Exploring the relationship between access to social care and healthcare utilisation by older adults

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Abstract

Poor access to social care for older adults is increasingly cited as a key factor driving healthcare demand, yet these claims are often made without evidence. This thesis explored the relationship between access to social care and healthcare utilisation by older adults. A lack of evidence about inequitable access to social care warranted a focus on the role of older adults' financial resources in this relationship.

Two systematic reviews examined evidence about the relationship between access to social care and healthcare utilisation by older adults. An analysis of cohort data from England (Newcastle 85+) explored the role of financial resources in this relationship. A critical scoping review of applying measures of socioeconomic status in older populations supplemented this work. Studies were carried out between 2016 and 2019.

Findings confirmed that greater access to social care was associated with lower healthcare utilisation. The findings from the main analysis also hinted that older adults' financial resources may, to a small degree, moderate this relationship. That is, healthcare use was lower for those with the most financial resources using community social care (coefficient= -0.12, CI:-1.50, 1.26) or living in a care home (coefficient= -1.08, CI:-3.69, 1.52), compared to non-social care users, adjusting for covariates. However, there was much statistical uncertainty in these estimates.

The relationship between access to social care and healthcare utilisation may be best understood as a reflection of the mechanisms of care (prevention and substitution), and the conditions of access imposed on each sector (e.g. universalism). These interpretations are located within a theoretical framework that builds upon Andersen's (1995) model of access to care. The challenges of measuring financial resources in older populations may partly account for why it appeared to exert only a modest influence on this relationship. Further research is needed to understand inequity at the interface between access to social care and healthcare utilisation by older adults.

Dedication

For my parents, who told us anything was possible.

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Contents

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Journal articles

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Awards

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Seminars

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Key study terms and definitions

** Study definitions are explained in detail in chapter 1.*

Term	Definition as used in this research
Older adults/populations	Those aged 60+ years, except when referring to the main analysis, which used a sample of those aged 85 years.
Social care	Services that support older adults to achieve outcomes relating to activities of daily living, as defined by the 2014 Care Act: nutrition, personal hygiene, toileting, dressing, using one's home safely, maintaining one's home, maintaining relationships, participating in work, training, education or volunteering, using community services and facilities, and carrying out responsibilities for a child. Social care refers to formal care (i.e. not unpaid or 'informal' care) and includes state-funded or self-funded care unless otherwise stated. Social care services include care homes with and without nursing, and community social care.
Care homes	Care homes refers to both care homes with onsite nursing (nursing homes) and without (residential care homes). Where necessary in the thesis, the type of care home (i.e. with or without onsite nursing) is specified.
Community social care	Social care services provided in the community to older adults, such as home care, day and night sitting, day centres, meals services. Where necessary in the thesis, the type of community social care is specified.
Healthcare	Services that meet needs relating to "the treatment, control or prevention of a disease, illness, injury or disability", as defined by the NHS Continuing Healthcare Framework (p.59).
Financial resources	An older adult's income (e.g. pensions) and capital (e.g. savings, owned homes, property), which may determine the extent to which care costs impose barriers to their access to social care, and which they can potentially use to fund social care.
Need	The capacity to benefit from (health and/or social) care.

Chapter 1: Introduction

1.1. Chapter overview

This thesis presents novel research about the relationship between access to social care and healthcare utilisation by older adults. In this chapter, the background, context and rationale for this research is described, followed by a statement of the aims and objectives. A theoretical framework within which this study is situated is discussed, and key study definitions set out.

1.2. Background

In the UK, both the National Health Service (NHS) and social care provision originated with the 1948 National Assistance Act, with healthcare free at the point of use and social care services subject to charges and means testing.[1] This distinction between free healthcare and means-tested social care has remained to this day. Victor (2012) summarises these differences as social care being "represented as an area of private personal responsibility in contrast to the more collective responsibility ascribed to medical care".[2 (p.153)] Financial, administrative, and professional boundaries between the two sectors have long been a source of debate around responsibilities for meeting social care needs. Indeed, these boundaries have shifted back and forth over time.[3] At present, the financial and administrative responsibility for social care for older adults mostly lies with local authorities in the adult social care sector (with some exceptions). However, professional boundaries remain variable with integrated working arrangements.[4]

Funding for the two sectors has followed different paths. Whilst the NHS has largely remained ring-fenced and funded from general taxation, the 1990 NHS & Community Care Act saw responsibility for adult social care transferred from central government to local authorities.[1] More recently, significant changes in funding have followed the measures implemented by the 2010 coalition government. A programme of spending cuts was implemented across public services; since 2010, adult social care funding has decreased by 2.2% per year.[5] Social care spend per head in England has fallen

from £345 in 2010/11 to £310 in 2016/17, which is 43% less than the spend per head in Scotland in 2016/17.[6]

The Better Care Fund was announced in 2013, aimed at encouraging efficiency and integration across health and social care.[7] However, some have observed that the timing of its implementation (2017-2019) would not adequately offset the cuts made to the sector in the interim.[8] As an additional measure, local authorities were given the option of raising council tax by 2%, increasing to 3% in 2017/2018 and 2018/2019, to generate further funds for adult social care services. This was discretionary and not all councils were obliged to raise council tax. Indeed, some chose not to do so.[9] Critics have argued that not only was this insufficient to fund the sector, but that it would increase inequality between areas. That is, more affluent councils would be able to raise greater funds compared to those in more economically deprived areas.[10,11] There is already geographical variation in council tax revenues for adult social care,[12] and this measure would, in theory, exacerbate this. Pressures to achieve cost savings within adult social care continue. For example, in the 2018 Association of Directors of Adult Social Care budget survey, 75% of directors reported that reducing the number of individuals receiving state-funded care was necessary to achieve savings.[13]

With such funding restrictions, the long-term sustainability and quality of the adult social care sector is a major policy and public concern.[14-18] The sector is often described as being in crisis (for example, see[9,19,20]). An investigation by The Observer newspaper in 2016 found that 77 of 152 local authorities in England reported at least one care home closure due to budget cuts.[21] Similarly, the 2016 and 2017/2018 State of Care reports described a sector characterised by a slow growth with the number of care home beds unable to meet demand, a proportion of services providing inadequate care, and a lack of profitability leading to a loss of services from the market.[18,22] Coverage is also subject to local influences, with geographical variations in funding, provision and demand for social care.[12,23-26] Furthermore, the sector has faced staffing shortages and high turnover rates,[27] exacerbated by insufficient funding, low pay, poor training opportunities and market instability.[13,28] Skills for Care argue that in order to meet the care needs of an ageing population, the UK social care workforce must grow by 18% by 2025.[29] Yet with the funding pressures faced by councils, adequate growth of the workforce seems unlikely.

At the same time that adult social care funding is decreasing, demand for social care is projected to rise with the growth of the older population. In the UK, people aged 65 years and over currently make up 17.8% of the population.[30] This is a population that has already grown by 47% between 1974 and 2014 and is projected to increase 20% by 2024.[31,32] This reflects a wider global trend in the growth of the over 60 population.[33] In terms of older adults requiring care to support their independence, it is estimated this population will grow by 61% between 2000 and 2051.[34] Access to a properly funded social care system is, therefore, critical.

However, access to social care in England is already compounded by structural barriers. First, access to *state-funded* social care is determined by the national eligibility criteria set out in the 2014 Care Act. These criteria ration care to people with an illness or disability who are unable to achieve two or more specified outcomes, resulting in "a significant impact on the adults' wellbeing".[35 (p.1)] People who do not meet these criteria may still have a need for support, but will not be entitled to state-funded social care. In theory, people with non-eligible social care needs should be signposted to other sources of support in the community.[36] However, the extent to which this signposting is sufficient to address such needs is unclear. Furthermore, Human Rights Watch have recently highlighted the inconsistent application of these needs criteria between local authorities.[37] This post-code lottery, they argue, is likely to hinder fair access to care and contribute to unmet need amongst older adults.[37]

For people whose needs *do* meet these criteria, means-tested financial contributions to care costs may pose further obstacles. This means-test assesses an individual's income and savings (for home care) and house value and other held assets (care home placement). Only people whose income and savings (for home care), and house value (care home placement) are below £14,250 (England) are not required to pay towards state-funded care.[38,39] People whose income and savings (for home care), and house value (care home placement) are between £14,250 and £23,250 will be required to contribute towards some of the care costs. People whose income and savings (for home care), and house value (care home placement) exceed £23,250 will be required to self-fund the entirety of their care. Given the average house price in England is £226,906,[40] these criteria effectively mean most owner-occupiers are eligible to pay for a care home placement.

Thus, not everyone with a perceived need for social care may be able to access state-funded social care. In the financial year 2015/2016, there were 1,811,000 new requests for short and long-term adult social care support in England. Of these, 57% resulted in no 'direct' support from councils.[41] Those unable to access state-funded social care may be forced to find other sources of support, such as informal care or services provided by the private sector. However, the private social care sector will inevitably favour the better off who can afford such care, imposing yet further barriers to access.

It is estimated that around one million older adults in England have an unmet need for social care, particularly amongst the oldest old and those who live alone.[15] Unmet need for social care also appears to be greater for the most disadvantaged. For example, The Health Foundation report that the gap between need for, and receipt of, care is 23% and 8% for those with the lowest and highest incomes respectively.[42] These eligibility and payment barriers, combined with the funding and workforce pressures faced by the sector, point to social care becoming increasingly inaccessible to older people who may require such care. This is perhaps most clearly demonstrated by evidence that the number of individuals receiving state-funded social care has fallen by 27% since 2005.[42]

1.3. The consequences of poor access to adult social care

The consequences of poor access to social care are likely to be wide ranging. Unmet need for support to maintain independence in older age will undermine quality of life, and lead to increased pressures on family members, particularly women, to provide unpaid care.[43,44] One consequence in particular has been subject to much media attention and public discourse in the UK: the claim that poor access to social care is increasing demand for, and pressures on, the health sector (for example, see[20,45-47]). Such arguments are typically framed in terms of how the 'crisis' in social care creates additional stress for the NHS, which is facing its own set of funding, workforce and demand pressures.[48-50] Claims that poor access to social care may impact the NHS are particularly significant amid policy efforts to contain avoidable use of health services.[51] Indeed, poor access to social care has the potential to affect the healthcare sector in two ways.

First, social care may prevent health deterioration by supporting older adults to carry out routine daily tasks. These sorts of activities, such as washing, dressing,

shopping for groceries and cooking meals, facilitate physical activity and social participation, which are critical for the maintenance of mental, cognitive and physical health.[52-54] The importance of being able to carry out these activities should not be understated. Take, for example, shopping for groceries and preparing and cooking meals. Shopping facilitates exercise and social contact,[55-58] whilst cooking and preparing meals supports nutrition,[55,59] social and recreational activity,[60] and quality of life.[55-57,61] Older people report that the sense of control and meaningful participation that comes from being able to carry out such activities is essential to their overall health and wellbeing.[62] Difficulties accessing social care to support these activities of daily living may thus lead to a deterioration in older people's health.[63-65] This is supported by evidence that social care expenditure is inversely associated with level of unmet need in older adults.[66] Deterioration in health from unmet social care needs may then create need and demand for health services.[12,64,65] Indeed, evidence supports a link between unmet need for assistance with activities of daily living and increased risk of hospital admissions.[64,67,68]

The second way poor access to social care may increase demand for healthcare is in the form of delayed discharges and transfers of care. A person is well enough to be discharged, either to a care home or their own home with support, but remains in hospital due to the unavailability of a social care package.[2,18,69] The National Audit Office estimates that 2.7 million hospital bed days between 2014 and 2015 were occupied by older adults unable to be discharged due to the poor availability of care home placements or home care packages, with a cost to the NHS of £820,000,000.[70] But the consequences are not simply cost-related: pro-longed stays in hospitals are detrimental to older adults' health and wellbeing.[71,72] Some studies have examined this hypothesis, showing evidence of a relationship between increased care home provision and reduced emergency admissions and delayed discharges.[69,73] Forder (2009)[74] frames this as a *substitution* effect.

Both of these scenarios, *prevention* and *substitution*, propose that greater access to social care may be associated with reduced use of health services. However, the relationship between the two sectors may be more nuanced, depending on the type of healthcare. For example, a key part of the social worker role is to advocate on behalf of the client and carer.[75,76] Thus, access to social care may also facilitate greater access to planned healthcare through advocacy and signposting. Use of planned healthcare may then reduce *unplanned* healthcare, such as emergency

hospital admissions.[77,78] The relationship between access to social care and healthcare utilisation may, therefore, reflect a number of possibilities.

Whilst the relationship between access to social care and healthcare utilisation by older adults has been subject to some investigation, there remains a lack of clarity about what any observable relationship demonstrates. This is a pressing issue, not only in the UK but also across the world. Many high income countries are contending with how to fund and organise social care to support their older populations.[79] Clear evidence about this relationship would have important policy implications for supporting the care needs of older adults and the allocation of resources across both health and social care. As a highly politicised topic, especially in the UK, it is critical that any concerns about the potential consequences of poor access to social care for the health sector are met with robust evidence. Thus, an in-depth exploration of the relationship between access to social care and healthcare utilisation by older adults is both valuable and overdue.

1.4. Study aims and objectives

The aim of my research is to address the question: *How does access to social care influence healthcare utilisation by older adults?* Two study objectives will guide the research protocol:

a. To present a clear synthesis of what is known and the key gaps in knowledge about the relationship between access to social care and healthcare utilisation by older adults;
b. To further explore the relationship between access to social care and healthcare utilisation by older adults through analysis of existing cohort data

Further objectives are detailed for each of the studies reported in this thesis and are described in the relevant chapters.

Inevitably, investigating the relationship between access to social care and healthcare utilisation by older adults presents a number of conceptual challenges. These include how best to define both social care and healthcare, where a distinction between the two can be drawn, and what is meant by '*access*'. In the following section, key study definitions applied to this research are set out, followed by a theoretical framework of access to social care.

1.5. Study definitions and theoretical framework

1.5.1. Older adults

There is no a single definition of what constitutes an 'older adult'. However, UK health and care policy for older adults implies that older age starts from 60 years onwards. For example, prescriptions and eye tests for older adults are free of charge from the age of 60, whilst vaccinations are free of charge from aged 65. Age UK typically adopts 65+ years to refer to older adults (for example, see[80,81]), whilst the World Health Organisation and the United Nations have considered those aged 60 years and over as constituting older populations.[33,82] In this research, older populations are considered to be people aged 60 years and over. The terms 'older adults' and 'older populations' are thus used to refer to this group unless otherwise stated, and with exception for the main analysis, which used a sample of those aged 85 years.

1.5.2. Defining social care, healthcare and the distinction between the two

The definition of social care has the potential for ambiguity, owing to between-country differences in terminology, as well as the existence of state and private forms of care, and the provision of care to populations of varying ages. In the research reported here, *social care* refers to services that respond to *social care needs*, which are defined as those set out in the NHS Continuing Care Framework and the 2014 Care Act.[83,84] That is, *social care needs* refer to difficulties achieving outcomes relating to: nutrition, personal hygiene, toileting, dressing, using one's home safely, maintaining one's home, maintaining relationships, participating in work, training, education or volunteering, using community services and facilities, and carrying out responsibilities for a child.[84] Thus, *social care* is defined as services that support older adults to achieve these outcomes.

In this thesis, *social care* refers to: services provided to those aged 60 years and over, formal services (i.e. paid-for care and *not* informal or unpaid care), both state-funded and private (voluntary and for-profit) services unless otherwise stated, and services aimed at supporting older adults in the long-term (i.e. not fixed term care, such as reablement). Social care services include care homes with and without onsite nursing, and community services, such as, but not limited to, home care, day centres and meals services. Care homes refer to care homes both with and without onsite nursing. Specific social care services (e.g. care homes with nursing, home

care) will be referred to where necessary in this thesis. Whilst the term *long-term care* is more commonly used in international contexts to refer to similar services, this term is avoided in this thesis for purposes of consistency and clarity.

Healthcare is defined based on the NHS Continuing Healthcare framework definition, where health services are those meeting needs relating to "the treatment, control or prevention of a disease, illness, injury or disability".[85 (p.50)] Healthcare includes primary (e.g. general practice, family physicians, district nursing) and secondary (e.g. hospital care) health services.

To answer the question posed for this research, it is necessary to impose a distinction between social care and healthcare. As noted earlier, the boundaries between healthcare and social care have been subject to much debate.[3] As such, there is no single correct way to divide the two sectors. For the purpose of this research, the distinction imposed is based on two factors. First, the distinction between social care and healthcare is made based on how needs for each type of care are defined in the NHS Continuing Healthcare Framework. That is, social care services are those meeting needs relating to activities of daily living, and health services are those meeting needs relating to "the treatment, control or prevention of a disease, illness, injury or disability".[85 (p.50)] The benefit of using this approach is that whilst it is based on the English model, the distinction reflects the different objectives of both healthcare and social care, which are applicable beyond the English context.

Second, the distinction between social care and healthcare made here is based on the conditions of universality and means-testing as applied to both sectors in England. That is, healthcare in England is universal and free at the point of use, whilst social care is means-tested. This is an important distinction for understanding the interface between the two sectors if, as set out earlier, barriers to accessing social care could lead to deterioration in health and a greater need for healthcare. That is, a free health sector may absorb the consequences of restricted access to social care.

This distinction treats the two sectors as separate, reflecting the key differences between the two outlined above. However, a strong drive to integrate both health and social care persists in UK policy and continues to develop in practice.[86] Different approaches to integrated working means there is no single definition of what this looks like but will involve joint input from both social care and healthcare.[86] Any

service that reflects some form of joint input from each sector represents a challenge for addressing the research question of this thesis. Thus, to isolate the influence of social care on healthcare utilisation, services that are integrated (i.e. where arrangements are in place to allow a service to be delivered with joint input from both health and social care professionals) are excluded from this research, unless the influence of the social care component can be isolated from the healthcare component. Whilst this exclusion is appropriate, the findings should be considered in light of the move towards greater integration of health and social care in the UK. These issues are discussed further in Chapter 6 (see also below).

