices, increasing admissions by 0.088 for every unit increase in LSOA social fragmentation. There remains significant variance between GP practice level, and it has not improved from model 4, showing the effects of LSOA social fragmentation between GP practices alone. The model fit does not improve either, showing that the number of GPs per 10,000 patients does not explain variations in 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham between GP practices.

However, older people have been shown to use GP services more than other age groups, so the number of older people per GP may be a more appropriate measure of workload. Figure 6.7 shows the number of older patients per GP by GP practice.

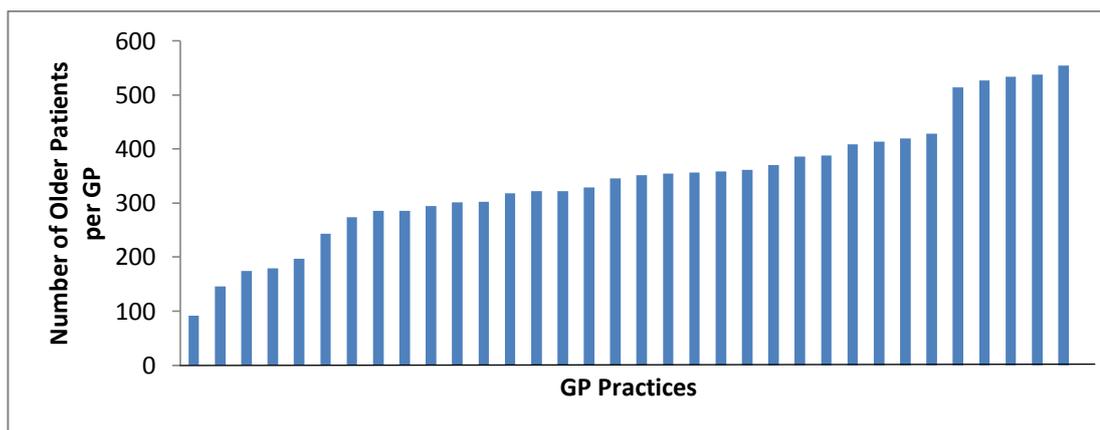


Figure 6.7: Number of Older Patients per GP by GP Practice in Barking & Dagenham (2004)

There is a large difference in the number of older patients per GP across the GP practices in Barking & Dagenham, ranging from 92 patients per GP to 554 patients per GP. It is possible that where there are higher numbers of older people, this could

produce higher workloads, resulting in older people less able to get quick appointments with a GP. However, it could also be possible that GP practices with higher numbers of older patients per GP are able to adapt services to the needs of older people more appropriately. Table 6.9 shows the association between the number of older patients per GP and 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham after controlling for the effects of age, sex and social fragmentation.

Fixed Effects	Model 10	
	Mean	St. Error
Avoidable Admissions - All		
Intercept	-4.592	0.077
Age 75-84	0.774	0.069
Age 85+	1.499	0.077
Female	-0.038	0.059
Random Effects		
GP Practice level variance	0.061	0.023
Model fit	12248	

Table 6.9: Multilevel Model Results for the Effects of Numbers of Older Patients per GP and Social Fragmentation on Individual 'Potentially Avoidable' Emergency Admissions for the Older Population of Barking & Dagenham

Model 10 introduces the average number of older people per GP by GP practice. The average numbers of older people per GP by practice and the average social fragmentation of GP practice patients are not associated with variations in 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham between GP practices. There continues to be a significant positive effect of LSOA level social fragmentation for individuals. There remains significant

variance at GP practice level, although this has reduced considerably compared with models 9. However the model fit does not improve.

Chapter 5 demonstrated that the proportion of GP practices that are single-handed GP practices at PCT level was positively associated with 'potentially avoidable' emergency admissions for the older population of London. Barking and Dagenham has 16 single-handed GP practices in total, 47 per cent of the total number of practices. It is therefore possible to test whether individuals registered with single-handed GP practices are more likely to be admitted to hospital as an emergency with a 'potentially avoidable' condition in Barking & Dagenham. Table 6.10 shows the association between the proportion of GP practices that are single-handed and 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham after controlling for the effects of age, sex and social fragmentation.

Fixed Effects	Model 11	
	Mean	St. Error
Avoidable Admissions - All		
Intercept	-4.616	0.091
Age 75-84	0.773	0.069
Age 85+	1.498	0.077
Female	-0.038	0.059
Social fragmentation - Individual level	0.087	0.034
GP practice mean social fragmentation	0.011	0.056
Single-handed GP practices	0.050	0.108
Random Effects		
GP Practice level variance	0.250	0.045
Model fit	12248	

Table 6.10: Multilevel Model Results for the Effects of the Proportion of GP Practices that are Single-Handed and Social Fragmentation on Individual 'Potentially Avoidable' Emergency Admissions for the Older Population of Barking & Dagenham

Model 11 introduces the proportion of GP practices that are single-handed. The proportion of GP practices that are single-handed shows no significant association

with 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham after controlling for the effects of social fragmentation. As previously, there is a significant positive effect of LSOA level social fragmentation, but no effect of GP practice level social fragmentation on 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham between GP practices. The variance at GP practice level and the model fit does not improve from previous models. The proportion of GP practices that are single-handed does not explain the variation in 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham between GP practices.

Quality of the GP practice may also be associated with increased 'potentially avoidable' emergency admissions for the older population and is measured in the *Quality of Outcomes Framework* data (QOF data) by GP practice. As explained in chapter 3, a number of domains make up QOF data, however as chapter 5 demonstrated, the domains are highly correlated. Therefore only QOF total points as a percentage of all points available is included in this chapter as this represents the overall performance of each GP practice. As figure 6.8 shows, QOF total points vary by GP practice.