Imposing a distinction between social care and healthcare also presents challenges with respect to certain types of care that may not fit exclusively within one or the other. Care homes with onsite nursing are a key example of where the boundaries between the two sectors distort. Care homes with *and* without nursing are typically classed as being part of the social care sector both in the UK and internationally. However, the provision of nursing care onsite means they also offer health-related support. In this research, care homes with nursing are classed as being within the social care sector because they are provided from this sector in the UK and are thus subject to the barriers outlined earlier.

Care home placements that are funded by NHS Continuing Healthcare represent a further conceptual challenge to the distinction made here between social care and healthcare. In this research, NHS Continuing Healthcare-funded care home placements are considered healthcare, rather than social care. This is because these placements are funded for those whose needs are primarily health-related and are not subject to the means-testing barriers of social care.[83]

Finally, fixed-term intermediate care interventions, which include reablement and crisis-response care delivered at home, in care homes or hospitals, are not included in the definition of social care as applied here. This is because these services are free (and are thus not subject to the means-testing barriers as that of longer-term social care), and include input from both health and social care.[87]

A summary of these definitions for each social care and healthcare as applied in this research is provided in Table 1.1.

Table 1.1 Summary of social care and healthcare as applied to this research

	Includes	Excludes
Social care *Services responding to 'social care needs' as defined by the NHS Continuing Care Framework and the 2014 Care Act.*[83,84]	• Services provided to those aged 60 years and over) • Formal services • State-funded and private (voluntary and for-profit) services (state-funded social care and private social care will be referred to specifically where necessary) • Services aimed at supporting older adults in the long-term • Care homes with and without onsite nursing, community services, such as, but not limited to, home care, day centres and meals services	• Informal care • Fixed-term intermediate care interventions • NHS Continuing Healthcare-funded care home placements
Healthcare *Services meeting needs relating to "the treatment, control or prevention of a disease, illness, injury or disability"*[85 (p.50)] *as set out in the NHS Continuing Care Framework.*	• Primary care (e.g. general practice, family physicians, district nursing) • Secondary care (e.g. hospital care)	
***Integrated health and social care** services will be excluded unless the influence of the social care can be isolated.*		

1.5.3. Social care and healthcare between countries

The boundaries between health and social care will also differ by country in terms of financial and professional structures and also models of welfare. A major challenge of undertaking research into health and social care is that these systems of care are not necessarily comparable. Even in the UK, the structures and processes of the two sectors differ markedly across the four devolved countries. For example, both are provided as separate sectors in England, Scotland and Wales, but as an integrated system in Northern Ireland. In England and Wales, social care often requires financial contributions from the individual, whereas social care is free for those over 65 years in Scotland, and those over 75 years receiving home care in Northern Ireland.[88,89] These between-country differences in the organisation of health and social care will inevitably present a challenge when dealing with international evidence on this topic.

Variations between countries in health and social care reflect differences in the degree of coverage and accessibility afforded by the model of welfare used. These between-country variations in structural arrangements for health and social care systems have implications for understanding the relationship between the two. In England, for example, state-funded social care is means-tested whilst private social care requires out of pocket payments. Thus, when access is restricted by these payment barriers, the demand may instead fall upon free, universal NHS healthcare. This premise may not hold true for systems where both sectors are means-tested or do not have universal coverage (for example, the USA), or where both sectors have universal coverage (for example, Sweden).[90] The type of health insurance used (i.e. public or private) is also important in considering the difference between countries, as this may influence access to care.[90,91]

Ultimately, this means that where the research draws upon international data, these between-country differences may influence the extent to which the research question can be answered. Further consideration of this and how it impacted the interpretation of the study findings is provided in Chapter 6.

1.5.4. Defining 'access' to social care

Access to social care is a key policy concern in many high income countries, but little attention has been given as to how best to define this. By contrast, theoretical

perspectives on access to healthcare are well developed. The most widely used and accepted models of access to healthcare are those of Andersen (1995)[92,93] and Gulliford and colleagues (2002, 2003).[94,95] This section appraises these models and considers how they can be applied to conceptualise access to social care for this research.

Andersen's (1995) model frames access as a multifaceted concept in which the use of healthcare and associated outcomes are shaped by environmental, population and behavioural factors.[92,93] Environmental factors comprise both the physical and political environment that may determine access to care. This includes health-related policies and the organisation of the care system. Population factors comprise predisposing demographic characteristics (e.g. sex, age, ethnicity), enabling resources (e.g. income) and need for care. Behavioural factors include attitudes, decisions and practices that shape the take up of services. Later iterations of this work emphasised the inter-connectedness of the model, with potential for ongoing feedback between each of these components and the outcomes of access to care.

Gulliford and colleagues (2002, 2003) build on Andersen's model, arguing that access to healthcare is comprised of both the *availability and supply* of care and of its eventual *utilisation*.[94,95] The availability and supply of health services as a domain of access reflects the potential and opportunity to use services, regardless of whether they are used or not. This is, therefore, the supply side of access.[96] Utilisation of care, by comparison, refers to the actual use of services, and may be compounded by the factors outlined in Andersen's model.[95]

Gulliford and colleagues (2002, 2003) go further, adding a third dimension of access to healthcare: equity. This reflects the financial and material barriers outlined in Andersen's model, and must relate to service availability or utilisation.[94,95] For example, past studies have examined equity of service use and health resource allocation.[96-98] Any consideration of equity of access to healthcare also requires a consideration of need.[96,97] Horizontal equity refers to equal access to care for those with equivalent needs. Vertical equity refers to proportionately equal access to care for those with differing needs. Gulliford and colleagues (2002) do not prioritise one particular approach but others note that horizontal equity is the more widely used of the two in empirical research.[96,97,99] This may reflect the difficulties in measuring

vertical equity, which requires a judgement about how access should proportionately differ for variations in need, and whether need is being met.[95]

The potential for *in*equitable access to healthcare may reflect marginalisation of certain groups based on factors such as age, gender, ethnicity, socioeconomic position, and geography.[100] This is not the same as health inequality, where differences in health status, rather than access to care, are observed among these groups.[101] Oliver (2004) argues that those marginalised by income and the ability to pay for care should be prioritised in policy debates on equitable access given that the principles of many healthcare systems are based on some form of 'social solidarity'.[100]

A fourth and final dimension of access concerns outcomes. Gulliford and colleagues (2002) refer to the *effectiveness and relevance of services* where it is proposed that access could be measured in terms of health status upon using healthcare. That is, if the healthcare use was timely, of good quality and effective, then this may result in favourable health outcomes, representing optimised access.[95] However, this presents the question of what should be considered 'favourable health outcomes'. Clinical improvement outcomes alone cannot be considered indicators of optimal access given that some populations will not seek curative healthcare. Similarly, outcomes of effective and relevant healthcare may not always relate to *health* status, with patient experience and satisfaction outcomes also relevant.[102,103]

Gulliford and colleagues (2003) argue that the *quality of services* is also a component of access, although this is not elaborated and nor is any indication given as to how this could be measured.[94] However, care quality is implicated in the process of achieving optimal health outcomes.[96] Therefore, despite its ambiguity as a concept, *quality of care* overlaps with the *effectiveness and relevance of services* as a dimension of access. The inherent difficulties of defining and measuring the concepts of 'effectiveness' and 'quality' are important limitations of this model of access to healthcare. However, this model benefits from offering a clear distinction between service availability and usage, and the incorporation of equity as a key dimension of access. Others have conceptualised access to healthcare in similar ways.[96,104]

The applications of the Gulliford (2002, 2003) model thus far have been health service related (e.g. [105,106-109]). Even so, the four domains of this model have some

resonance to understanding access to social care. For example, access to social care could easily be conceptualised in terms of its availability and supply, and its utilisation. Tangible measures of these include, for example, the number of care home beds per capita (availability and supply), or number of hours of home care used (utilisation). This research will, therefore, adopt these proposed dimensions of access and investigate how the *availability and supply*, and *utilisation* of social care influences healthcare utilisation by older adults.

Regarding equitable access, this domain has clear relevance to social care. This is because in many high-income countries, users are expected to contribute to the costs of care.[79] In England, state-funded social care is rationed by national criteria.[84] Those whose care needs do not meet this criteria will be required to fund their own care through the private social care market. Even if an individual is eligible for state-funded care, means-testing will require many older adults to contribute to part or all of the costs of care. Only those whose income and savings (home care), and house value (care home placement) are below £14,250 (England) are not required to pay towards state-funded care.[38,39] Data are not available to ascertain the number of older adults paying for community social care. However, recent estimates indicate that 39.6% and 47.6% of residents in care homes with and without nursing, respectively, self-fund their care places.[110]

Thus, the potential for inequitable access to social care stems from differences in the social care people receive because of what they can afford or are financially entitled. Ultimately, the requirement to pay for social care makes an older person's financial resources a potential barrier to access.[110] In this research, *financial resources* refer to income (from, for example, pensions) and capital (for example, savings, owned home and property) belonging to an older person that may determine the extent to which care costs impose barriers to their access to social care (through means-testing[38,39]), and which older adults could, potentially, draw upon to fund social care. *Financial resources* is a term that has been used previously to describe these types of resources in older populations,[111] and in the context of paying for social care.[112-114]

Whilst the requirement to pay for social care may create scope for inequitable access, the reality may be more nuanced. For example, the ability to pay for care does not necessarily translate to a willingness to pay for care. Resistance to self-funding later life care is well-documented.[115-120] Housing wealth may also incentivise use of community social care to avoid the use of this resource to fund care home

placements. Indeed, home ownership is associated with a lower risk of moving into a care home, and increased use of community and informal care, even after controlling for need and other factors.[121-124] Thus, when considering equitable access to social care in terms of potential payment barriers, it is important to recognise this is also compounded by attitudes and expectations about paying for care.

Area deprivation is also important in considering equitable access where this may influence local availability and supply of social care. In England, for example, there are geographical variations in local authority funding of adult social services.[12] More affluent local authorities are therefore potentially able to fund and provide more social care services than less affluent local authorities in economically deprived areas.[125]

Thus, in applying this domain to social care, equitable access refers to those with the same level of need being able to access the same social care regardless of an individual's ability to pay for such care (financial resources) or where they live (area level deprivation). This applies a horizontal approach to equitable access. To assess inequity in access to care, analyses must either examine outcomes in groups comparable in need, or standardise, or adjust for, need in the analysis.[97] Thus, in addition to framing access to social care in terms of the *availability and supply*, and *utilisation*, this research will also consider the third dimension, *equitable access*.

The final domain of access is that of the effectiveness, relevance and quality of care.[95] However, applying this domain to social care presents difficulties. In terms of *social care effectiveness*, this is complex to measure for three reasons. First, the possible outcomes of social care are wide-ranging. For example, the Adult Social Care Outcomes Framework (ASCOF) sets out eighteen *separate* outcomes of using social care in England.[126] Second, it must be questioned whether social care effectiveness outcomes can reliably say anything about access to social care alone. As Goddard and Smith (2001) argue, outcomes are not always determined solely by the use of care.[96] This is particularly relevant for social care outcomes, which have the potential to capture the influence of informal care alongside of that of formal care. Third, some outcomes of access to social care include reduced use of, and dependency on, healthcare.[126] Yet, this is the very premise being questioned in this research. To use this outcome as an indicator of the effectiveness of social care presents a circular argument that would be impossible to investigate. Given these

limitations, considering access in terms of social care effectiveness is not a feasible application of Gulliford and colleagues' (2002, 2003) model for this research.

Conceptualising access in terms of social care *quality* is equally challenging. This owes partly to multiple and conflicting definitions of care quality, and partly to its subjectivity as a concept.[127-129] There is no single definition of social care quality, and indicators of this are wide ranging. For example, weight loss/gain, presence of ulcers, catheter use, use of restraints and staff hours per person have all been used as indicators of care quality in care homes.[130-132] In applying this domain of access to social care, it is likely that many potential indicators will be used. The feasibility of using quality of social care as an indicator of access will be explored in the systematic reviews. Further detail of this is provided in Chapter 2.

Overall, whilst there are some limitations in applying the Gulliford model to social care, it offers a useful starting point in the absence of any other theoretical model on access to social care. Thus, as a preliminary framework to guide the systematic review, and on which to build for the main analysis, access to social care was defined using these four domains: *availability and supply, utilisation, equitable access*, and *quality*.[94,95] This offers a novel application of Gulliford and colleagues' (2002, 2003) model to the study of access to social care. Further detail of how these domains were operationalised in the research are detailed in the relevant chapters.

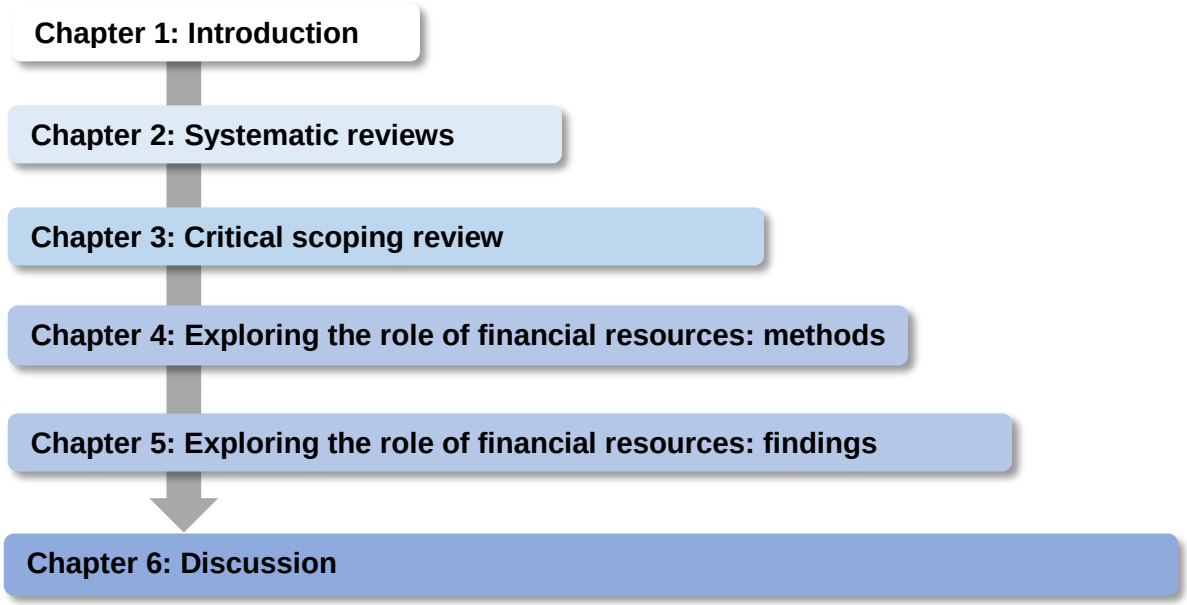
In the final section of this chapter, the studies comprising this research, and how these are reported across the remainder of this thesis, are summarised.

1.6. Research overview and thesis structure

A series of linked studies were conducted to address the aims and objectives of my research (see section 1.4). To achieve objective A, a series of systematic reviews were carried out, identifying what is known and highlighting key gaps in evidence. The methods and findings of these reviews are described in Chapter 2. To achieve objective B, an analysis of cohort data was conducted using the Newcastle 85+ study dataset. This analysis was informed by gaps identified in the systematic reviews and explored the role of older adults' financial resources in the relationship between their access to social care and healthcare utilisation. To supplement this analysis, a systematic critical scoping review was conducted to examine different approaches to measuring financial resources, and socioeconomic status more broadly, in older populations. Chapter 3 describes this critical scoping review, and Chapters 4 and 5

present the rationale, methods and findings of the analysis. Chapter 6 draws together the work presented in chapters 2-5 and details a critical discussion of the findings. A theoretical framework to understand these findings is also presented and considered. Chapter 6 then describes the strengths and limitations of this work, and implications for policy, before presenting a future research agenda. The structure of the thesis is summarised in Figure 1.1.

Figure 1.1. Structure of thesis



1.7. Chapter summary

Concerns about the consequences of poor access to social care amid increasing financial pressures in the NHS and growing demand for healthcare by an ageing population signify the need for clear and robust evidence. My research asks *how access to social care influences healthcare utilisation by older adults,* and seeks to answer this though a series of studies. This thesis sets out the methods and findings of this research, culminating in a critical discussion of the implications of this new evidence, the limitations of this work, and avenues for future research.

Chapter 2: Systematic Reviews

The content of this chapter has been published as: Spiers, G., Matthews, F.E., Moffatt, S., Barker, R., Jarvis, H., Stow, D., Kingston, A., Hanratty, B. (2018). Impact of social care supply on healthcare utilisation by older adults: A systematic review and meta-analysis. Age & Ageing, doi.org/10.1093/ageing/afy147; Spiers, G., Matthews, F.E., Moffatt, S., Barker, R., Jarvis, H., Stow, D., Kingston, A., Hanratty, B. Does older adults' use of social care influence their use of healthcare? A systematic review of international evidence. Health & Social Care in the Community (In Press); and, referred to in the following Editorial: Stott, D.J. (2019) Editor's View. Age & Ageing, doi.org/ 10.1093/ageing/afy187.

Contributions to the systematic reviews reported in this chapter include: Barbara Hanratty, Suzanne Moffatt, Robert Barker, Helen Jarvis and Daniel Stow contributed to record screening for study selection; Fiona Matthews contributed to data extraction and undertook the meta-analyses for the first systematic review. All remaining parts of the reviews in this chapter are my own work.

2.1. Chapter overview

Despite the common assertion that access to social care may reduce healthcare utilisation by older populations, the extent to which this is supported by evidence is unclear. As a starting point for this research, a series of systematic reviews were conducted to clarify what is known about this relationship. Evidence was mapped onto the four domains of access to social care outlined in Chapter 1: the *availability and supply* of social care, the *utilisation* of social care, *equitable* access to social care and the *quality* of social care. It was thus intended there would be separate evidence syntheses for each domain of access. This chapter presents the methods and findings of this work.

2.2. Review aims

The aims of these systematic reviews were:

1. To clarify the relationship between access to social care and healthcare utilisation by older adults
2. To identify key gaps in evidence about the relationship between access to social care and healthcare utilisation by older adults
3. To inform the development of study questions for the main analysis of this research

The review protocol was registered on PROSPERO (CRD42016050772).

2.3. Search strategy

A preliminary search strategy was developed based on keywords used in relevant papers identified during an initial scoping exercise. These were then piloted and refined, resulting in the following search strategy:

(1) "health services" OR "healthcare" OR "health care" OR "health services needs and demand" OR " "hospital care" OR "hospital use" OR "hospital discharge" OR "Primary care" OR "community health services" OR "emergency services" OR "general practice" OR "accessibility" OR "access" OR "utilisation" OR "utilization" visits" OR "frequency" **AND**

(2) "social care" OR "long-term care" OR "care home*" OR "Nursing home*" OR "Residential care" OR "Home care" OR "Homecare" OR "home nursing" OR "Home help" **AND**

(3) "Older adult*" OR "Older people" OR "Aged" OR "Elderly" OR "Frail elderly" OR "Geriatrics"

The terms were then adapted to the electronic databases searched, as some databases use controlled vocabularies. The searches were conducted in the following electronic databases:

- OVID Medline In Process, 1946-present, other non-indexed citations
- Embase 1974-present
- Scopus
- Health Management Information Consortium (HMIC) 1979-2016 September
- EBM Reviews: Cochrane Database of Systematic Reviews, NIHR Health Technology Assessment, NHS Economic Evaluation Database, Database of Abstracts of Reviews of Effectiveness
- SCIE Online

- ASSIA

Grey literature was accessed through HMIC and SCIE Online.

These searches resulted in a total of 11533 records. Table 2.1 details the number of records obtained from each database.

Table 2.1 Records obtained from each database

Database	Number of records obtained	Duplicates	Number of unique records	Number of accumulative unique records
Medline	5506	94	5412	5412
HMIC	1742	69	1673	7085
Embase	1922	235	1687	8772
EBM NHSEED	26	0	26	8798
EBM HTA	1	0	1	8799
EBM DSR, DARE	557	1	556	9355
ASSIA	1798	114	1684	11039
Scopus	574	95	479	11518
SCIE Online	19	4	15	11533

The table of contents of key journals (2016-2017), publications of authors known to have carried out work on this topic, reference lists of included studies, and references list of relevant systematic reviews, were also checked. No systematic reviews on the exact topic were identified, however, systematic reviews on similar topics were identified.[133-137] In April 2017 and May 2018, the searches were rerun to identify any further eligible studies that had been published in the period of undertaking the review.

2.4. Study criteria

The review criteria are detailed in Table 2.2. These criteria were tested independently by two researchers with approximately 10% of the records. Minor revisions were made to the criteria before proceeding with study selection. As described in Chapter 1, access to social care was defined using the four domains of Gulliford and colleagues' model (2002, 2003); a summary of how each domain was operationalised for the review is summarised in Table 2.3. Availability and supply refers to the opportunity to use care, and was thus operationalised as a measure of social care provision or expenditure relative to a measure of the population that might require access to it. For social care utilisation, studies must have examined a measure of usage (e.g. the amount of care used). For equitable access to social care, studies must have examined either: the relationship between social care funding source (state-funded or self-funded) and healthcare use; or, a measure of

financial resources or area deprivation and the role this played in the relationship between social care and healthcare utilisation. As described in Chapter 1, there is no single definition of social care quality. Indicators of social care quality were those described as such by authors of studies screened.

Studies of social care utilisation and equitable access that did not account for a measure of need in the study design or analysis were excluded. The concept of need is often defined as the capacity to benefit from care.[100] However, there is no consensus on how best to measure this.[96,100] In Goddard and Smith's (2001) review, studies measured need based on a number of assumptions, but no one approach offered a perfect solution.[96] For the purpose of this review, indicators of need that were considered relevant included: number of comorbidities, number of dependencies, measures of dependency, measures of difficulty with activities of daily living, measures of cognitive functioning or status, levels of care required, and severity of a particular condition (e.g. dementia). For ecological studies that looked at the number of social care users as the exposure, measures of area deprivation were considered indicators of need. A study was judged to have accounted for need if:

- The analysis controlled for one or more of the above indicators
- The analysis was stratified by one or more of the above indicators
- The study was carried out in a sample that was relatively homogenous in one or more of the above indicators
- The study was randomised (which minimises the influence of potential confounders) and the Risk of Bias assessment[138] indicated a low risk of bias regarding randomisation procedures.

Studies of integrated or combined health and social care services were excluded, unless the effect of the social care component could be isolated. Studies of fixed-term rehabilitation interventions, and interventions to reduce hospitalisations from nursing and care homes (e.g. changes to staffing models, influenza programmes, guidance and tools), were not included in this review. Originally, studies were included if published after 1990. However, during study selection, it was clear that many of the studies published between 1990 and 2000 used outdated data from the 1980s. To ensure the evidence reviewed was contemporary and relevant, the date of publication criterion was narrowed to studies published after 2000.

Table 2.2 Review criteria

Parameter	Inclusion criteria	Exclusion criteria
Population	Older adults aged 60+. If the study does not specify age range but states the population is 'elderly' or of 'older adults' and/or the sample mean age is above 80 years, then this should be included.	Those aged less than 60 years, unless the data are reported separately for those aged 60+.
Exposure: Access to social care	Social care: Any type of service for those aged 60+ that aims to enable independence with and support activities of daily living. This may include care homes (with and without nursing), or services provided in the community. The service may be publicly or privately provided. Studies of integrated forms of health and social care will only be included if it is possible to isolate the influence of the social care element. Access is defined as (as per the Gulliford (2002, 2003) model): • availability and supply of social care services • utilisation of social care services • quality of social care services • equity of access to social care services Social care measures can be continuous (e.g. spend) or categorical (e.g. type of social care service).	Studies that do not look at some form of variation in social care (e.g. if reporting only descriptive data about rates of healthcare use for a care home without assessing how that healthcare use differs according to variation or changes in the exposure) Studies examining the relationship between social care use and healthcare use but which do not control for need. Fixed term rehabilitation interventions.
Outcome: healthcare utilisation	Any type of health service (e.g. general practice, community nursing, hospital services, emergency services). Utilisation refers to actual use (e.g. admissions, number of GP contacts) and proxies for use (e.g. spend/costs). Delayed hospital discharge is included as an indicator of hospital use. Utilisation can be measured as continuous (e.g. spend) or categorical (e.g. high/low rates of emergency bed use).	
Study type/design	Studies investigating associations and/or predictions between variations in social care accessibility and healthcare utilisation.	Studies of interventions for social care users that are designed to influence healthcare use (e.g. nurse practitioner versus physician prescribing within care homes), unless the intervention is a variation in social care accessibility.

	Studies investigating the impact/influence of a variation in social care accessibility on healthcare utilisation. Study designs may be cohort, case control, or cross-sectional. Before and after studies if looking at healthcare utilisation before and after a change in social care accessibility. Analysis of secondary/administrative data. Studies using qualitative data will only be included if part of a mixed methods study where the primary aim is to investigate the influence of social care variation on healthcare utilisation, and where the qualitative data helps to explain the quantitative findings. Systematic reviews will be included only for reference checking and sourcing additional material.	News items, commentaries, policy guidance/briefings.
Country/ language	Any language. Studies from the OECD classification of high income countries: Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak, Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States	Studies from any country not listed across.
Date	2000 - present	
Publication type	Journal articles Grey literature	Books Conference abstracts where there is no corresponding full text publication.

Table 2.3 Application of the four domains of access to social care to the review

Availability and supply	A measure of social care provision (e.g. number of care homes and/or care home beds, the number of home care hours, and social care expenditure) relative to a measure of the population that might require access to it (e.g. per 1000 adults, per capita). As availability and supply refers to the opportunity to use social care, studies were excluded if they presented information solely from existing users of social care without any comparison group or other data from the source population.
Utilisation	A measure of usage (e.g. amount of social care used) or use of a comparator group (e.g. types of social care used, or use versus no use of social care). Amount of care used can be indicated by the number of units of care (e.g. days in care home, number of home care hours) or number of individuals using care. For ecological studies, measures must be relative to a measure of the population. Studies must adjust for need.
Equity of access	Measures of older adults' financial resources, or whether social care is paid for by the state or is paid for privately ('self-funders'). Studies must examine the role of these in the relationship between social care (availability, supply, utilisation) and HCU and adjust for a measure of need.
Quality	Measures of an indicator of quality of social care, defined as such by the study authors, and its influence on HCU.

2.5. Study selection

Titles and abstracts of all records were read to assess the potential relevance of the study. The study details were not masked at this point. Masking of study details is an additional measure to ensure objectivity of assessments by the researchers. However, it is recognised that the time and effort required for this may not necessarily offset the benefits.[138] Given the volume of records identified in this review, masking was not used. Joint screening of abstracts and titles was completed by two researchers for 50% of the records. Record screening was also assisted by an online

software tool (https://rayyan.qcri.org/), which identifies potentially relevant publications based on reviewers' screening decisions.[139] Where records were assessed by two researchers independently, decisions were compared and disagreements resolved through discussion and, if required, consensus with a third team member. The full texts were read and assessed for inclusion against the review criteria.

2.6. Quality assessment

Included studies were subject to a quality assessment using the National Institute of Health (NIH) Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies.[140] This tool was chosen for its useful summative judgement regarding overall study quality and potential biases. Quality assessments were recorded on an Excel spreadsheet. A summary of the quality assessments for each study is detailed in Appendix A.

2.7. Data extraction and synthesis

A narrative synthesis of the studies was used, which involved extracting study details and data onto an Excel® workbook, and the "systematic ordering and description of results".[141 (p.170)] Evidence was mapped onto the four access domains described by Gulliford and colleagues (2002, 2003),[94,95] with separate synthesis intended for each. Evidence was then synthesised by outcome. Where two or more studies included the same outcome and exposure measures, an estimate was calculated based on the data provided in the publication or by using standard statistical methods to calculate an error term. Random effects meta-analysis was used to generate a summary estimate and 95% confidence intervals.

2.8. Findings

Twenty-five studies reported across 28 papers met the inclusion criteria and were included in the review (Figure 2.1, Table 2.4 and Table 2.5). This chapter presents the results of the syntheses for each domain of access to social care. Some studies looked at healthcare utilisation outcomes according to more than one domain of social care access. Thus, the numbers of studies reporting evidence for each domain are not mutually exclusive:

- 12 studies (across 13 papers) reported evidence about the relationship between availability and supply of social care and healthcare utilisation outcomes;
- 13 studies (reported over 15 papers) reported evidence about the relationship between social care utilisation and healthcare utilisation outcomes;
- Studies of social care quality were omitted from this review (see section 2.14);
- One study reported evidence about the relationship between a measure of the equitable access to social care and healthcare utilisation outcomes.

Figure 2.1 PRISMA Flowchart

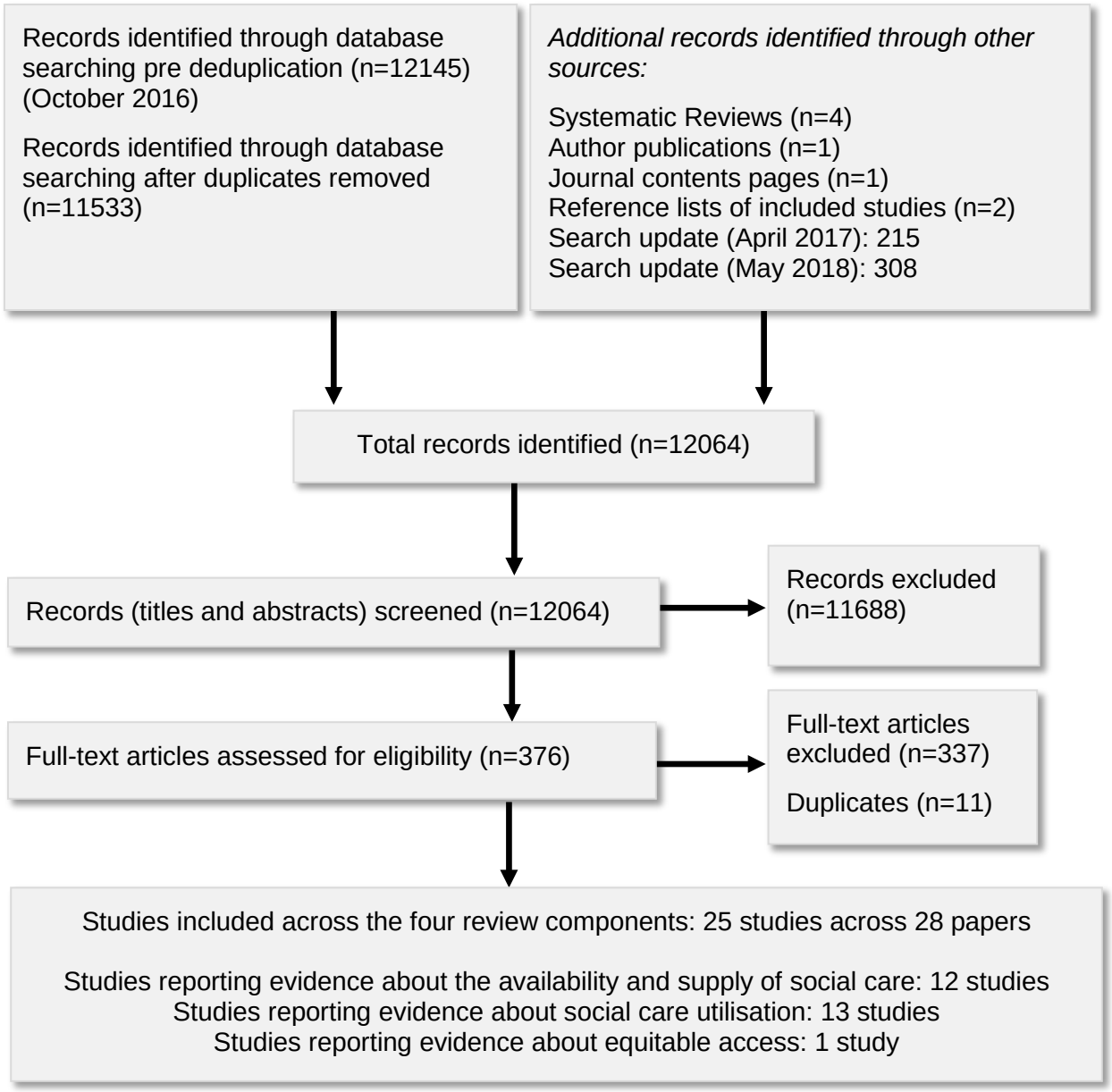


Table 2.4 Number of papers excluded by reason

Reason for exclusion	Number of papers
The paper did not report a study on the influence of social care accessibility on HCU outcomes	205
Only a conference abstract was available	23
The paper examined the influence of integrated or combined health and social care on HCU outcomes but it was not possible to isolate the effect of the social care component	24
The paper reported evidence about the relationship between social care utilisation and HCU but did not adequately adjust for need	24
The paper was a news item/commentary, review or otherwise did not report any data	18
The study sample included those aged less than 60 years of age, or was not specific to those aged over 60 years of age, or did not provide enough detail to ascertain this	17
The paper was published prior to 2000	14
The study took place in a country not listed in the review criteria	3
The study examined a measure of social care provision relative to a measure of population to determine availability and supply, but only for existing care home residents	2
The paper reported variations in social care but did not look at the HCU outcomes	2
The paper reported access to healthcare as an outcome but it was not clear if this was healthcare utilisation	2
It was not clear if the intervention reported was solely a social care intervention or if integrated	2
The study appeared relevant but only the methods were reported. A trial registration number was available, and two later publications from the completed study were retrieved. These, however, were not relevant and thus excluded.	1

Table 2.5 Summary of included studies

Author name and date	Country	Study design	Access to social care domain and measure	Healthcare utilisation outcomes	Sample size
Evidence synthesis 1: Availability and supply of social care					
Gaughan 2013[142]	UK (England)	Cross-sectional secondary analysis of administrative data	**Availability and supply** Care home beds within 10km of resident	LOS (number of days)	55,060
Gaughan 2014[143] (also reported in[144])	UK (England)	Cross-sectional secondary analysis of administrative data	**Availability and supply** Care home beds within the Local Authority (English administrative regional unit)	Delayed discharge (number of patients experiencing delays); Delayed discharge (number of days of delay)	Data from 147 local authorities in England during 2010 to 2013. Total sample size not reported.
Fernandez 2008[73]	UK (England)	Cross-sectional secondary analysis of administrative data	**Availability and supply** Care home beds per individual over 65; Hours of home care supported by the LA per individual over 65; Gross LA expenditure per individual aged 65+	Delayed discharge rates; (Emergency) readmission rates; Finished consultant episodes	Data from all 150 local authorities in England in 1998/99 and 1999/2000. Total sample size not reported.
Forder 2009[145]	UK (England)	Cross-sectional secondary analysis of administrative data	**Availability and supply** Local Authority (English administrative regional unit) spend on care homes per capita (£).	Hospital expenditure (£)	3 million hospital episodes in 2004/2005. Total sample size not reported.