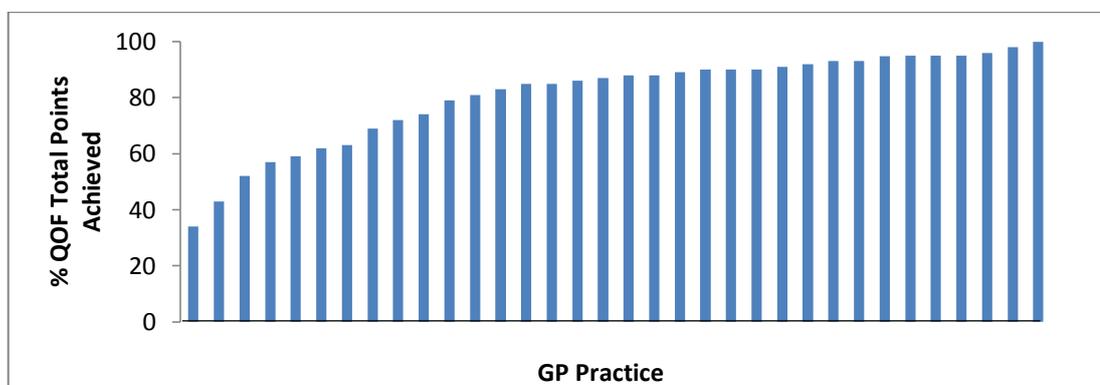


Figure 6.8: QOF Total Points as Percentage of Points Available by GP Practice (2005)

The percentage of QOF points achieved as a percentage of all points available varies by GP practices from as little as 34 per cent up to 100 per cent. This variation may be reflecting the quality of care for the older people of Barking & Dagenham and therefore may be associated with 'potentially avoidable' emergency admissions. Table 6.11 shows the association between QOF total points and 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham after controlling for the effects of age, sex and social fragmentation.

Fixed Effects	Model 12	
	Mean	St. Error
Avoidable Admissions - All		
Intercept	-4.595	0.076
Age 75-84	0.775	0.069
Age 85+	1.498	0.077
Female	-0.038	0.059
Social fragmentation - Individual level	0.089	0.034
GP practice mean social fragmentation	0.000	0.053
QOF total points	0.078	0.053
Random Effects		
GP Practice level variance	0.238	0.044
Model fit	12246	

Table 6.11: Multilevel Model Results for the Effects of the Percentage of QOF Total Points Achieved and Social Fragmentation on Individual 'Potentially Avoidable' Emergency Admissions for the Older Population of Barking & Dagenham

Model 12 introduces the proportion of total QOF points achieved. QOF total points show no significant association with 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham after controlling for the effects of social fragmentation. As previously, there is a significant positive effect of LSOA level social fragmentation, and no effect of GP practice level social fragmentation on 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham between GP practices.

Overall, none of the GP practice level variables are associated with variations in 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham between GP practices. The social fragmentation index of the LSOA the person lives in is strongly associated with variations in admission rates between GP practices. No information on *individual* health status is available. There is information from the 2001 Census on self-reported health status, but this is not available for individuals. Table 6.6 showed that ill health status and social fragmentation and deprivation are closely related and so there would be no benefit in examining the effects of LSOA level self-reported ill health on individual level admissions. However, information on whether or not individual older people in Barking & Dagenham receive homecare or meals on wheels services is available. The receipt of Social services help shows an increased need for care amongst certain individuals. Figure 6.9 shows the overall proportions of older people with 'potentially avoidable' emergency admissions and their homecare provision status for older people in Barking & Dagenham.

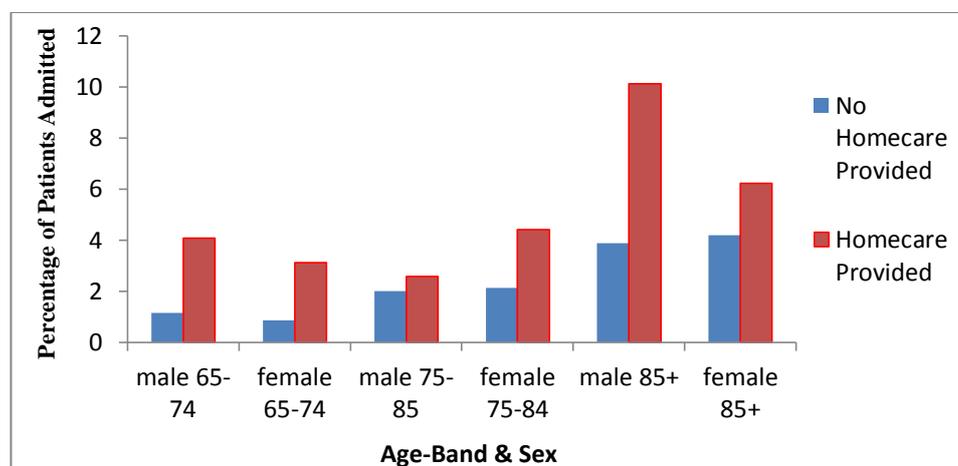


Figure 6.9: Percentage of Patients Admitted to Hospital for a 'Potentially Avoidable' Condition and if in Receipt of Homecare or Not by Age and Sex (2001/20-2004/05)

It is clear that a significantly higher percentage of the older population are admitted to hospital with a 'potentially avoidable' condition if they are in receipt of homecare. The percentage of people admitted significantly increases with age whether in receipt of homecare or not. However, the graph appears to show the increase in greater (although not significantly so) for people in receipt of homecare.

A similar picture is seen for those in receipt of meals on wheels (Figure 6.10).