Reeves 2004[146]	UK (England)	Cross-sectional secondary analysis of administrative data	**Availability and supply** Gross social services expenditure per capita (£); Gross social services expenditure on 'elderly' per capita 75+	Delayed discharge (rate per 1000 ≥75 population); Emergency admissions (rate per 1000 ≥75 population); Emergency admissions (rate per 1000 ≥75 population) controlling for material deprivation	Data from all Primary Care Groups/Trusts and Social Service Authorities in England in 2000. Total sample size not reported.
Imison 2012[147]	UK (England)	Cross-sectional secondary analysis of administrative data	**Availability and supply** Local authority spend on personal services per needs weighted populated over 65 years (£); Number of care home places per 1,000 needs–weighted population over 65;	Emergency bed days (needs-weighted emergency bed days per person over 65 per annum), split into: - PCTs with the highest emergency bed use - PCTs with the lowest emergency bed use - PCTS in urban areas with lowest emergency bed use - PCTs with the biggest reduction in emergency bed use	Data from 40 Primary Care Trusts in England in 2006/07 and 2009/10. Total sample size not reported.
Bardsley 2010[148]	UK (England)	Cross sectional analysis of administrative data	**Availability and supply** Social care costs band per year	Average hospital inpatient costs per year	16,479
Damiani 2009[149]	Italy	Cross-sectional secondary analysis of administrative data	**Availability and supply** Level of care home bed supply, categorised as the following groups: (1) High level of supply of care	Long stay discharge (%)	11,254,000

			home beds with low level of potential care needs; (2) Low level of supply of care home beds with high level of potential care needs; (3) Balanced level of supply of care home beds with potential care needs.		
Liotta 2012[150]	Italy	Cross-sectional secondary analysis of administrative data	**Availability and supply** Care home beds per 1000 population	Hospitalisation (rate per 1000 ≥65 inhabitants)	2,999,617 hospitalisations in 2006. Total sample size not reported.
Herrin 2015[151]	US	Cross sectional secondary analysis of administrative data	**Availability and supply** Care homes per 100km	30 day risk standardised hospital readmission rates	Data from 4,073 hospitals during 2007-2010. Total sample size not reported.
Hunold 2014[152]	US	Cross-sectional secondary analysis of administrative data	**Availability and supply** Care home beds per 100 older adult	Emergency department visits	640,086 emergency department visits in 2010. Total sample size not reported.
Holmås 2014[153]	Norway	Cross sectional secondary analysis of administrative data	**Availability and supply** Home care capacity (quantiles) based on proxy measure of usage/recipients per 80+ population Care home capacity (quantiles) based on proxy measure of	LOS (from emergency and planned admissions combined and each separately)	386,167 observations across variables. Total sample size not reported.

			usage/recipients per 80+ population		
Evidence synthesis 2: Utilisation of social care					
Reeves 2004[146]	UK (England)	Cross-sectional secondary analysis of administrative data	**Utilisation (amount)** Number of home help/care hours used per 1000 65+ Number of households receiving intense home help/care per 1000 65+ Number of people in care homes per 1000 65+	Delayed discharge (rate per 1000 ≥75 population); Emergency admissions (rate per 1000 ≥75 population); Emergency admissions (rate per 1000 ≥75 population) controlling for material deprivation	Data from all Primary Care Groups/Trusts and Social Service Authorities in England in 2000. Total sample size not reported.
Carter 2003[154] (also reported in[155,156])	US	Cross sectional secondary analysis of administrative data	**Utilisation (amount)** Duration of care home (with nursing) stay (years)	Hospitalisations; any + ambulatory care sensitive (ever having had a hospitalisation)	72,319 observations across 527 care homes. Total sample size not reported.
Amador 2014[157]	UK (England)	Longitudinal prospective cohort	**Utilisation (amount)** Length of stay in care home (without nursing) (years)	Emergency ambulance services	133 participants across 6 care homes
Hutt 2011[158]	US	Cross sectional secondary analysis of administrative data	**Utilisation (amount)** Number of care home (with nursing) days	Hospitalisation for residents with a single care home stay of <90 days Hospitalisation for residents with a single care home stay >180 days	187,408

Gruneir 2012[159]	Canada	Retrospective cohort study	**Utilisation (amount)** Care home length of stay, categorised as: newly admitted (length of stay at baseline <30 days); shorter stay (length of stay at baseline between 31 and 90 days); longer stay (length of stay at baseline > 90 days)	Emergency department presentation	64,589
Deraas 2011[160]	Norway	Cross-sectional secondary analysis of administrative data	**Utilisation (amount)** Number of recipients of care (both at home and in institution) per 1000 inhabitants, split into six percentile groups: Percentile 1 represented the lowest 17% and percentile 6 the highest 17% of the within each age group.	Hospitalisation rates	605,676
Bardsley 2012[161]	UK (England)	Cross sectional secondary analysis of administrative data	**Utilisation (type of social care)** High level of care home use (> 28 days, £5000+ per annum), high level of home care use (£5000+ per annum), medium (£1000-5000 per annum), low (under £1000). (*NB. It is not clear if the low and medium groups included both home care and care home users*).	Inpatient admissions Emergency admissions Elective admissions A&E visits Outpatient attendances Day case attendances	133,055
Hollander 2007[162]	Canada	Secondary analysis of data from a longitudinal database, retrospective cohort longitudinal	**Utilisation (type of social care)** Comparing care (of varying levels) delivered at home and care homes without nursing	Average annual acute hospital days and costs	7817 in 1987/88, 9023 in 1990/91, 9344 in 1993/94
Chappell 2004[163]	Canada	Cross sectional survey study	**Utilisation (types of social care)**	Hospital and physician costs	580

			Comparing those receiving care at home and in care homes without nursing		
Sloane 2005[164]	US	Longitudinal cohort study	**Utilisation (types of social care)** Comparing those living in care homes with and without nursing	Hospitalisation	1,272
Wysocki 2014[165]	US	Retrospective matched cohort study	**Utilisation (comparing social care with no social care)** Comparing those who stay or leave a care home with nursing	Ambulatory care sensitive hospitalisations	2338
Victor 2000[166]	UK (England)	Cross sectional case note review	**Utilisation (comparing social care with no social care)** Receipt of care home placement after hospital discharge or not; Receipt of community based social services after hospital discharge or not	Delayed discharge	456
Blackburn 2016[167]	US	Matched retrospective cohort study	**Utilisation (comparing social care with no social care)** Care homes (with nursing) compared to usual care (those receiving home health care)	Number of hospital stays LOS Number of emergency department visits	1,291
Evidence synthesis 3: Equitable access to social care					
Intrator 2004[168]	US	Cross sectional secondary analysis of administrative data	**Equity** Whether a care home with nursing has >35% residents who are self-payers	Ambulatory and non-ambulatory sensitive hospitalisations	54, 631

2.9. Availability and supply of social care

Twelve studies (13 publications) reported evidence on the influence of the availability and supply of social care on healthcare utilisation outcomes.[73,142,143,145-153] All studies used a cross-sectional design and presented analyses of administrative data. Seven studies were carried out in England,[73,142,143,145-148] two each in Italy[149,150] and the US,[151,152] and one in Norway.[153] Reported outcomes included delayed hospital discharge,[73,143,146,147,149] length of hospital stay (LOS),[142,153] hospitalisation,[150] emergency admissions, readmissions and emergency service use,[73,146,147,151,152] and healthcare expenditure.[145,148] Seven studies were rated good,[73,142,143,145,146,151,152] one was rated fair,[153] and four studies were rated poor.[147-150] Ten studies were re-analysed to provide estimates and confidence intervals, and were eligible for meta-analysis (Table 2.6).[73,142,143,145,147,148,150-153] Two studies reported data that could not be combined: these are reported separately (Table 2.7).[146,149] Three of the four studies that were rated poor in quality were re-analysed from the published results and included in the meta-analysis where data were available for pooling.[147,148,150]

Table 2.6 Key data from studies reporting evidence about the availability and supply of social care (re-analysed)

Study	Year	Social care exposure[1]	Type of social care exposure[2]	Predictor[3]	Predictor definition	Outcome[4]	Type of admissions[5]	Outcome definition	Estimate	95% CI Low	95% CI High	SE
Fernandez	2008	Care	Availability	Beds	Per 1% beds per population	Admissions	Emergency	% of discharges that become admissions	-1.373	-2.244	-0.502	0.444
Herrin	2015	Care	Availability	Beds	Per 1% beds per population	Admissions	Emergency	% of discharges that become admissions	-0.486	-0.703	-0.270	0.068
Imison	2012	Care	Availability	Beds	Per 1% beds per population	Admissions	Emergency	% of discharges that become admissions	0.069	-1.003	1.141	0.547
Imison	2012	Care	Availability	Beds	Per 1% beds per population	Length of stay	Emergency	Length of stay (days)	-0.063	-0.678	0.551	0.314
Gaughan Hip	2013	Care	Availability	Beds	Per 1% beds per population	Length of stay	All	Length of stay (days)	-0.129	-0.203	-0.056	0.023
Gaughan Stroke	2013	Care	Availability	Beds	Per 1% beds per population	Length of stay	All	Length of stay (days)	-0.077	-0.150	-0.004	0.023
Holmas	2013	Care	Availability	Beds	Per share % of 80+	Length of stay	Emergency	Length of stay (days)	-0.002	-0.012	0.007	0.005
Holmas	2013	Care	Availability	Beds	Per share % of 80+	Length of stay	All	Length of stay (days)	-0.003	-0.008	0.002	0.002
Holmas	2013	Care	Availability	Usage	Per % who are not discharged home	Length of stay	Emergency	Length of stay (days)	1.713	1.622	1.804	0.046
Imison	2012	Care	Availability	Beds	Per % who are not discharged home	Length of stay	Emergency	Length of stay (days)	0.020	-0.283	0.322	0.154
Holmas	2013	Care	Availability	Usage	Per % who are not discharged home	Length of stay	All	Length of stay (days)	1.283	1.221	1.346	0.032
Fernandez	2008	Care	Availability	Beds	Per 1% beds per population	Delayed discharge	Emergency	% of discharges that are delayed	-0.292	-0.477	-0.107	0.094
Gaughan	2015	Care	Availability	Beds	Per 1% beds per population	Delayed discharge	Emergency	% of discharges that are delayed	-0.578	-1.048	-0.108	0.240
Gaughan	2015	Care	Availability	Beds	Per 1% beds per population	Length of delay	Emergency	Length of delay (days)	-0.784	-1.409	-0.159	0.319
Imison	2012	Care	Availability	Beds	Per 1% beds per population	Length of delay	Emergency	Length of delay (days)	-1.595	-4.856	1.667	1.664
Hunold	2014	Care	Availability	Beds	Per 1% beds per population	Visits	Emergency	Visits to emergency departments	0.830	0.304	1.356	0.269
Fernandez	2008	Care	Spend	Spend	Per £1 spent	Admissions	Emergency	% of discharges that become admissions	-0.009	-0.015	-0.003	0.003
Imison	2012	Care	Spend	Spend	Per £1 spent	Admissions	Emergency	% of discharges that become admissions	0.002	-0.001	0.005	0.002
Imison	2012	Care	Spend	Spend	Per £1 spent	Length of stay	Emergency	Length of stay (days)	-0.002	-0.004	0.000	0.001
Fernandez	2008	Care	Spend	Spend	Per £1 spent	Delayed discharge	Emergency	% of discharges that are delayed	-0.123	-0.201	-0.045	0.040
Bardsley	2010	Care	Spend	Spend	Per £1 spent	Hospital spend	All	Hospital Spend £1 per year	-0.396	-0.523	-0.269	0.060
Forder	2009	Care	Spend	Spend	Per £1 spent	Hospital spend	All	Hospital Spend £1 per year	-0.330	-0.410	-0.250	0.041

Study	Year	Social care exposure[1]	Type of social care exposure[2]	Predictor[3]	Predictor definition	Outcome[4]	Type of admissions[5]	Outcome definition	Estimate	95% CI Low	95% CI High	SE
Gaughan Hip	2013	Care	Cost	Cost	Per £1 cost	Length of stay	All	Length of stay (days)	0.001	0.000	0.002	0.000
Gaughan Stroke	2013	Care	Cost	Cost	Per £1 cost	Length of stay	All	Length of stay (days)	0.000	-0.001	0.000	0.000
Gaughan	2015	Care	Cost	Cost	Per 1% increase in price	Delayed discharge	Emergency	% of discharges that are delayed	0.603	-0.566	1.772	0.596
Gaughan	2015	Care	Cost	Cost	Per 1% increase in price	Length of delay	Emergency	% of discharges that are delayed	0.851	0.136	1.566	0.365
Liotta	2012	Home	Availability	Percent	Per 1% increase in home care	Admissions	All	% of hospital admissions	0.846	0.020	1.672	0.390
Fernandez	2008	Home	Availability	Hours	Per 1 hour increase in homecare	Admissions	Emergency	% of discharges that become admissions	-0.800	-2.313	0.713	0.772
Holmas	2013	Home	Availability	Percent	Per 1% increase in home care	Length of stay	Emergency	Length of stay (days)	-0.001	0.000	0.000	0.000
Holmas	2013	Home	Availability	Percent	Per 1% increase in home care	Length of stay	All	Length of stay (days)	0.002	0.000	0.001	0.000
Liotta	2012	Home	Availability	Percent	Per 1% increase in home care	Length of stay	All	Length of stay (days)	0.922	0.976	1.008	1.008
Fernandez	2008	Home	Availability	Hours	Per 1 hour increase in homecare	Delayed discharge	Emergency	% of discharges that are delayed	-0.050	-0.166	0.066	0.059

[1] Social care exposure: Impact of care home (care) or impact of home care (home); [2] Type of social care exposure: social care availability, costs or spend; [3] Predictor: Summary type of predictor; [4] Outcome: Summary description of the type of healthcare use outcome; [5] Type of admissions: type of admission accounting for healthcare use outcome;

Table 2.7 Key data from studies reporting evidence about the availability and supply of social care not eligible for pooled analysis

Study	Exposure (social care use)	Outcome (healthcare use)	Estimate	P, CI	Direction of evidence[a]	Quality rating
Damiani 2009[149]	Level of care home bed supply	Long-stay discharges in residence region by group (index ratio)	High level of supply of care home beds with low level of potential care needs: 125.0 Low level of supply of care home beds with high level of potential care needs: 72.3 Balanced level of supply of care home beds with potential care needs): 97.6	p<0.001	Positive	Poor
		Long-stay discharges in region different from residence by group (index ratio)	High level of supply of care home beds with low level of potential care needs: 76.6 Low level of supply of care home beds with high level of potential care needs: 125.2 Balanced level of supply of b care home beds with potential care needs: 103.2	p=0.010	Positive	
Reeves 2004[146]	Gross social services expenditure per capita	Delayed discharge	r= -0.01	None reported	Inverse	Good
	Gross social services expenditure on 'elderly' per capita 75+	Delayed discharge	r= -0.02	None reported	Inverse	
	Gross social services expenditure per capita	Emergency admissions	Partial r controlling for material deprivation: r= 0.06	None reported	Positive	
	Gross social services expenditure on 'elderly' per capita 75+	Emergency admissions	Partial r controlling for material deprivation: r= 0.17	None reported	Positive	

[a] Inverse relationship (greater social care availability and supply associated with reduced healthcare utilisation, or reduced/lower social care use associated with greater healthcare utilisation); positive relationship (greater social care availability and supply associated with increased healthcare utilisation); No statistically significant relationship

2.9.1. Delayed hospital discharge

Four UK studies examined availability and supply in relation to delayed hospital discharge.[73,143,146,147] Greater availability of care home beds was associated with reductions in: rates of delayed discharges and the number of days of delay (Figures 2.2 and 2.3).[73,144,147] There was no strong evidence to associate the availability of *home care* with reductions in delayed discharges (Figure 2.2).[73]

In two studies where data could not be pooled, there was also evidence that greater social care expenditure was associated with reductions in delayed discharges.[73,146]

2.9.2. Length of hospital stay

Four studies examined LOS.[142,147,150,153] Greater availability of care home beds was associated with shorter LOS (Figure 2.4).[142,147] Care home prices were not associated with LOS.[142] LOS did not differ according to care home capacity.[153] There was mixed evidence about the association between home care and LOS.[150,153]

2.9.3. Healthcare expenditure

Two studies investigated the relationship between social care expenditure and healthcare expenditure.[145,148] Both provide evidence of a reduction in healthcare spend per £1 of social care expenditure (Figure 2.5).

2.9.4. Readmissions, emergency readmissions and emergency department visits

Emergency admissions and readmissions, emergency department visits and emergency bed use were investigated in five studies.[73,146,147,151,152] Three of these studies reported data available for pooling.[73,147,151] Greater availability of care homes was associated with a reduction in rates of emergency readmissions and admissions (Figure 2.6).[73,147,151] Greater availability of care home beds was associated with a minor increase in number of emergency department visits in one US study that could not be pooled.[152] Inconsistent evidence was observed regarding the impact of social care expenditure on readmissions: one study with a low quality rating failed to find any clear association, but another good quality study demonstrated a clear effect (Figure 2.7).[73,147] In one study that could not be combined with others, there was a weak positive relationship between social care expenditure and emergency

admissions, after adjusting for material deprivation.[146] There was evidence of a weak reduction in emergency readmissions in relation to hours of home care (Figure 2.6).[73]

2.9.5. Summary: the influence of availability and supply of social care

Twelve studies reported evidence about the influence of social care availability and supply on a range of healthcare utilisation outcomes. Four key points can be drawn from this evidence. First, evidence was weighted towards an inverse relationship between the availability and supply of social care (measured either as care home availability or social care expenditure) and secondary healthcare use. Second, the majority of studies were carried out in England, and when considering only these studies, the weight of evidence towards an inverse relationship was especially notable. This lends support to the hypothesis that in the context of England, greater availability and supply of social care is associated with reduced healthcare use (and vice versa). Third, smaller associations were observed for home care compared to care homes, indicating the latter may have more influence on healthcare utilisation outcomes. This is an important distinction and any future analysis should consider home care separately to care homes. Finally, the evidence reflected secondary healthcare outcomes, with clear gaps regarding primary care use outcomes.