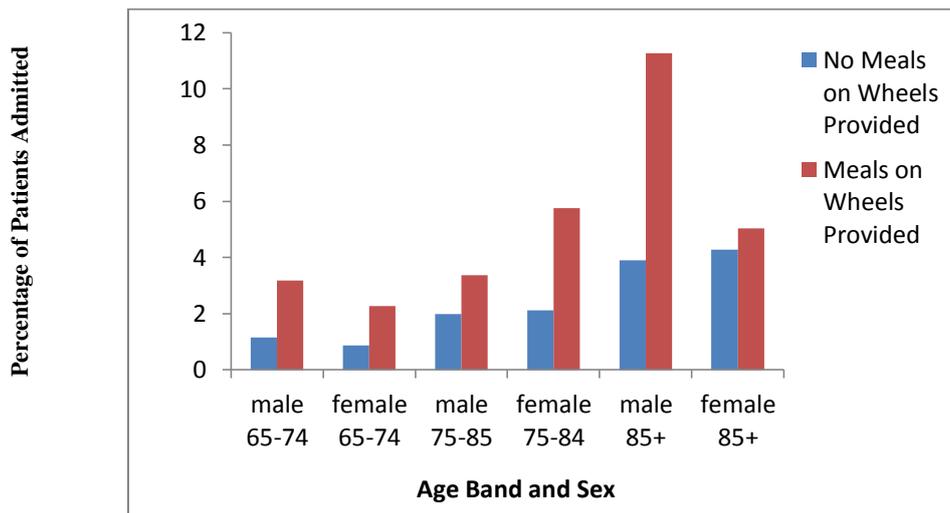


Figure 6.10: Percentage of Patients Admitted to Hospital for a 'Potentially Avoidable' Condition by Receipt of Meals on Wheels or Not by Age and Sex (2001/2002 – 2004/2005)

Whether receiving meals on wheels or not, the percentage of the older population admitted to hospital for 'potentially avoidable' conditions significantly increases with age. Older males (over age 85) have the highest percentage of admissions of all. However a higher percentage of patients in receipt of meals on wheels are admitted to hospital than for those not in receipt of homecare for each age-band and sex (although not significantly so for the lower age groups).

The final models (models 13 and 14) explore whether the receipt of homecare or meals on wheels for individuals and aggregated over GP practices is associated with variations in 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham between GP practices.

	Model 13 Homecare		Model 14 MOW	
admitted	Mean	St.Error	Mean	St.Error
Intercept	-4.770	0.170	-4.534	0.143
Age 75-84	0.760	0.069	0.764	0.069
Age 85+	1.457	0.078	1.474	0.078
Female	-0.052	0.059	-0.046	0.059
Individual Social Fragmentation Index	0.085	0.034	0.086	0.034
Proportion of GP practice patients receiving homecare	0.677	0.141		
Individual receiving homecare	0.111	0.094		
Proportion of GP practice patients receiving meals on wheels			0.652	0.162
Individual receiving meals on wheels			-0.048	0.098
Random Effects	Estimate	St.Error	Estimate	St.Error
GP Practice level variance	0.242	0.044	0.249	0.045
Model fit	12227		12235	

Table 6.12: Multilevel Model Results for the Effects of Homecare, Meals on Wheels and Social Fragmentation on Individual 'Potentially Avoidable' Emergency Admissions for the Older Population of Barking & Dagenham

Model 13 introduces the provision of homecare. The receipt of homecare by individuals has no significant effect on variations in 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham between practices. However, the proportion of patients in GP practices who are in receipt of homecare has a significant positive effect on variations in SARs between GP practices. The social fragmentation index of the LSOA the individual lives in also has a significant positive effect on SARs between GP practices. A 1 unit rise in the social fragmentation score of the individual increases the average admission ratio by 0.085, however, a 1 unit rise in the proportion of patients in the GP practice that are in receipt of homecare increases the average SAR by 0.667. There is also a

significant amount of residual variation between GP practices remaining and the model fit does not improve.

It would seem that homecare and meals on wheels may be a predictor of increased healthcare needs amongst the older population, as practices with more patients receiving homecare or meals on wheels are admitted to hospital more. However there is a lack of effect seen on the variation in SARs between practices with individual level homecare and meals on wheels. This is almost certainly due to the close association between social fragmentation and ill health. Because the actual socioeconomic status of each individual is unknown, the socioeconomic conditions (in this case the social fragmentation index) of the LSOA they live in has been used as a proxy; however individuals will not necessarily have the same socioeconomic status as the average across the LSOA they live in. When averaged over GP practices, there is the potential for more error to occur, as values that are already acting as proxies for the individuals' socioeconomic status are being averaged across practices. Whether an individual is in receipt of homecare or meals on wheels, or the proportion of patients in receipt of homecare or meals on wheels is far more accurate, as the information is exact to each individual in the GP practice. It is probable, therefore, that the receipt of homecare or meals on wheels is indicative of poor health amongst older frail individuals and therefore could be used as an indicator of increase risk of hospital admission.

Overall, the relative risk of being admitted to hospital as an emergency for a 'potentially avoidable' condition in Barking and Dagenham increases with age, however, the risk of being admitted is far greater where there are higher proportions of GP practice populations' in receipt of home care or meals on wheels or where the

individual lives in a more socially fragmented area. This suggests that 'potentially avoidable' emergency admissions for the older population of London are related to ill health in an ageing and increasing frail older population. This raises the question of whether 'potentially avoidable' emergency admissions for the older population are actually avoidable, or whether closer monitoring by GP practices and more help at home are required. Exploring the differences in *frequent* 'potentially avoidable' emergency admissions for the older population between GP practices may shed some light on this.

6.3.3 Frequent 'Potentially Avoidable' Emergency Admissions

The attributes of practices that were important for predicting risk of *any* 'potentially avoidable admission (homecare, meals on wheels and social fragmentation) were introduced into further models to see whether they were still apparent for *frequent* admissions. Figure 6.11 shows the trend in *frequent* 'potentially avoidable' emergency admissions per 1,000 older people by age and sex throughout the study period.