Figure 2.2 Impact of availability of care home beds (care) and home care (home) on delayed discharge

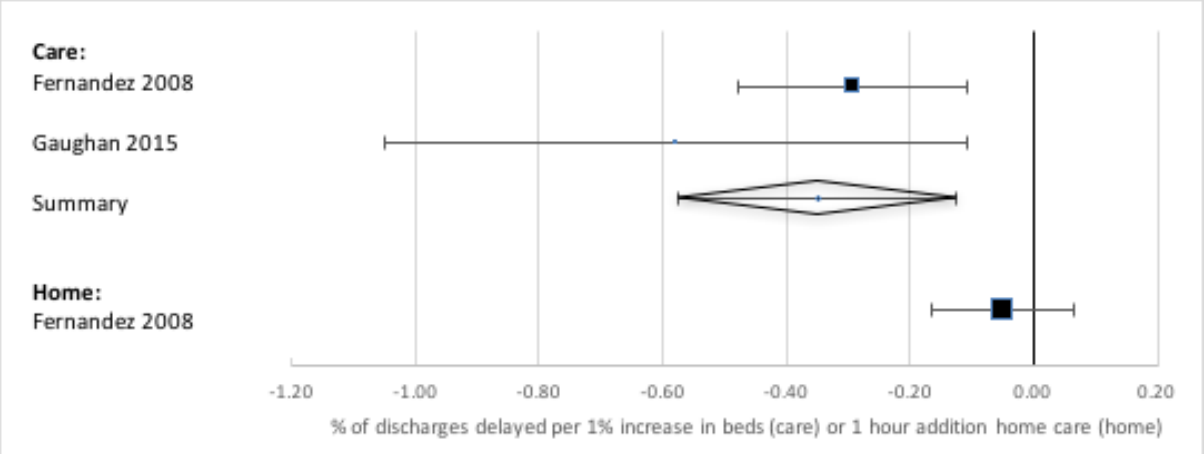


Figure 2.3 Impact of availability of care home beds on length of delay

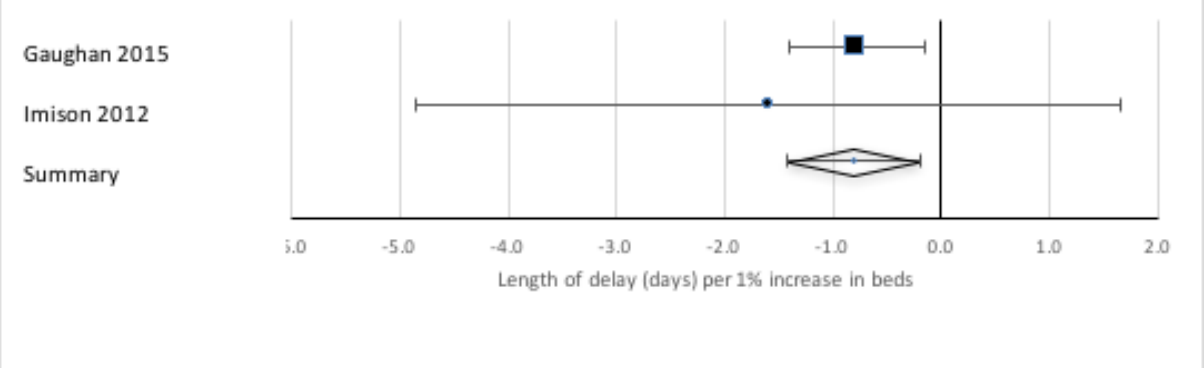


Figure 2.4 Impact of care home beds (care) and home care (home) availability on length of stay

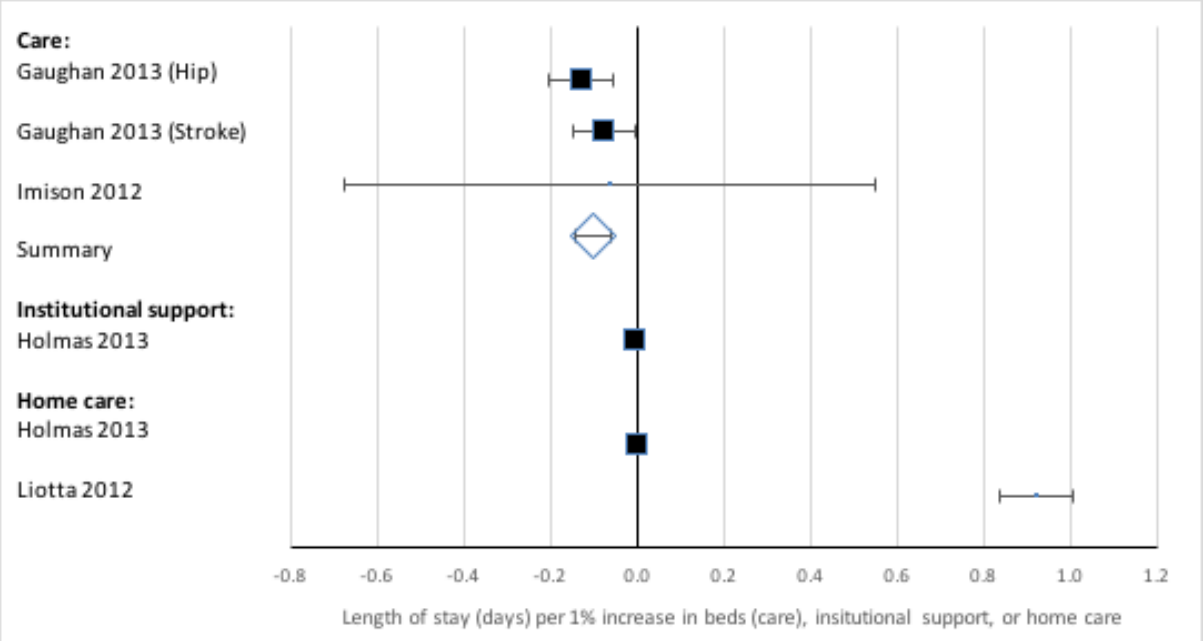


Figure 2.5 Impact of social care expenditure on hospital care expenditure

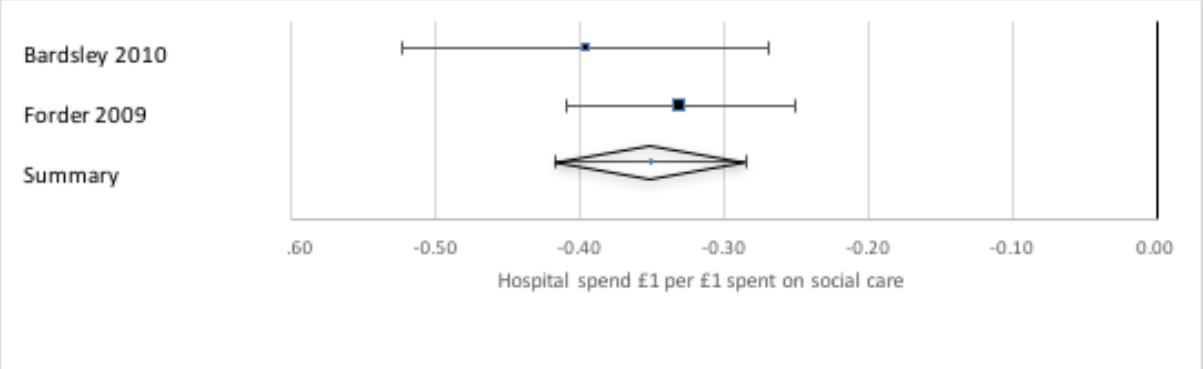


Figure 2.6 Impact of care home beds (care) and home care (home) availability on emergency readmissions

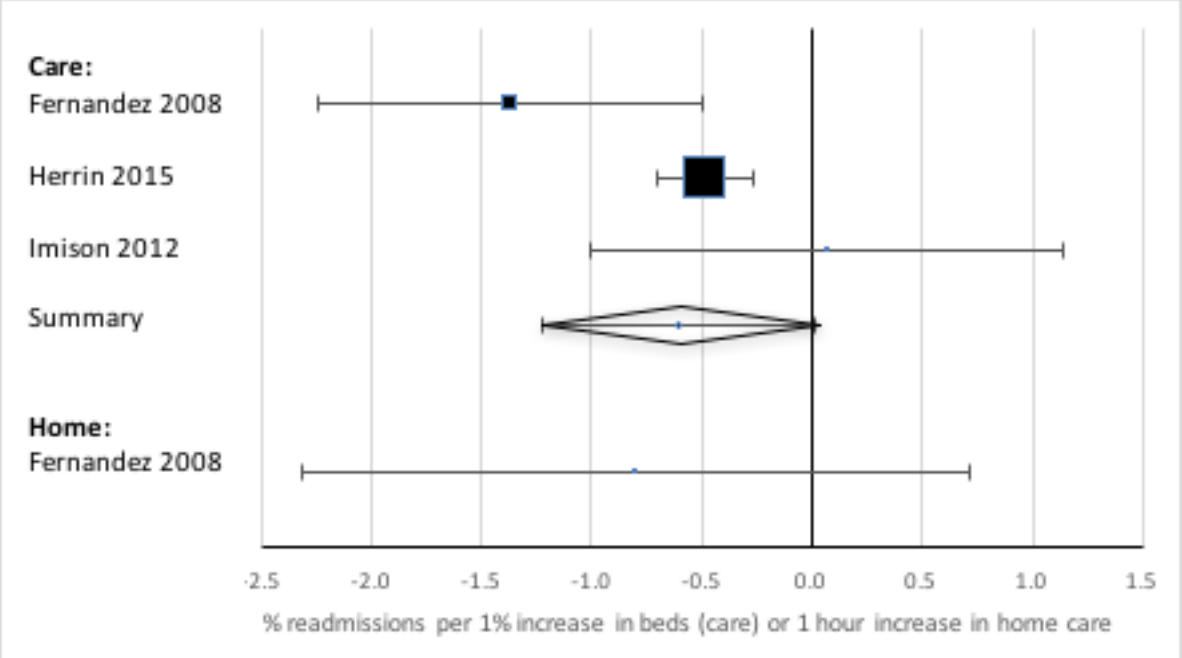
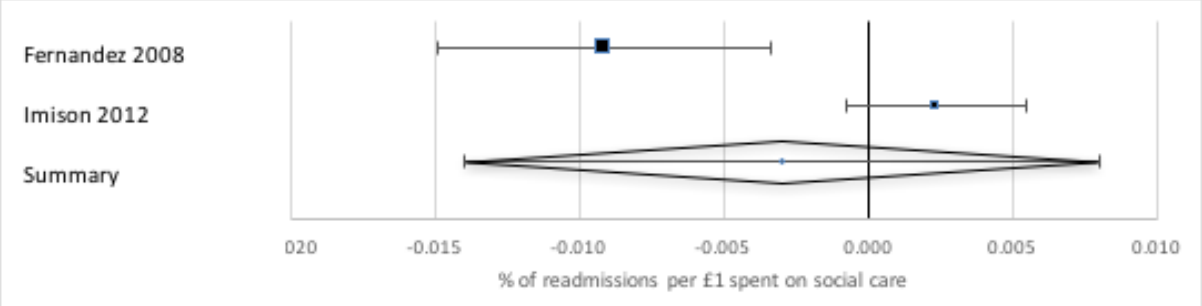


Figure 2.7 Impact of social care expenditure on emergency readmissions



2.10. Utilisation of social care

Thirteen studies (15 papers) were identified that examined social care utilisation and accounted for need (Table 2.5).[146,154-167] Eleven of these studies accounted for need in all parts of the analysis.[154,157-165,167] Two further studies accounted for need for part, but not all, of the reported analyses.[146,166] These two studies are included in the synthesis below, but only findings from analyses adjusting for need are reported. Another 23 studies were identified that examined the relationship between social

care utilisation and healthcare use but did not account for need. These were thus excluded from the synthesis.

Of the 13 studies reporting evidence about the relationship between use of social care and healthcare utilisation:

- 4 compared healthcare utilisation between use of different types of social care
- 3 compared healthcare utilisation between those who were using a form of social care and those who either received no care or who received usual care
- 6 examined the relationship between the amount of social care used (length of residency in a care home or number of social care users) and the amount of healthcare used

Data were not available for pooling and thus a narrative synthesis is reported. Studies rated poor in quality are summarised in Tables 2.8 to 2.10 and briefly described in each section. However, evidence from these studies is not included in the synthesis.

Table 2.8 Key data for studies reporting evidence about the influence of the amount of social care use on healthcare utilisation

Study	Exposure (social care use)	Outcome (healthcare use)	Estimate	P, CI	Direction of evidence[a]	Quality rating
Amador 2014[157]	Length of care home (without nursing) stay	Emergency department visits	OR=0.965	CI: 0.735, 1.266	No statistically significant relationship.	Good
Hutt 2011[158]	Length of care home (with nursing) stay	Hospitalisation (for residents with a single care home stay >180 days)	OR=0.99	CI: 0.99–0.99	Inverse	Good
	Length of care home (with nursing) stay	Hospitalisation (for residents with multiple care home stays totalling >180 days)	OR=0.997	CI: 0.997–0.998	Inverse	
Reeves 2004[146]	Home help/care user rate	Emergency admissions	r=0.15	None reported	Positive	Good
	Care home user rate	Emergency admissions	r=0.13		Positive	
Gruneir 2012[159]	Length of care home stay (newly admitted)	Emergency department transfer	OR=1.9	CI: 1.7-2.1	Inverse	Good
	Length of care home stay (short stay)	Emergency department transfer	OR=1.5	CI:1.4-1.7	Inverse	
Carter 2003[154]	Length of care home (with nursing) stay	Hospitalisation	OR=0.942	p=0.0001	Inverse	Fair
	Length of care home (with nursing) stay	Ambulatory sensitive conditions hospitalisation	No data reported	Reported only as not significant	No statistically significant relationship.	
Deraas 2011[160]	Long-term care (home care and care home) user rate	Hospitalisation rate, men, 67-84 years	Coef=76.99	CI: 44.3, 109.7 p<0.001	Positive	Poor
	Long-term care (home care and care home) user rate	Hospitalisation rate, men, 85+ years	Coef=142.36	CI: 58.3, 226.5 p<0.001	Positive	
	Long-term care (home care and care home) user rate	Hospitalisation rate, women, 67-79 years	Coef=52.47	CI: 25.7, 79.2 p<0.001	Positive	
	Long-term care (home care and care home) user rate	Hospitalisation rate, women, 80+ years	Coef=-16.14	CI: -54.0, 21.7 NS	No statistically significant relationship.	

[a] Inverse relationship (greater social care use associated with reduced healthcare utilisation, or reduced/lower social care use associated with greater healthcare utilisation); positive relationship (greater social care associated with increased healthcare utilisation); No statistically significant relationship

Table 2.9 Key data for studies reporting evidence on healthcare utilisation between different types of social care

Study	Exposure (social care use)	Outcome (healthcare use)	Data social care group 1	Data social care group 2	Estimate, CI, p	Direction of evidence[a]	Quality rating
Bardsley 2012[161]	Home care versus care home		*Home care*	*Care home*		Care home, but no test of difference used	Poor
		Ratio of expected/observed:					
		Inpatient admissions	1.80 (CI:1.73, 1.84)	1.32 (CI:1.27, 1.34)	No test of difference used		
		Emergency admissions	2.64 (CI:2.50, 2.71)	1.80 (CI:1.73, 1.84)			
		Elective admissions	1.61 (CI:1.40, 1.71)	1.09 (CI:0.98, 1.15)			
		A&E visits	1.83 (CI:1.73,1.87)	1.40 (CI:1.34, 1.43)			
		Outpatient visits	1.17 (CI:1.14, 1.19)	0.62 (CI:0.61, 0.63)			
		Day case attendances	0.98 (CI:0.87, 1.04)	0.51 (CI:0.45, 0.53)			
Hollander 2007[162]	Home care versus care home (without nursing)		*Home care*	*Care home without nursing*		Care home without nursing, but no test of difference used	Poor
		Data not extracted due to the volume of data presented. Reader is referred to tables 4 and 5 of original paper.					
Chappell 2004[163]	Home care versus care home (without nursing)		*Home care*	*Care home without nursing*			Poor
		Mean annual physician and hospital costs (Winnipeg)	Care level B: 2459	Care level B: 160	Type of care: P<0.01	Care home without nursing	
			Care level C: 1063	Care level C: 255	Level of care: NS		
			Care level D: 1676	Care level D: 675	Type x level of care: NS		
			Care level E: 1956	Care level E: 880			
		Mean annual physician and hospital costs (Victoria)	Level A: 1970	Level A; 579	Type of care: NS	No difference	
			Level B: 2422	Level B: 257	Level of care: NS		
			Level C: 1020	Level C: 959	Type x level of care: NS		
			Level D: 434	Level D: 379			
Sloane 2005[164]	Care home without nursing versus care home with nursing		*Care home without nursing*	*Care home with nursing*			Fair
		Hospitalisation (mild dementia)	14.2	8.4	p=0.009	Care home with nursing	
		Hospitalisation (moderate/severe dementia)	14.2	10.0	p=0.115	No difference	

[a]Type of social care favoured for lower healthcare utilisation; 'no difference' for non-statistically significant results

Table 2.10 Key data for studies reporting evidence on healthcare utilisation between use of social care and no use of social care

Study	Exposure (social care use)	Outcome (healthcare use)	Estimate	CI, p	Direction of evidence[a]	Quality rating
Wysocki 2014[165]	Care home with nursing stayer versus leavers	Odds of first potentially preventable hospitalisation	OR: 1.40	CI: 1.01-1.93	Social care use	Good
Victor 2000[166]	Care home /community social care post discharge versus no care	Odds of delayed discharge	OR: 2.6	CI: 1.6-4.4, p<0.001	No care	Fair
		Odds of delayed discharge	OR: 1.3	CI: 0.8-2.2, p=0.85	No difference	
Blackburn 2016[167]	Care home with nursing versus usual care	Hospital visit rate	Difference: -0.2	p<0.001	Social care use	Fair
		Length of stay rate (days)	Difference: -0.9	p=0.1222	No difference	
		Emergency department visits rate	Difference: -0.1	p=0.0021	Social care use	

[a]Use of social care or no social care/usual care favoured for lower healthcare utilisation; 'no difference' for non-statistically significant results

2.11. The amount of social care used

Six studies examined the influence of the amount of social care utilisations on healthcare utilisation [146,154,157-160] (Table 2.8). Healthcare utilisation outcomes reported included emergency admissions,[146] emergency service use,[157,159] and hospitalisations/inpatient admissions.[154,158,160] Two studies were carried out each in the US[154,158] and England[146,157] and one each in Canada[159] and Norway.[160] Three studies were specific to a condition group: Alzheimer's or dementia or impairments indicative of dementia,[154,157] and heart failure.[158] Five drew upon some form of administrative and/or patient data in a cross sectional or retrospective cohort design.[146,154,158-160] One study collected data as part of a prospective longitudinal cohort study.[157] Four studies carried out analysis at the individual level, whilst two carried out area level ecological studies.[146,160] Four achieved a quality rating of good,[146,157-159] and one study was rated fair.[154] One study was rated poor due to irregularities in the analysis presented, and is not included in the synthesis below.[160]

2.11.1. Emergency admissions

One study examined the relationship between three indicators of social care utilisation (number of home help/care hours, number of people in care homes and number of households receiving intense home help/care) and emergency admissions.[146] For all variables, when controlling for material deprivation, there was no strong evidence of any association.

2.11.2. Emergency service use

Two studies examined the outcome emergency department visits. There was no significant effect of length of residency in care homes (without nursing) in one study.[157] In another, there was an increased risk of emergency department transfer for those newly admitted to a care home (<30 days) and for those with shorter care home stays.[159]

2.11.3. Inpatient admissions/hospitalisations

Evidence from two studies indicated limited evidence for this outcome. One study showed an inverse relationship between length of care home (with nursing) stay and number of inpatient admissions, but not for ambulatory sensitive admissions.[154]

Another study reported a slightly lower odds of hospital admission per unit increase in care home (with nursing) length of stay.[158]

2.12. The type of social care used

Four studies compared healthcare utilisation outcomes between different forms of social care (Table 2.9).[161-164] Healthcare utilisation outcomes reported included elective admissions,[161] emergency admissions,[161] emergency service contacts/use,[161] healthcare costs,[162,163] inpatient admissions/hospitalisations,[161,164] LOS,[162] and outpatient attendances/contacts.[161] Two studies were carried in out Canada,[162,163] and one each in England[161] and the US.[164] Two studies carried out secondary analysis of administrative and patient data and/or data from previous cohort studies,[161,162] one used a longitudinal cohort design[164] and one was a cross sectional survey study.[163] The quality assessment is detailed in appendix A. One study was rated fair,[164] and three studies were rated poor due to insufficient information to make a judgement, potential bias in sample selection, and a lack of clarity in the findings presented. Only evidence from the study rated fair is presented.

2.12.1. Inpatient admissions/hospitalisations

One study rated fair examined this outcome, which compared care homes with and without nursing.[164] Analysis was stratified by level of dementia severity.[164] Higher rates of hospitalisation were observed for those in care homes without nursing compared to those with nursing for those with mild dementia. No significant difference between care homes was observed for those with moderate/severe dementia.[164]

2.13. Use versus no use of social care

Three studies compared healthcare utilisation outcomes between those who did and did not receive social care [165-167] (Table 2.10). All used retrospective cohort or cross sectional designs, drawing upon secondary analysis of patient, case note, and/or administrative data to compare healthcare utilisation between those in receipt of social care and those who were not.[165-167] In two studies, social care use was residence in a care home with nursing. One study included both care homes and home care.[166] The comparators were those not receiving social care,[166] those receiving usual care,[167] and those transitioning out of a care home with nursing to home and community based health services.[165] Healthcare utilisation outcomes

included delayed discharge,[166] emergency service use/contacts,[167] inpatient admissions/ hospitalisations,[165,167] and LOS.[167] Two studies were carried out in the US[165,167] and one in England.[166] The quality assessment for these studies is presented in Appendix A. One study was rated good,[165] and two were rated fair.[166,167]

2.13.1. Delayed discharge

One study demonstrated that receipt of community based social services did not influence the odds of delayed discharge.[166]

2.13.2. Emergency service use/contacts

One study demonstrated those admitted to a care home (with nursing) had significantly fewer emergency department visits than those admitted to usual care.[167]

2.13.3. Inpatient admissions/hospitalisations

One study demonstrated evidence that residence in a care home (with nursing) was associated with fewer hospital stays compared to those admitted to usual care.[167] A second study reported a lower odds of admission to hospital for ambulatory sensitive conditions, for those remaining in a care home (with nursing), compared to those transitioning out of the care home.[165]

2.13.4. Length of hospital stay

One study indicated no significant difference in hospital LOS between care home (with nursing) residents and those using usual care.[167]

2.13.5. Summary: the influence of social care utilisation

Thirteen studies examined the relationship between social care utilisation and healthcare utilisation outcomes for older adults. Four of these were rated poor and should be discounted. The remainder are split between three approaches to examining the relationship between use of social care and healthcare utilisation and are non-comparable, rendering the evidence across each approach limited in quantity. A small amount of evidence suggested that use of care homes (with nursing) was associated with fewer hospital admissions or a lower odds of hospital admission. This was in comparison to those not using social care or using an alternative form of care, or in relation to the amount of social care used (one of which demonstrated only a weak relationship). There was no strong evidence of any relationship between use of social care and other healthcare utilisation outcomes.

Given the small number of studies accounting for these relationships, these conclusions should be considered indicative. A final point regarding this set of studies concerns the outcomes examined. As with the studies examining availability and supply of social care, the focus was on secondary healthcare outcomes, with no studies reporting primary care outcomes.

2.14. Quality of social care

As described in Chapter 1, the feasibility of examining social care quality was explored as part of this review. Studies were identified that compared healthcare utilisation according to variables that study authors defined as social care service quality indicators. The quality indicators described and used varied from paper to paper but included, for example, variables such as whether a care home had a physician, staffing levels, and percentage of patients with pressure sores or depression. This was problematic because other studies also looked at similar variables but did not describe these as quality indicators. Therefore, it was likely there would be inconsistency in the studies included, simply because variables were described and used as quality indicators in some studies but not others. As a result, data about social care quality from these studies were not included in the review to ensure a consistent and systematic evidence synthesis.

2.15. Equitable access to social care

Just one study was identified that looked at a factor that could be considered an indicator of equitable access – whether the proportion of self-paying residents in a care home (with nursing) was greater than 35%.[168] This was examined as one of several risk factors for ambulatory care sensitive and non-ambulatory care sensitive hospitalisations. The study was carried out in the US, used a cross-sectional design, and achieved a quality rating of ‘good’. The odds of ambulatory care sensitive hospitalisations were lower for those from care homes (with nursing) with more than 35% of residents self-paying. There was no influence on non-ambulatory care sensitive hospitalisations.

2.16. Chapter summary

A series of systematic reviews has clarified the evidence regarding the relationship between access to social care and healthcare utilisation by older adults. Strong evidence of an association between the availability and supply of care homes and

secondary healthcare outcomes was observed. A limited and less consistent evidence base was identified regarding social care utilisation. A small number of studies indicated those living in care homes with nursing were less likely to be admitted to hospital. Almost no evidence was identified regarding equitable access to social care, and inconsistency in how social care quality is defined in the literature precluded this evidence from the review. Healthcare use outcomes were exclusively secondary (hospital) care focused with a clear lack of evidence regarding primary care.

The absence of evidence regarding equitable access to social care informed the focus of the main study, which explored the role of older adults' financial resources in the relationship between their access to social care and their healthcare use. The methods and findings of this analysis are described in chapters 4 and 5. This analysis also necessitated consideration of how best to measure financial resources in older populations. Thus, a supplementary scoping review was also undertaken to identify and critically appraise measures of financial resources, and socioeconomic status more broadly, used in studies with older populations. This work is described next.

Chapter 3: Measuring Socioeconomic Status in Older Populations: A Critical Scoping Review

3.1. Chapter overview

The systematic reviews conducted at the outset of this research identified key gaps in evidence regarding the relationship between equitable access to social care and healthcare utilisation by older adults. This informed the focus of the main study, which explored the role of older adults' financial resources in this relationship, and which is described in chapters 4 and 5. *Financial resources* are defined in this work as income and capital that may determine the extent to which care costs impose barriers on older adults' access to social care, and which may be used to fund social care. Financial resources are intrinsically situated within the concept of socioeconomic status, a construct that reflects a person's economic circumstances *and* their social and educational capital relative to that of others.[169]

The focus on financial resources prompted consideration of the challenges of measuring this, and socioeconomic status more broadly, in older populations. Previous work by Grundy and Holt (2001) set out these challenges.[170] However, new and different approaches to measuring socioeconomic status have emerged. An up-to-date, critical review of the measures of socioeconomic status used in studies of health inequalities in older populations was thus conducted. This chapter sets out the methods, findings and conclusions of this scoping review.

3.2. Review aims

This review aimed to a) identify which measures of socioeconomic status have been used in studies of inequalities in older adults' health, healthcare utilisation and social care utilisation, and b) critically appraise the application of these measures to older populations. The overarching objective of this critical scoping review was to facilitate critical thought about measuring, in particular, the economic aspects of socioeconomic status in older populations to supplement the main analysis.

3.3. Methods

Scoping review methods were used to address the aims of this work. Scoping reviews aim to map evidence in relation to a defined question using systematic searches, criteria, selection process, data coding and synthesis.[171-173] This approach differs from *systematic reviews* in three ways. First, systematic reviews ask what a combined body of evidence says with respect to a question. By contrast, scoping reviews address the nature and scope of evidence, rather than what it collectively demonstrates.[171,173] Second, scoping reviews do not usually appraise the quality and bias of evidence, as this is not typically necessary for scoping review objectives.[171] Third, systematic reviews are defined by pre-set criteria, whereas scoping reviews are iterative: the focus of the review can be refined and criteria adjusted accordingly as evidence is mapped.[171,173] A scoping review was the most appropriate method as the aim was to identify what measures of socioeconomic status had been used in studies of health inequalities in older populations, before appraising the measures identified. This review therefore updates the earlier work of Grundy and Holt (2001).

3.3.1. Search strategy

A search strategy was developed based on keywords used in relevant papers identified during some preliminary scoping. Terms were tested and refined, resulting in the following search strategy:

(1) Wealth OR socio-economic OR socioeconomic OR asset* OR income OR social position OR resources OR economic OR financial, **AND**

(2) Old OR “Older adults” OR elderly OR aged OR ageing OR retire*

These terms were adapted and applied to the electronic databases searched: Medline, Scopus, EMBASE, PsychInfo, Web of Science and Health Management Information Consortium (Table 3.1). Searches were carried out in May 2018. Reference lists of relevant systematic reviews were also checked.

Table 3.1 Records identified from each database searched

Database	Number	Duplicates	Accumulative total
Medline	1381	15	1366
Scopus	3890	761	4495
EMBASE	2083	1490	5088
PsychInfo	910	533	5465
HMIC	131	7	5589
Web of Science	4205	1981	7813
After de-duplication:			6579

3.3.2. Review criteria

The scoping review criteria are summarised in Table 3.2. Observational studies were included if they examined a measure of socioeconomic status in relation to a health, healthcare or social care utilisation outcome in older adults (aged 60 years+).

Socioeconomic status is a construct that describes a person's economic circumstances and the associated social capital relative to that of others.[169] In order to identify what new and emerging measures were used, measures of socioeconomic status were not pre-defined for the review. However, eligible measures must have examined some variation in socioeconomic circumstance in the context of understanding health-related inequalities. Due to the wide variation in terminology used in publications, it was not necessary that eligible studies explicitly referred to such measures as indicators of 'socioeconomic status'.

Healthcare use outcomes included any primary care or secondary healthcare services. Social care use outcomes included care homes with and without nursing, and community based (e.g. home help) social care services. Health outcomes were not pre-defined prior to study selection, and a wide range of health outcomes were evident in the resultant searches. As per scoping review methods,[171] the focus of the review was narrowed after screening titles and abstracts, and a single exemplar health outcome was chosen: self-rated health. This outcome was chosen as it is one of the most commonly used and strongest indicators of health.[174] Self-rated health

consistently predicts mortality, including in older age groups,[175,176] and has a high level of predictive power across the socioeconomic spectrum.[177,178]

Studies that did not examine how the outcomes (health, healthcare use and social care use) varied according to the measure of socioeconomic status were ineligible. Studies published before 2000 were excluded to ensure only contemporary measures were identified. Due to the highly variable and complex ways in which measures of socioeconomic status are described, translation of non-English studies risked loss of meaning and accuracy in terminology. Therefore, studies not published in the English language were excluded.

Finally, no initial limits were set regarding the country in which the study should be carried out. However, the searches identified some studies from developing countries. In these studies, the measurement of socioeconomic status was compounded by additional complexities and thus notably different to studies carried out in high-income countries. Whilst this is an interesting finding, it became apparent that the measurement of socioeconomic status in developing nations had the potential to be a highly specialised topic, with tailored searches necessary to exhaust the literature. Therefore, the scope of the review was refined to studies conducted in OECD-listed high-income countries.[179]

Table 3.2 Review criteria

	Inclusion	Exclusion
Population	Adults aged 60+ years. If samples include those less than 60 years, only studies presenting data separately for those aged 60+ are eligible.	
Exposure	Measures of socioeconomic status.	Socioeconomic status measured in childhood.
Outcome	Health outcome: self-rated health. Healthcare use outcomes: any primary or secondary healthcare service. Social care use outcomes: any long-term care use, including care homes with or without nursing, and community based services such as home care or day centres.	
Study design	Observational English language studies OECD-listed high income countries	

3.3.3. Study selection, data extraction and synthesis

Titles and abstracts of records were screened for relevance, and full texts assessed against the review criteria for inclusion. Study details were extracted onto a spreadsheet, summarising: the study population, measure(s) of socioeconomic status used and methods of measurement, the justification and rationale for using the measure if given, outcome(s), a summary of whether a socioeconomic gradient was observed in the results, and any other commentary about the measure as applied to older populations deemed relevant.

Data were synthesised by first grouping studies into outcomes (healthcare use, social care use and self-rated health) and then by the socioeconomic status measure. The measures identified were then critically appraised in terms of the strengths and limitations of applying these to older populations. Grundy and Holt's (2001) criteria for appraising measures of socioeconomic status were also used to assist the critical synthesis: whether the measure was grounded in theory for use in older populations

(including whether behaviourist or materialist explanations for inequality are used); and any observed issues raised by study authors about ease of, or problems with, data collection using the measure.[170]

Another approach to assess the validity of these measures in older populations would be to examine whether such measures demonstrate a clear socioeconomic gradient in the expected direction. This is a feasible approach in studies of health outcomes, such as self-rated health, where there is a well-established socioeconomic gradient. That is, those in lower socioeconomic groups are more likely to report worse health outcomes. However, it is less realistic to use this approach in studies of social care use and healthcare use outcomes. Unlike health outcomes, there is not a clear and well-established socioeconomic gradient for social care use outcomes. Healthcare use outcomes observe some socioeconomic patterns, but recent systematic reviews indicates this varies by the type of healthcare accessed, and a gradient is not consistently observed.[180,181] Therefore, whether the measures observed a socioeconomic gradient are reported only for the studies of self-rated health outcomes.

In Grundy and Holt's (2001) work, consideration was also given to whether measures rule out the potential for reverse causation in the relationship between socioeconomic status and health. This was not considered here, as this issue is not specific to measuring socioeconomic status in older populations. Furthermore, recent work has estimated that the pathway between socioeconomic status and health in older age is mostly one of social causation than health selection.[182]

3.4. Findings

Sixty-two studies met the review criteria (Figure 3.1 and Table 3.3).

The majority (n=30) examined the outcome self-rated health; 21 studies reported healthcare use outcomes and 13 reported social care use outcomes. Two studies reported more than one of these outcomes; these categories are therefore not mutually exclusive. Figure 3.2 shows the number of studies using each of the socioeconomic status measures identified. Measures of education (n=41) and income (n=37) were most common, followed by measures of home ownership (n=13), occupational or employment status (n=10) and area deprivation (n=10). Other measures included subjective assessments of economic circumstance (n=8), measures of combined wealth or assets (n=7), income inequality using the Gini

coefficient (n=2), and housing conditions (n=2). Seven other measures not classified in the above categories were also identified and are described in further detail in the synthesis below.

Figure 3.3 shows the proportion of studies using each measure according to outcome (healthcare use, social care use, self-rated health). Measures of education were most common in studies of self-rated health and healthcare use, whilst home ownership and income measures were most common in studies of social care utilisation.

As expected, terminology varied widely across studies. In many cases, measures were described in the context of health inequalities, but not explicitly referred to as measures of 'socioeconomic status'. Studies were also selective about *which* measures were indicators of socioeconomic status. For example, a study may have used multiple measures such as education, income and home ownership, but described only one of these as their chosen indicator of socioeconomic status. A minority of studies described 'socio*demographic*' variables and measures; this was usually a collective reference to demographic variables (e.g. sex, age) and socioeconomic variables (e.g. education, income). Where studies described using sociodemographic variables and measures, only those reflecting socioeconomic measures were included in this synthesis.