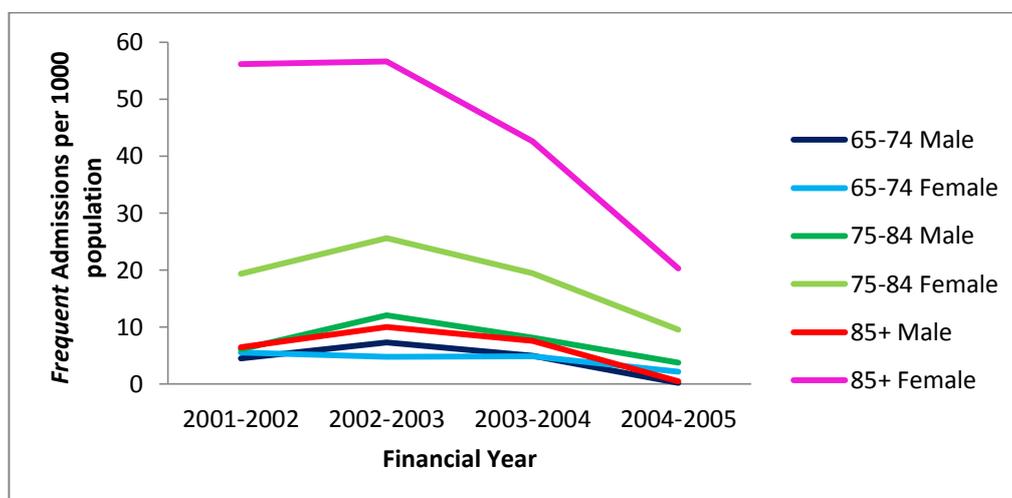


Figure 6.11: Frequent 'Potentially Avoidable' Emergency Admissions per 1000 Population by Age-Band, Sex and Year

Overall, across Barking & Dagenham *frequent* 'potentially avoidable' emergency admissions for the older population of London have reduced across all age bands (although the reduction is not significant for the 65-74 and 75-84 age band). The biggest reduction is for the over 85 age band, where *frequent* 'potentially avoidable' emergency admissions rates for both males and females significantly reduced over the years, and a dramatic decrease in admission rates for females in particular. Figure 6.12 explores this reduction by condition and year.

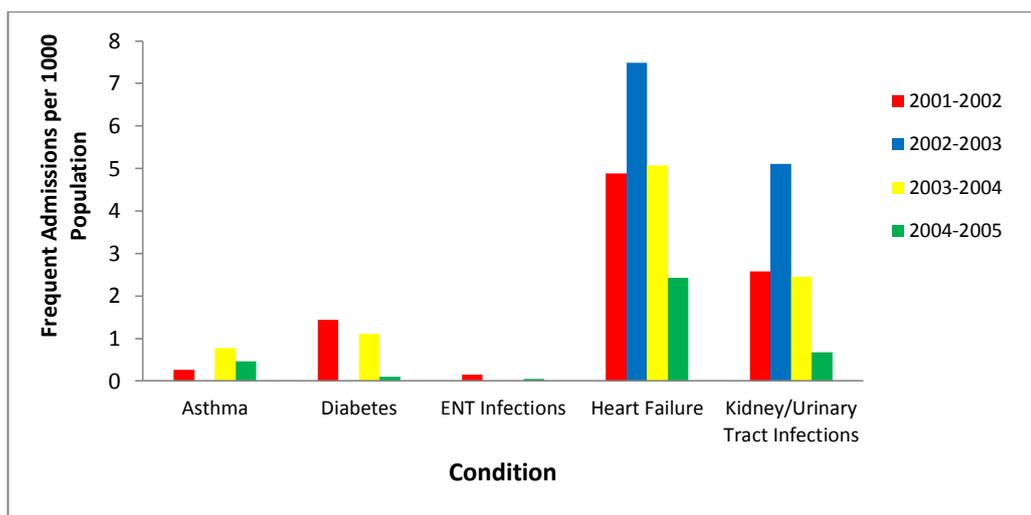


Figure 6.12: Frequent 'Potentially Avoidable' Emergency Admissions to Hospital for the Older Population of Barking & Dagenham by Condition and Financial Year

As will *all* 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham (Figure 6.3), heart failure and kidney/urinary tract infections make up the highest rates of *frequent* 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham. For these two conditions, admission rates significantly increased between 2001/02 and 2004/05, before decreasing significantly the following two years. There was no significant increase or decrease with asthma and ENT infections, where frequent admissions were much

fewer overall. *Frequent* admissions significantly reduced over time for diabetes, although numbers are lower overall.

Model 15 partitions the variance in *frequent* ‘potentially avoidable’ condition between GP practices. Models 16 and 17 then introduce the effects of the receipt of homecare and meals on wheels respectively. The results are shown in table 6.13.

Fixed Effects	Model 15 GP Practices		Model 16 Homecare		Model 17 MOW	
	Mean	St.Error	Mean	St.Error	Mean	St.Error
Frequent Avoidable admission						
Intercept	-0.798	0.215	-0.468	0.305	-0.298	0.248
Age 75-84	0.337	0.135	0.336	0.135	0.326	0.135
Age 85+	-0.151	0.155	-0.159	0.156	-0.145	0.155
Female	0.112	0.113	-0.089	0.114	-0.098	0.113
Average Practice Social Fragmentation Index			0.224	0.097	0.219	0.095
Proportion of GP practice patients receiving homecare			-0.080	0.164		
Individual receiving homecare			0.315	0.215		
Proportion of GP practice patients receiving meals on wheels					-0.229	0.163
Individual receiving meals on wheels					0.258	0.253
Random Effects	Estimate	St.Error	Estimate	St.Error	Estimate	St.Error
GP Practice level variance	0.395	0.097	0.171	0.080	0.375	0.095
Model fit	2055		2041		2040	

Table 6.13: Multilevel Model Results for the Effects of Homecare, Meals on Wheels and Social Fragmentation on Individual ‘Potentially Avoidable’ Emergency Admissions for the Older Population of Barking & Dagenham

Model 15 partitions the variance in 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham between GP practices and shows that a significant amount of the variance in *frequent* avoidable admissions is explained by differences between GP practices.

Model 16 introduces the effects of homecare provision for individuals and as an average proportion of patients in receipt of homecare across GP practices. There is no significant effect of whether an individual is in receipt of homecare or the

proportion of the GP practice population that is in receipt of homecare on SARs between GP practices. However there are still significant effects of individual level social fragmentation on SARs between practices; a 1 unit increase in the social fragmentation score of the individual raises SARs by 0.224. There is still a significant amount of residual variation, however this has reduced considerably. The model fit also shows some improvement.

The receipt of meals on wheels by individuals and averaged over GP practices has no significant effect on the variation in SARs between GP practices. However the individual level social fragmentation index continues to show a significant positive effect on variations in SARs between GP practices. Again there is a significant amount of residual variation, and this has increased considerably in comparison to model 16 (homecare).

Although homecare in itself was not associated with variations in *frequent* 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham either at an individual or by the proportion of the practice population that are in receipt of homecare, it does show a contrast to what is happening with *all* 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham, where a positive association was seen with the proportion of the GP practice receiving homecare. Therefore this lack of association with frequent admissions shows that homecare is having some effect in reducing 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham. However it is possible that some patients were at the end of life. The following section explores mortality rates for people admitted to hospital for 'potentially avoidable' conditions.

6.3.4 Mortality in 'potentially avoidable' emergency admissions

Death is an inevitable part of life, and is more assured the older a person is. Not all older patients admitted to hospital with 'potentially avoidable' conditions in Barking & Dagenham during the study period were discharged home; some of them died whilst in hospital. The percentage of patients admitted with a 'potentially avoidable' condition that died whilst admitted varied with age and whether they have multiple admissions (Table 6.14).

	65-74 Male	65-74 Female	75-84 Male	75-84 Female	85+ Male	85+ Female
% All Avoidable Admissions that Died	14	11	17	15	17	18
% Deaths that were Frequent Admissions	48	30	31	36	18	35

Table 6.14: Percentage of 'Potentially Avoidable' Emergency Admissions to Hospital for the Older Population of Barking & Dagenham that Died During Admission by Age-Band and Sex

A slightly lower percentage of older people die during admission for the younger age-bands than the oldest age-band. However on average over a third of the patients who die are patients who have had multiple admissions (although the relationship is not statistically significant, $p=0.129$). Death is considered premature if it occurs under the age of 75, and it is clear from the table that a relatively large proportion of *frequent* admissions for the under 75 age group die prematurely.

However, some 'potentially avoidable' conditions are more likely to end in death than others. This is particularly true for heart failure, which is a progressive condition that causes the heart to work less effectively. Although treatments for heart failure have enabled prognosis to be significantly extended, eventual death is

inevitable in many cases (Goldstein, 2004). Of those patients who died, there is variation in the percentage of deaths by age and condition (Table 6.25).

Condition	65-74 Male	65-74 Female	75-84 Male	75-84 Female	85+ Male	85+ Female
Asthma	0	0	4	0	5	0
Diabetes	0	4	8	6	0	8
ENT Infections	0	0	0	0	0	0
Heart Failure	100	83	76	70	64	52
Kidney/Urinary Tract Infections	0	13	12	24	32	40

Table 6.15: Percentage of Deaths by Condition Died of, Age and Sex for the Older Population of Barking & Dagenham

For the younger age-band (age 65-74) the highest percentages of deaths are for heart failure accounting for 100 per cent for males and 83 per cent for males. This high percentage of premature deaths in this age group is particularly worrying. Deaths from heart failure reduce with age, however this may be reflecting higher numbers of admissions as age increases. There are very few deaths from asthma and diabetes, particularly considering there are few admissions in these categories. There are no deaths for people admitted with ENT infections. However, the proportion of patients admitted with urinary tract/renal infections that die while in hospital increases with age. As infections are usually treatable if timely treatment is started, this is again worrying. Overall, it may again be that a proportion of ‘potentially avoidable’ admissions are in fact unavoidable.

6.4 CONCLUSION

This chapter has demonstrated that ‘potentially avoidable’ emergency admissions for the older population of Barking and Dagenham have decreased slightly (although not

significantly) over the period 2001 to 2005. However this decrease in admission is explained mostly by a decrease in *frequent* admission, and there is little decrease in the number of initial emergency hospital admissions for 'potentially avoidable' conditions. Admission rates increase with age, with little difference between males and females. Admission rates are highest for patients with heart failure and urinary tract/renal infections.

Social fragmentation, deprivation and long-term limiting illness were all associated with 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham, all of which are correlated; the former two most probably having a causal effect on ill health. The social fragmentation index includes variables that reflect deprivation and ill health, and as it had a marginally higher association with 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham than the other two variables, was used to represent all three.

Social fragmentation continued to dominate in explaining variations in *all* and *frequent* 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham between GP practices. GP practice factors (average number of patients per GP, average number of older patients per GP, percentage of GP practices that are single-handed and QOF total points achieved) showed no association with all or frequent 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham. However, the proportion of the GP practice population receipt of homecare (and meals on wheels) had a significant positive effect on variations in *all* SARs between GP practices, and homecare was shown to have a significant negative effect on variations in *frequent* SARs between GP practices. It is possible that individuals in receipt of homecare could make a good proxy for

individual health status where the individual health status of individuals is unknown. Although closely related to social fragmentation, whether a person receives homecare is exact to the individual rather than making inferences on their health status from the LSOA they live in.

A relatively high proportion of patients died whilst in hospital, and it is questionable whether these deaths were un-necessary. Certainly the high proportion of premature death (under age 75) for patients admitted with heart failure is particularly worrying. And it is noticeable that the proportion of deaths in hospital from heart failure reduces with age. However this is most probably reflecting the higher numbers of patients admitted as age increases. It is also possible that patients who are at the end of life with heart failure are not admitted to hospital to die, but die in their own homes or in hospices. However it is impossible to tell this from the HES data. However this is something worthy of further study and would be possible from the Office of National Statistics mortality data files.