In the next section, a critical synthesis of the application of these measures is detailed, ordered by measure and outcome. Table 3.4 summarises the main points of this synthesis.

Figure 3.1 Study selection

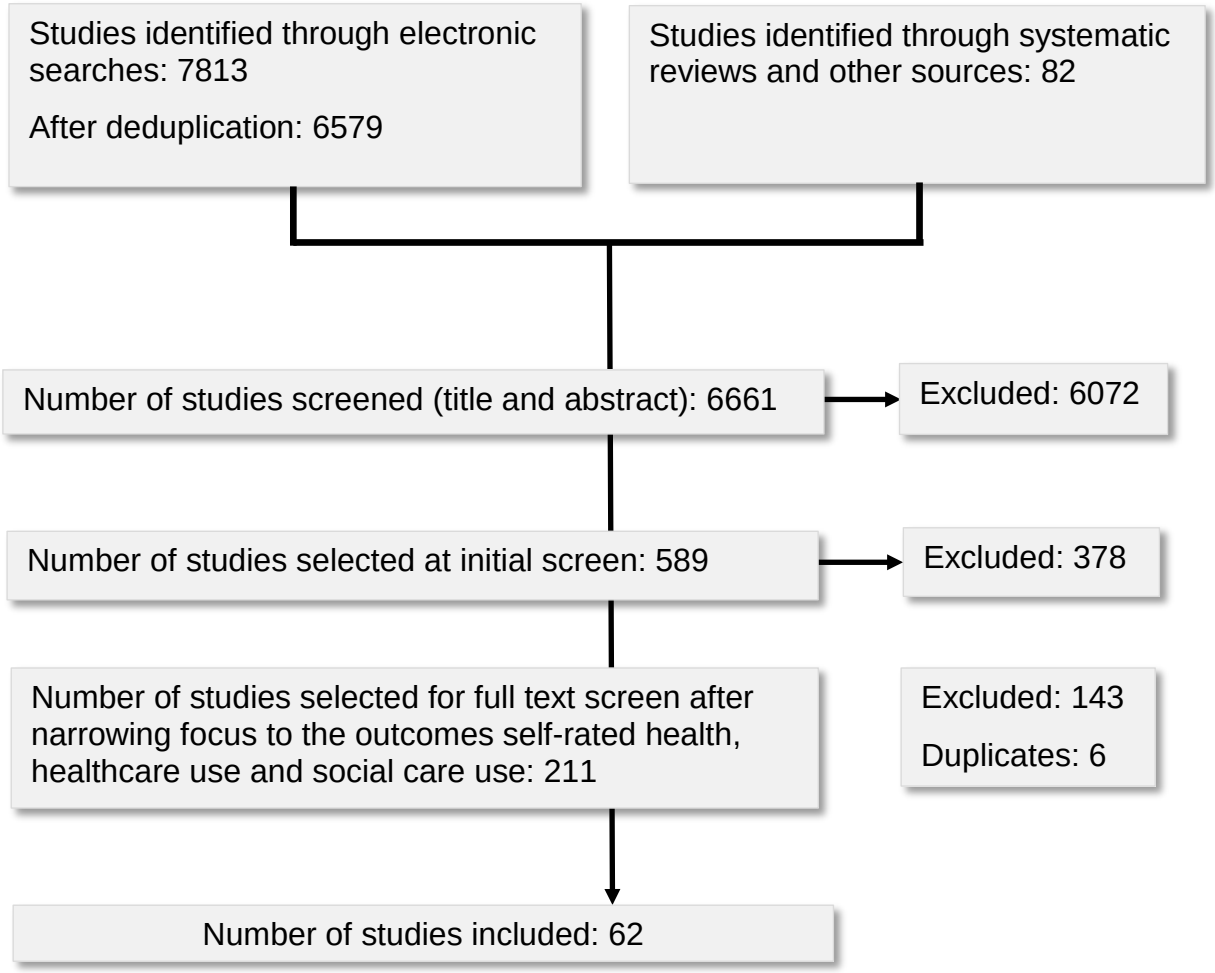


Figure 3.2 Number of studies using each measure of socioeconomic status

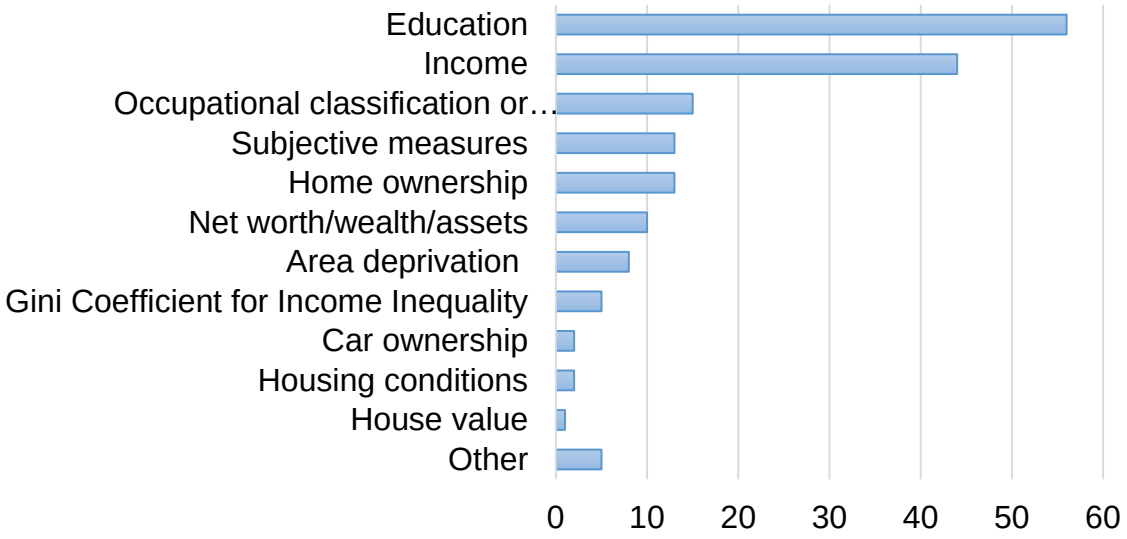


Figure 3.3 Proportion (%) of studies using each measure of socioeconomic status by outcome

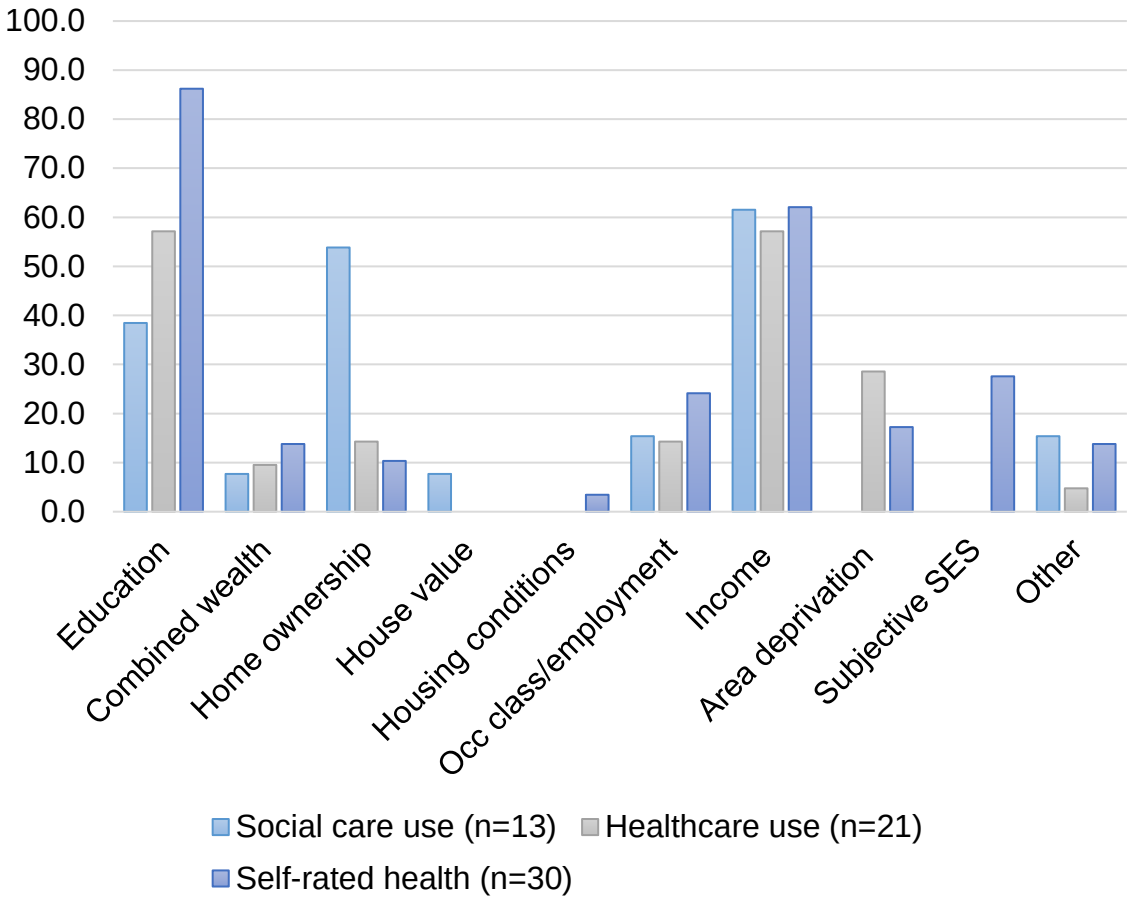


Table 3.3 Summary of measures of socioeconomic status used in studies

Study	Measures used	Application of measure: count, hierarchical (3+) categories, categories (non-hierarchical), dichotomised
Outcome group: social care use		
Grundy 2007[123]	Housing tenure	Hierarchical categories
Hancock 2002[124]	Home ownership	Dichotomised
	Income (self and spouse)	Hierarchical categories
Himes 2000[183]	Income (household)	Count
Lakdawalla 2003[184]	Education (level attained)	Hierarchical categories
	Income (individual)	Hierarchical categories
Martikainen 2009[185]	Home ownership	Dichotomised
	Income (household)	Hierarchical categories
McCann 2011[121]	Home ownership	Dichotomised
	House value	Hierarchical categories
Nihtila 2007[186]	Education (level attained)	Hierarchical categories
	Income (household)	Hierarchical categories
	Occupational classification	Categories (non-hierarchical)[a]
	Housing tenure	Dichotomised
	Car ownership	Dichotomised
Rodrigues 2018[187]	Net worth	Count
	Net income (household)	Count
Schmidt 2017[188]	Income (individual)	Hierarchical categories
Shea 2003[189]	Education (level attained)	Hierarchical categories
Tomiak 2000[190]	Home ownership	Dichotomised
	Education (years)	Hierarchical categories
	Income (type not specified)	Hierarchical categories
	Receipt of private pension	Dichotomised
	Receipt of investment income	Dichotomised
	Above or below designated income 'cut-off'	Dichotomised
Van den Bosch 2013[191]	Preferential status for public health insurance	Dichotomised
van Groenou 2006[192]	Home ownership	Dichotomised
	Education (level attained)	Hierarchical categories
	Occupational classification	Hierarchical categories
Outcome group: healthcare use		
Allan 2011[193]	Education (level attained)	Hierarchical categories
	Income (household)	Hierarchical categories
Allin 2009[194]	Education (level attained)	Hierarchical categories
	Income (household)	Hierarchical categories
	Net worth	Hierarchical categories

Alwan 2007[195]	Area deprivation measures	Count (%)
Ancona 2007[196]	Income (family)	Hierarchical categories
Auchincloss 2001[197]	Education (level attained)	Hierarchical categories
	Income (family)	Hierarchical categories
Cohen 2013[198]	Income (area)	Hierarchical categories
Fernandez-Mayorales 2000[199]	Education (level attained)	Hierarchical categories
	Employment status	Categories (non-hierarchical)[a]
Francois 2011[200]	Education (level attained in household)	Hierarchical categories
	Income (household)	Hierarchical categories
	Home ownership	Dichotomised
Freedman 2004[201]	Education (level attained)	Dichotomised
	Income (individual)	Dichotomised
	Home ownership	Dichotomised
	Non-housing assets	Hierarchical categories
Gill 2004[202]	Area deprivation measure	Hierarchical categories
Hoeck 2013[203]	Education (level attained in household)	Hierarchical categories
	Income (household)	Hierarchical categories
	Home ownership	Dichotomised
Kim 2012[204]	Education (years)	Hierarchical categories
	Income (family)	Count
	Employment status	Dichotomised
	Area deprivation measure	Score
Lindenaur 2013[205]	Income inequality (Gini coefficient)	Score
Park 2014[206]	Education (level attained)	Dichotomised
	Income (individual)	Dichotomised
Rathore 2006[207]	Area deprivation measure	Score
Roe-Prior 2007[208]	Education (level attained)	Hierarchical categories
	Income (type not specified)	Hierarchical categories
	Employment status	Dichotomised
Sheifer 2000[209]	Area deprivation measure	Score
Suominen-Taipale 2004[210]	Education (level attained)	Hierarchical categories
Wachelder 2017[211]	Area deprivation measure	Count
Walker 2006[212]	Income (family)	Hierarchical categories
Wastesson 2014[213]	Education (years)	Hierarchical categories
Outcome group: self-rated health		
Adjei 2017[214]	Education (level attained)	Hierarchical categories
	Employment status	Dichotomised
	Home ownership	Dichotomised
	Car ownership	Hierarchical categories
Ahn 2012[215]	Education (level attained)	Hierarchical categories
	Income (individual)	Hierarchical categories
	Perceived financial preparedness	Hierarchical categories
Aida 2011[216]	Education (years)	Hierarchical categories

	Income (individual)	Hierarchical categories
	Income inequality (Gini coefficient)	Score
Alwan 2007[195]	Area deprivation measures	Count (%)
Angel 2003[217]	Income (household)	Hierarchical categories
	Financial strain	Dichotomised
Bambra 2010[218]	Education (years)	Dichotomised
Enroth 2013[219]	Education (level attained)	Hierarchical categories
	Occupational classification	Categories (non-hierarchical)[a]
Evans 2008[220]	Income (type not specified)	Hierarchical categories
Giron 2012[221]	Education (level attained)	Hierarchical categories
	Occupational classification	Hierarchical categories
	Income (family)	Categories (non-hierarchical)[a]
Grau 2001[222]	Education (level attained)	Hierarchical categories
	Income (household)	Hierarchical categories
Kim 2011[223]	Education (years)	Hierarchical categories
	Income (household)	Count
	Poverty status	Dichotomised
	Work status	Dichotomised
Knurowski 2005[224]	Education (level attained)	Hierarchical categories
	Occupational classification	Hierarchical categories
	Income (self and spouse)	Dichotomised
	Home ownership	Dichotomised
Lasheras 2001[225]	Education (level attained)	Dichotomised
Li 2008[226]	Education (years)	Count
	Income (family)	Hierarchical categories
	Area deprivation	Score
Mather 2014[227]	Education (level attained)	Hierarchical categories
	Income (household)	Hierarchical categories
	Area deprivation	Hierarchical categories
Nummela 2007[228]	Education (level attained)	Dichotomised
	Income (household)	Hierarchical categories
	Adequacy of income	Hierarchical categories
Orfila 2000[229]	Education (level attained)	Hierarchical categories
	Occupational classification	Hierarchical categories
Otaki 2017[230]	Economic security	Dichotomised
Park 2014[206]	Education (level attained)	Dichotomised
	Income (individual)	Dichotomised
Park 2009[231]	Income (self and spouse)	Hierarchical categories
	Net wealth	Hierarchical categories
Pirani 2012[232]	Education (level attained)	Hierarchical categories
	Perceived economic resources	Dichotomised
	Housing conditions	Dichotomised
Piumatti 2017[233]	Subjective financial wellbeing	Hierarchical categories
Robert 2002[234]	Education (years)	Count
	Income (self and spouse)	Count
	Assets	Categories (non-hierarchical)[a]
	Area deprivation	

		Score
Robert 2009[235]	Education (level attained)	Hierarchical categories
	Income (household)	Hierarchical categories
	Assets	Hierarchical categories
Rueda 2008[236]	Education (level attained)	Hierarchical categories
	Income (household)	Hierarchical categories
Rueda 2012[237]	Education (level attained)	Hierarchical categories
	Area deprivation	Not described
Sherman 2012[238]	Education (level attained)	Hierarchical categories
Sulander 2012[239]	Education (level attained)	Hierarchical categories
	Adequacy of income	Dichotomised
Tigani 2012[240]	Education (level attained)	Hierarchical categories
	Income (not reported if individual, household etc.)	Dichotomised
	Reported financial problems	Hierarchical categories
von dem Kneesbeck 2003[241]	Education (years)	Hierarchical categories
	Occupational classification	Hierarchical categories
	Home ownership	Dichotomised
	Income (household)	Hierarchical categories
	Assets	Hierarchical categories

[a]Included an ‘unknown’ or ‘missing’ category, so a hierarchy of categories was not observed

Table 3.4 Summary of critical appraisal for the main measures of socioeconomic status identified

	Key limitations of applying these measures in older populations	***Theoretical justification of using measures in identified studies:***	***Difficulties collecting data reported in identified studies:***
EDUCATION	Level of educational attainment largely homogenous for older populations, with differences by gender and country. Not necessarily a key driver of later life advantage: labour market opportunities may have played a more significant role. Gender bias may exist. Highest household/ family educational attainment may overcome homogeneity of this measure, but it is unclear to what extent older adults benefit from the education of younger household members	In studies of social care use and some studies of healthcare use, *education* was typically located as driver of the factors (income, housing) that shape inequalities in access to care. Mostly, the use of this measure was not explained, and in some studies positioned separately to the construct of socioeconomic status.	None reported.
INCOME	Older adults may be cash-poor but asset rich. Income would not capture wealth accumulated through housing assets and other financial resources (e.g. savings). Potential difficulties collecting data.	Typically used as a measure of socioeconomic status, and in studies argued to be a weaker measure than home ownership and assets for measuring accumulated wealth in older populations.	Minority of studies reported missing data in this measure, with potential for this to be socially patterned.