It would seem that efforts by GP practices to reduce 'potentially avoidable' emergency admissions for this vulnerable population are effective to some degree, however these efforts may be being swamped due to the sheer frailty of this group of patients. This raises the question of whether, for some patients, admissions are unavoidable. Yet there has been a significant reduction in *frequent* 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham, suggesting that increased monitoring of patients, and help at home may be effective in reducing admissions. If future multiple admissions can be avoided, why are initial admissions not being? This may come down to the behaviour of individuals. Certainly the vast majority of admissions were via A&E rather than via the GP, so it

is possible patients are not seeking help early enough. However, the information provided in the HES database does not include whether patients visited their GP in the days prior to admission. Equally it is not known whether patients have problems accessing the services of their GP in the early stages of illness.

Overall, exploring 'potentially avoidable' emergency admissions for the older population at an individual level provides further information that is not available at a wider geographic scale.

CHAPTER 7 Conclusion

This thesis has explored variations in ‘potentially avoidable’ emergency admissions for the older population of London at a variety of geographic levels, examining the relationship with aspects of community and unpaid care that are rarely studied in conjunction with hospital admissions. The analysis reported above has made an original contribution to research in this field by making a detailed assessment of how ‘potentially avoidable admissions’ in London relate to a wide range of socio-demographic, socio-economic and health and social care variables. The analysis also has presented findings showing how very local and individual variability relates to conditions at the broader geographical scale of Primary Care Trust areas.

The study has raised questions about the ways that we theorise and operationalise the idea of a ‘potentially avoidable’ admission. Since socio-economic conditions seem in most of the models to be the dominant variables driving variation in admission of this type there is a real question over whether these are really ‘avoidable’, at least with current levels of health and social care provided across London. While there is some evidence from this research that levels of health care spending and health and social care provision relate to this type of hospitalisation, the general impression is that these are insufficient to prevent such hospitalisation.

This study has also demonstrated innovative methods for combining data at various scales to study this research question. New indicators of deprivation that are more specifically relevant to older people have been developed in this study and partly validated through the modelling carried out as useful ways to summarise local health and social care needs for this age group. The use of information at various scales

and the analysis of data on individuals, derived from different sources with inconsistent user identifiers also make an original contribution to this field of research.

Chapter 4 demonstrated that at the local geographical scale of wards the provision of unpaid care reflects increased need in the population, and higher amounts of unpaid care (over 50 hours a week) in particular were closely correlated with morbidity in the population. Even after controlling for the effects of deprivation, there continued to be a significant positive association between a measure likely to be reflecting a high demand for care (morbidity and over 50 hours of unpaid care) and *all* 'potentially avoidable' emergency admissions for the older population of London at ward level. Thus poor living conditions and health problems requiring significant support by informal carers are importantly associated with rates of potentially avoidable admission. However, a high demand for care showed no significant association with *frequent* 'potentially avoidable' emergency admissions for the older population of London after controlling for the effects of deprivation. This suggests that there are not particularly intense levels of demand for care that are distinguishing patients with frequent admissions from those with no avoidable admissions or only one. However, deprivation levels do seem more intense in small areas where frequent rates of potentially avoidable admission are more common, which suggests that poor living conditions are an important factor giving rise to repeated admission for the health problems of interest here.

Chapter 5 introduced information about service provision at the scale of PCTs, responsible for health service provision in administrative areas that group several wards together. These measures included the effects of PCT funding and services

provision and social services spending and provision of care for older people on variations in 'potentially avoidable' emergency admissions between PCTs using a multilevel approach. The association of social services care provision and hospital admissions is largely ignored in the literature, yet social care can be invaluable in helping the older person to remain in their own home and an integrated approach to care being advocated. It was found that higher levels of PCT funding and social services spending on older people (which use a resource allocation formula to try to redress inequalities in health care need) somewhat reduced the 'effects' of PCT level deprivation on 'potentially avoidable' emergency admissions for the older population of London. However, in spite of more generous funding in more deprived areas older people living in more deprived PCTs were more likely to be admitted to hospital. Also, within PCTs, older people living in more deprived wards compared to the average across the PCT were more likely to be admitted to hospital for a 'potentially avoidable' condition, and PCT funding or Social services spending did nothing to reduce these local inequalities.

The proportion of GP practices in PCTs that are single-handed also showed a significant positive relationship with variations in 'potentially avoidable' emergency admissions for the older population of London between PCTs, although there was a larger amount of residual variations within and between PCTs remaining than when PCT funding was included. Thus the association between the proportion of GP practices that are single-handed and 'potentially avoidable' emergency admissions for the older population of London may be reflecting variations of care within individual GP practices.

Quality of care (measured by QOF total points achieved), the numbers of patients per GP and the number of older patients per GP showed no association with 'potentially avoidable' emergency admissions for the older population of London. However, GP practices in less deprived PCTs tend to earn more QOF points, indicating that care is better on average in these areas. There are also more GPs per capita of the population in more deprived areas, reflecting greater need in more deprived areas. Therefore the lack of effect of the numbers of GPs per 1,000 population/older population on variations in 'potentially avoidable' emergency admissions for the older population between PCTs is likely to be reflecting the close association between numbers of GPs and deprivation. Help to live at home for older people and the provision of intensive homecare also had no significant effect on variations in 'potentially avoidable' emergency admissions for the older population of London between PCTs.

Overall deprivation was found to be predominant in explaining variations in 'potentially avoidable' emergency admissions for the older population of London between PCTs, and PCT funding and Social services spending on older people only partly attenuate the variation between PCTs associated with deprivation. Also it was still apparent that older people living in more deprived wards in more deprived PCTs were more likely to be admitted to hospital for a 'potentially avoidable' emergency admissions. The association between a high demand for care and 'potentially avoidable' emergency admissions for the older population of London seen at ward level in Chapter 4 was no longer apparent once service provision variables were included in the models. This may be reflecting the strong association between deprivation and ill health, with deprivation swamping the effects of ill health. However it is also possible that PCT/LA service provision is having some (modest)

effect in reducing differences between PCT level admission rates where there is greater ill health.

The study then continued by exploring the effects of PCT/LA level service provision on *frequent* 'potentially avoidable' emergency admissions for the older population of London between PCTs as compared with people with no more than one avoidable admission. Now it was seen that there was no association between PCT funding and frequent 'potentially avoidable' emergency admissions for the older population of London was seen directly, after controlling for the effects of deprivation within and between PCTs, however, there was a cross level effect on admission rates, showing higher levels of funding in more deprived PCTs may have some effect in reducing the level of avoidable admission. Although the effects of deprivation alone both within and between PCTs continued to be stronger, it does show that PCT funding helps to redress some of the inequalities in healthcare need amongst older people. Social services spending on older people showed no association with *frequent* 'potentially avoidable' emergency admissions for the older population of London; however it did significantly attenuate the effects of PCT level deprivation, reflecting higher social services spending in areas with particularly high levels of repeated admissions.

The study of individuals in Barking & Dagenham permitted a more detailed analysis of how individual experience of potentially avoidable admissions related to characteristics of general practices as well as other aspects of local conditions. These analyses showed that individual level admissions for 'potentially avoidable' conditions were remaining stable over time, however the proportion of admissions that were multiple admissions was reducing. It was therefore wondered whether

service provision by GP practices and Social services may account for some of those differences. The vast majority of patients were admitted to hospital directly through A&E rather than through their GP. However the data were not available on whether patients had visited their GP in the days before admission, whether they had been advised to go to A&E through another service, for example NHS Direct or whether it was personal choice.

The study of individual level 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham found no effect of GP practice characteristics (numbers of patients per GP, numbers of older patients per GP, whether the practice was single-handed and QOF points gained by the practice) on variations in admission rates between GP practices. Again socioeconomic conditions prevailed, this time measured as the social fragmentation score of the LSOA in which the individual lived. It was felt that this most probably acted as a proxy for the health status and living conditions of the individual. The receipt of homecare and meals on wheels was therefore explored. Now it was found that the receipt of homecare aggregated to the GP practice population had a significant positive relationship with admission rates at the level of GP practices. Individual level homecare was not associated with admission rates but this is possibly due to a close association with the social fragmentation index of the LSOA. However when the provision of homecare was analysed in relation to frequent 'potentially avoidable' emergency admissions for the older population of Barking & Dagenham, the practice level association with homecare was no longer seen. This suggested homecare is perhaps implemented after initial admission. However, it is also possible that closer

monitoring of individuals by GPs occurs post initial admission. Again though, it is possible that patients did not visit their GP prior to admission to hospital.

Overall it appears that individual level health care status of older person could be measured by whether they are in receipt of homecare. This would enable GPs to better identify patients at risk of admission to hospital. The close association between homecare and social fragmentation also shows that the socioeconomic status of the LSOA a person lives in makes a suitable proxy for individual level risk of 'avoidable' admissions . This justifies the use of local area socioeconomic conditions as measured here as a proxy for likely individual use of 'potentially avoidable' hospital care by older people, and perhaps for ill health more generally.

Future research could usefully explore in more detail the link between potentially avoidable admissions and subsequent mortality in this age group. Around a third of the older patients admitted to hospital for 'potentially avoidable' conditions between the years of 2001/2002 to 2004/2005 died during admission. It could be argued that for the very old (over 85) this is an inevitable consequence of ageing and as such it would be reasonable to omit this age-group from the classification of 'avoidable' admissions. However around a third of the age group 65-74 also died during admission and this could be classed a premature mortality. It would be interesting to compare these mortality rates with mortality in the general practice population overall. It would also be useful to study admission rates separately for the different age groups. Furthermore, it would be useful to extend this study to explore admissions for heart failure and urinary tract/renal infections separately as these were the two largest causes of admission.

There are a number of limitations with this study. Firstly and perhaps most importantly is how avoidable admissions are coded. Often patients have many ICD coded at any one time, representing comorbid conditions. This is particularly true of the older population. Yet avoidable admissions only use the primary diagnosis as an identifier, this could mean patients may be missed if their condition isn't put as the primary diagnosis.

A second problem with this study was using social services data. The data did have a lot of information attached yet it was recorded badly. Many of the records had missing postcodes or GP practice codes. One data set had to be returned as they had recorded the wrong postcodes for over half the data. The data also had multiple entries for some individuals, because for every service they received or every change in service, they had a new data entry added to the database. It was time consuming cleaning the data so it could be used for the analysis, and although some of the process could be automated, some of the data had to be cleaned by hand. It had been hoped to use some district nursing data but that data was unusable due to missing key fields in much of the data.

Working in a 'secure' environment to ensure confidentiality and using the four attributes of postcode, sex, age band and GP practice code has also proved a useful method for joining different data sets with no personal identification information attached or different identification coding systems used such as in this case with individual level social services homecare data and the GP practice population data set. However, although the matching process could be automated for the majority of the data matching process, some data did need examining by hand. It would therefore not be suitable for larger data sets. For smaller data sets it does make a

useful alternative to address matching, which again has specific problems when the same address may be recorded slightly differently, making an automatic match fail.

This study has also demonstrated that the older population need to be treated separately to the general population as they have specific healthcare needs. To this end a new social fragmentation index has been created to represent risk for the older population (based on Congdon's, 1996 work) and eliminates the need to use lots of correlated variables about living conditions.

This study has advanced knowledge about which factors are associated with 'potentially avoidable' emergency admissions for the older population. It has showed the resource allocation formulae, designed to reduce inequalities in healthcare provision and use by allocating funds in proportion to population needs, may have some effect in 'holding down' rates of admission for 'potentially avoidable' conditions. However this is apparently not sufficient to overcome deprivation and ill health factors which strongly associated with 'potentially avoidable' admissions independent of funding and quality of care indicators. Whether more funding would offset these inequalities further is unclear. It may be that within an increasingly ageing and aged population, admission to hospital, even for the conditions considered here, is unavoidable. It has also shown that within PCTs there are variations in admissions, and admission rates vary between individual GP practices; so more work may be needed in health and social care to ensure equity at the personal and small area level in health care outcomes.

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APPENDIX 1: VARIABLES INCLUDED IN THE VARIOUS DEPRIVATION SCORES

Jarman Index

Percentage of people in households who are over 65 and living alone (weighted at 6.62)

Percentage of people in households who are under 5 (weighted at 4.64)

Persons in households of one person over 16 with one or more children under 16 as a percentage of all persons in household (weighted at 3.01)

Persons in household headed by a person in socio-economic group 11 (unskilled workers) as a percentage of all residents in household (weighted at 3.74)

Economically active persons over 16 unemployed and seeking work (weighted at 3.34)

Persons in households with more than 1 person per room as a percentage of all residents in households (weighted at 2.88)

Persons aged 1 or over with a usual address one year before the census different from the present usual address as a percentage of total residents (weighted at 2.68)

People in households headed by a person born in the new commonwealth or Pakistan as a percentage of all residents in households (weighted at 2.50) (Jarman, 1983)

Townsend Material Deprivation Score

Economically active persons over 16 unemployed and seeking work

Percentage of households that are not owner occupied.

Percentage of households who do not own a car.

Persons in households with more than 1 person per room as a percentage of all residents in households. (Social Disadvantage Research Centre, 2003)

Index of Multiple Deprivation (Office of the Deputy Prime Minister, 2004)

Income Deprivation Domain (weighted at 22.5%)

Employment Deprivation Domain (weighted at 22.5%)

Health Deprivation and Disability Domain (weighted at 13.5%)

Education, Skills and Training Deprivation Domain (weighted at 13.5%)

Barriers to Housing and Services Domain (weighted at 9.3%)

Crime Domain (weighted at 9.3%)

The Living Environment Deprivation Domain (weighted at 9.3%).

Each of these domains use data from a variety of sources rather than from the census alone, as shown below:

Income (22.5%)

The income domain is a measure of people on low incomes. It includes counts of people in families who receive means tested benefits and is considered to be the most important domain. It includes information on:

“Adults in Income Support households (DSS) for 1998

Children in Income Support households (DSS) for 1998

Adults in Income base Job Seekers Allowance households (DSS) for 1998

Adults in Family Credit households (DSS) for 1999

Children in Family Credit households (DSS) for 1999

Adults in Disability Working Allowance households (DSS) for 1999

Children in Disability Working Allowance households (DSS) for 1999

Non-earning non-IS pensioner and disabled Council Tax Benefit recipients (DSS) for 1998 apportioned to electoral wards.” ((DETR, 2000, p7)

Adults and children were included separately so a separate Child Poverty Index could be published.

Employment (22.5%)

The employment domain is a measure of “those who want to work but are unable to do so through unemployment, sickness or disability” (DETR, 2000, p8). It includes information on:

“Unemployment claimant counts (JUVOS, ONS) average of May 1998, August 1998, November 1998 and February 1999

People out of work but in TEC delivered government supported training (DfEE)

People aged 18-24 on New Deal options (ES)

Incapacity benefit recipients aged 16-59 (DSS) for 1998

Severe Disablement Allowance claimants aged 16-59 (DSS) for 1999” (DETR, 2000, p8).

Health Deprivation and Disability (13.5%)

The health deprivation and disability domain “identifies people whose quality of life is impaired by either poor health or disability” (DETR, 2000, p8) It includes measures of:

“Comparative mortality ratios for men and women at ages under 65. District level figures for 1997 and 1998 applied to constituent electoral wards (ONS)

People receiving Attendance Allowance or Disability Living Allowance (DSS) in 1998 as a proportion of all people

Proportion of people of working age (16-59) receiving Incapacity Benefit or Severe Disablement Allowance (DSS) for 1998 and 1999 respectively

Age and sex standardizes ratio of limiting long-term illness (1991 Census)

Proportion of births by low weight (<2,500g) for 1993-97 (ONS)” (DETR, 2000, p8).

Education, Skills and Training (13.5%)

The education, skills and training domain uses lack of qualifications as a measure of deprivation ((DETR, 2000, p9). It includes measures of:

“Working age adults with no qualifications (3 years aggregated LFS data at district level, modelled to ward level) for 1995-1998)

Children aged 16 and over who are not in full-time education (Child Benefit data – DSS) for 1999

Proportions of 17-19 year old population who have not successfully applied for HE (UCAS data) for 1997 and 1998

KS2 primary school performance data (DfEE) for 1998

Primary school children with English as an additional language (DfEE) for 1998

Absenteeism at primary level (all absences, not just unauthorized) (DfEE) for 1998” (DETR, 2000, p9)

Barriers to Housing and Services (9.3%)

The housing domain is an indicator of people living in unsatisfactory housing or registered as homeless (DETR, 2000, p9). It includes measures of:

“Homeless households in temporary accommodation (local Authority HIP Returns) for 1997-98

Household overcrowding (1991 Census)

Poor private sector housing (modelled from 1996 English House Condition Survey and RESIDATA)” (DETR, 2000, p9)

Geographical Access to Services (10%)

The geographic access to services domain is access to services deemed essential to peoples everyday life. These include:

“Access to a post office (General Post Office Counters) for April 1998

Access to food shops (Data Consultancy) 1998

Access to a GP (NHS, BMA, Scottish Health Service) for October 1997

Access to a primary school (DfEE) for 1999” (DETR, 2000, p10)