	Family and household measures of income assumes older adults draw upon and benefit from the wealth of younger family members in multi-generation households, yet the reverse may also be true. Multi-generation households may be less common in western countries.		Some studies reported that income data were not available. Subjective measures and asset indexes were used in place of income data in a small number of studies.
COMBINED WEALTH/ASSETS	Whilst may be able to capture a range of older adults' sources of wealth and resources, data may be difficult to obtain.	Typically used to measure accumulated wealth in older populations.	Minority of studies reported missing data, but unclear whether this was socially patterned.
OCCUPATIONAL CLASS/ EMPLOYMENT	Poor applicability to a largely retired population. Although considered a proxy for lifetime earnings, longest held or main occupation is not necessarily a reflection of later life advantage due to compounding role of health/ disability. May overlook older women, many of whom were absent from labour workforce at working age, and/or have interrupted employment histories due to child-rearing and caring roles. Employment 'status' that distinguishes only between those employed and not	In studies of social care use, occupation and employment measures were located as a driver of the factors (income, housing) that shape inequalities in access to care. Little justification for use offered in studies of healthcare use and self-rated health.	None reported.

	employed will not capture variations in disadvantage in older populations.		
HOME OWNERSHIP	Captures a key component of older adults' economic circumstance, but potentially a homogenous measure due to high levels of home ownership amongst older adults in countries where home ownership is the norm. A dichotomised measure of ownership masks enormous differentials in accumulated housing wealth. Home ownership may not signal accumulated wealth in countries where this is not the norm.	Justified as a measure of accumulated wealth in older populations in studies of social care use and to a lesser extent studies of self-rated health. Other justifications relating to how home ownership influences preferences of care also given in one study.	None reported.
SUBJECTIVE MEASURES	May overcome limitations of more traditional and objective measures in older populations, but it is not clear to what extent subjective assessments represent a valid measure of socioeconomic status in later life. Not widely used; further investigation could clarify validity of measure.	Use of subjective measures of economic circumstance were not routinely explained. In some studies, use of a subjective measure was pragmatic (i.e. absent income data) or because it was thought to be superior to objective measures (e.g. to capture income adequacy, economic circumstance in older adults, overcomes limitations of objective measures in older populations).	None reported.

		Subjective measures may capture psychological stress resulting from economic hardship that shapes health outcomes.	
AREA DEPRIVATION MEASURES	Prone to ecological fallacy: those living in poor areas may not be poor themselves. Often include data from the whole adult population, and draw upon indicators not appropriate to older adults. Area deprivation may give some indication of property value, an important component of accumulated wealth in older populations.	Use of area deprivation measures were not routinely explained. Reasons for use include an absence of individual level data and environment effects of poverty influencing access to care.	None reported.

3.5. Measures of education

Measures of education are often used as an indicator of socioeconomic status.[169,170] Such measures may be used when behavioural and lifestyle explanations are used to understand health inequalities.[170,242] Data on education are typically easy to collect and routinely available in cohort datasets. In older populations, however, this measure of socioeconomic status may be a poor choice for examining health inequalities, for two reasons.

First, and as set out by Grundy and Holt (2001), most older adults currently over 60 years of age did not have access to education beyond school years, particularly those aged over 80 years. As a group they would be relatively homogenous on this measure, discriminating between only the most advantaged and the rest.[170] This varies depending on the availability of education, with the potential for differences between countries. Second, some have positioned educational attainment as a precursor to later life economic circumstances such as employment and income.[186,190] However, this reasoning may be somewhat precarious for today's cohorts of older adults, particularly in the UK. The nature of the UK labour market in the early and middle 20th century would suggest that educational attainment was not as important for employment at that time, as it is today.[243] For example, evidence shows that low educational attainment is not as strong a predictor for later life disadvantage for older generations as it is for younger generations.[244] George and colleagues (2015) argue this may be due to the changes in the labour market over time, where there was a lower demand for skills for current older generations at younger, working age.[244] Other employment opportunities facilitated through apprenticeships may have also facilitated social mobility, yet measures of education may not necessarily capture this. Thus, educational attainment in early life may not necessarily correspond with, and be a reliable proxy for, later life advantage in current older populations.

An important counter-point to these arguments, however, is that older adults may pursue educational opportunities at later points across the life course. Thus, it is important to consider whether measures of educational attainment reflect potentially homogenous early life schooling, or also include later life educational engagement.

Measures of education were used in five studies of inequalities in access to social care, 12 studies of inequalities in access to healthcare, and 25 studies of health inequalities (self-rated health).

3.5.1. Measures of education in studies of access to social care

Five studies used a measure of education in studies of inequalities in access to social care.[184,186,189,190,192] Such measures typically reflected categorical levels of education attained, although two studies measured years of schooling. Despite being used in these studies, education was rarely positioned as a factor that drove such potential inequalities in access to care. This measure was, in most cases, described as an indicator of socioeconomic status but distinguished from other measures of the participants' economic circumstance (e.g. income) that were hypothesised to influence access.[186,189,192] This is compatible with what is known about the materialist barriers to accessing fee-based long-term care by older adults in many high income countries.[79] In two studies, education was situated as a predisposing factor to later economic circumstances, rather than a 'current' enabler of access to care.[186,190] This is interesting, yet still questionable in terms of conceptual validity. Other factors, such as occupation and labour market conditions, may have played a more active role than education in shaping later life resources. Further, the added value of using education as a measure of socioeconomic status, when the focus of the inequality is a measure of economic circumstance, must be questioned.

Where studies used education alongside measures of income and home ownership, these latter measures showed stronger associations with access to social care than education measures.[184,186,190,192] This underlines the weakness of educational attainment as a measure of economic circumstance.

In terms of the argument that this measure can be homogenous in older populations, there was some evidence of this in studies that reported descriptive data about the split of the sample according to educational attainment (Appendix B). Two studies (Sweden and Finland), indicated that the largest proportion of the samples were concentrated in the lowest education category.[186,189] For example, 78.4% of sample males and 74.1% of sample females reported basic education or less in the Nihtila study.[186] Similarly, 68.2% of the sample reported their educational attainment as high school or less in the Swedish sample of the Shea study.[189] Notably, the Shea study

also included a US sample, where the spread of participants across the same education categories was more even.

3.5.2. Measures of education in studies of access to healthcare

Twelve studies used a measure of education in relation to inequalities in access to healthcare.[193,194,197,199-201,203,204,206,208,210,213] Education was typically measured as the level attained, in categories, although one study measured education in years of schooling. Whilst educational attainment was commonly used, this choice of measure was not always explained or theoretically justified. A minority of these studies used Andersen's model of access to healthcare to justify the use of education as a measure of socioeconomic status. For example, one study located educational attainment as an enabling factor (i.e. the resources that facilitate access)[193] whilst others considered it a predisposing factor (i.e. a factor that influences the acquisition of such resources).[199,200,203] As a predisposing factor, this assumes that education has played a sufficient role in shaping later life resources, including employment and income. Yet as argued earlier, this may not be the case for resources such as employment and income. As an enabling factor, higher educational attainment may indeed shape access to care through more informed health-related decision-making. However, where studies did locate a measure of education within a theoretical account of inequality, they did not discuss the limitation of applying this in older populations.

A further observation about the use of education as a measure of socioeconomic status in these studies is that it was typically measured in terms of the *individual's* level of educational attainment. However, two studies chose to measure the highest educational attainment within the household.[200,203] This was chosen on the grounds that older members of the household could benefit from the potentially greater levels of education of younger household members, and that education could facilitate access to services. This is a reasonable argument and overcomes the problem of homogeneity in older adults' educational attainment. However, to apply this approach presents the question of how likely older adults are to live in multi-generational households. In the UK at least, multi-generational households remain uncommon, yet this form of habitation is rising.[245] Younger people increasingly live with parents due to the economic downturn,[246] and some older adults may live with adult children due to a loss of independence. Thus, the feasibility of this measure is possible.

Furthermore, this approach could equally apply to couple households where the level of educational attainment differs between partners.

Even so, it is not clear to what extent the link between younger household members' educational attainment and the educational capital of older members is supported by evidence. Thus, whilst it is an interesting choice of measure, further investigation is needed to clarify the validity of this approach.

Finally, there was mixed evidence regarding the potential homogeneity of the sample on educational attainment across studies that reported descriptive data to assess this (Appendix B). In study samples from Finland, Norway and Sweden, larger proportions of the sample were observed in the lowest education categories.[210,213] A more even spread of the sample was observed in US studies where attainment was measured in 3 or 4 categories.[197,208] In one US study measuring whether or not participants had high school diplomas, the majority reported no diploma.[201] Two Korean studies showed contrasting findings regarding the spread of the sample.[204,206] This may reflect differences in how educational attainment was measured (years of education and highest level of education attained).

3.5.3. Measures of education in studies of health inequalities (self-rated health)

Twenty-five studies used a measure of educational attainment in studies of self-rated health.[195,206,214-216,218,219,221-229,232,234-241] Typically, however, there was little to no discussion of why this measure was used. Furthermore, some studies included a measure of education but did not categorise it with other socioeconomic status indicators. In some cases, education measures were labelled and grouped with socio*demographic* variables, or simply not discussed at all. Thus, whilst measures of education were common in studies of self-rated health, they were not necessarily used as a measure of socioeconomic status. Due to the lack of discussion of this measure in some studies, it was simply not always possible to gauge whether educational attainment was used to measure socioeconomic status.

Where educational attainment was used as an indicator of socioeconomic status *and* authors provided context for this measure, it was justified as: a widely used measure;[218] an indicator of social capital that could shape health outcomes;[232] and, a measure that captured one aspect of socioeconomic status.[236] Even so, limitations of applying this measure in older populations were rarely acknowledged; only one study discussed this.[232]

Measures of education were often categorised and there was, therefore, a hierarchy from which to assess a gradient. However, a socioeconomic gradient was not consistently observed across these studies.

With regards to potential homogeneity in education attainment, there was mixed evidence of this across studies that reported descriptive data (Appendix B). In some US studies, there were no notable concentrations of the sample in any particular education category.[214,215,222,241] However, for one US study with a sample of those aged 90+, and where educational attainment was measured as low/med/high, there was a larger proportion falling into the lowest educational attainment category.[219] In some studies with samples from the UK, Italy, Spain, Korea and Germany, there were larger proportions of the sample in either the lowest educational attainment category or the primary school education category.[241] Also, whilst most studies used 3 or 4 categories to measure education, a minority used 5 or more categories.[227,240] For these, there was no apparent concentration of the sample in any one category.

3.5.4. Measures of education: summary

Measures of education were commonly used in studies in this review, but the limitations of applying these to older populations were rarely acknowledged. In studies of self-rated health, there was no consistent evidence of a socioeconomic gradient using this measure. This would suggest education is a poor measure of socioeconomic circumstance in older populations, and may be due to the likely homogeneity of educational attainment. However, homogeneity in older adults' educational attainment was much more apparent for European samples than US samples. Thus, the argument that educational attainment can be a homogenous measure may be context specific. This may change over time for future older cohorts as educational opportunities change.

The use of a measure assessing highest educational attainment within a household may be one way of addressing the homogeneity of educational attainment in older populations. This was used in two studies of healthcare use. However, this could only be applied to contexts in which older populations live with younger people whose education is more varied. Further, it is not clear to what extent older adults may be able to benefit from younger people's educational attainment. A similar approach may also be possible within couple households where educational attainment differs between partners.

3.6. Measures of occupational classification and employment

Measures of occupational classification are often used in working age populations as an indicator of advantage, with distinctions made regarding the type and level of occupation. In the UK, for example, the National Statistics Socioeconomic Classification is used to distinguish those with manual or routine occupations, those with intermediate occupations and those with managerial or professional occupations.[247] As a measure of socioeconomic circumstance, it may capture both materialist mechanisms for inequality (e.g. as a precursor to income) and environmental mechanisms (e.g. working conditions).[170]

Applied in older populations, two key challenges arise using measures of occupational class as an indicator of socioeconomic status. First, whilst some older adults continue working past state pension age, many do not.[248] For example, 2011 census data indicate that 81% of those aged 65 years and over in England and Wales were retired.[248] Measures of occupational classification may, therefore, refer to the last occupational status prior to retirement. However, even this is problematic as it assumes the most recent occupational status may be the participants' 'highest'. Yet changes in employment due to, for example, changes in health, would not be sufficiently captured by a measure of last known employment.[170] Second, a measure of occupational classification may poorly represent the socioeconomic status of current cohorts of older women, whose participation in the workforce in the early to mid-twentieth century was much lower than that of men.[249] This may be overcome somewhat when measures default women's occupational classification to that of their male partner. Yet even this approach is problematic: it assumes women share equal access to household economic resources, when this is not always so.[250]

Measures of occupational and employment status were used in two studies of inequalities in access to social care, three studies of inequalities in access to healthcare, and seven studies of health inequalities (self-rated health).

3.6.1. Measures of occupational classification and employment in studies of inequalities in access to social care

Two studies examined a measure of occupational classification in analyses of inequalities in access to social care.[186,192] In one study, this measure was treated as a predisposing factor to the main indicator of interest, income.[186] In the second,

occupational classification was described as an indicator of socioeconomic status and distinguished from a separate indicator of 'material wellbeing'.[192] Thus, the use of these measures was supplementary to other indicators of economic circumstance that were proposed to drive inequalities.

3.6.2. Measures of occupational classification and employment in studies of inequalities in access to healthcare

None of the studies of inequalities in older adults' access to healthcare used occupational classification as a measure of socioeconomic status. Two studies included a variable that described whether or not the participant was employed, and one study described whether the participant was employed, unemployed or inactive.[199,204,208] These studies did not refer to these variables as indicators of socioeconomic status, but did provide data about variations in access to healthcare in relation to these. Employment status is highly likely to be a poor choice of measure to examine inequalities in access to care by older adults, given that most are not in paid employment. Indeed, in these studies, most were categorised as unemployed or inactive. Further, the dichotomisation of employed/unemployed offered no opportunity to assess variations in socioeconomic circumstance.

3.6.3. Measures of occupational classification and employment in studies of health inequalities (self-rated health)

Seven studies of self-rated health used a measure of occupational classification,[219,221,224,229,241] or employment status.[214,223] Two of the studies measuring occupational classification used the longest held occupation when working,[219,224] signalling the challenges of applying this measure in older populations. Further, the limitation relating to women's absence from the workforce for older populations was apparent in one study, where a separate category was created to account for this ('housewife').[219] As observed earlier, the use of employment status (yes/no), which was used in one study,[214,223] is particularly problematic in older, retired cohorts. A hierarchy was inherent in measures of occupational classification. However, there was no consistent evidence of a gradient across these studies.

3.6.4. Measures of occupational classification and employment: summary

Occupational classification and employment status were not commonly used in the studies identified. The challenges of applying this measure in older populations were

highlighted when studies drew upon the longest held occupation when employed, and/or had to create additional categories to account for women's absence from the workforce. As described earlier, the longest held employment may not necessarily represent an individual's later life economic circumstance. The use of a dichotomised employment status measure is particularly unhelpful in studies of older populations where the majority are not in paid employment.

3.7. Measures of income

Income is a commonly used indicator of socioeconomic status and may be used in studies where health inequalities are rooted in materialistic mechanisms.[170] The immediate disadvantage of using this measure in older populations is that their economic position often extends beyond income, with wealth accumulated over time through housing and other long-term held assets (e.g. businesses). Measures of income alone may give an incomplete picture of older adults' accumulated economic circumstances, and poorly capture variations in such.[194] For older adults living in care homes, receipt of income from, for example a state pension, may not be observed if paid directly to the provider, leading to inaccurate estimations.[170] As Grundy & Holt (2001) highlight, difficulties collecting income data are likely due to the number of possible income sources held by older populations (e.g. pensions, investments, benefits,).[170] Sensitivities around talking about money and personal finances may also hinder collection of these data in older populations.[170,251] Gender biases may also exist with measures of income due to differing levels of workforce participation between men and women.[252]

Measures of income were used in eight studies of inequalities in access to social care, 12 studies of inequalities in access to healthcare, and 18 studies of health inequalities (self-rated health).

3.7.1. Measures of income in studies of inequalities in older adults' access to social care

Eight studies of access to social care used measures of income.[124,183-188,190] Income in these studies was typically considered an indicator of the financial resources that may influence access to paid-for social care. This reasoning is theoretically sound, and the use of income as a measure of socioeconomic status in these studies clearly justified. Two studies measured *net* income, adjusted for taxes and outgoings,[187,188]

whilst four studies used an unadjusted measure of income or did not provide further detail.[124,183,184,190] Two studies also measured income per consumption unit in line with OECD recommendations.[186,253] Income was categorised into pre-set income bands,[124,184] used as a count measure,[183] or split into quintiles or quartiles based on sample data (i.e. relative).[186,188,253] One study measured income in quartiles but it was not clear if these quartiles were based on sample data (i.e. relative) or an external reference (i.e. absolute).[190]

Income was measured at the individual,[184,188] household,[183,185-187] and self and spousal,[124] level. However, there was insufficient description of these measures to clarify whose incomes were included in household measures, and whether this differed to those that measured the income of the participant and spouse.

One study measured receipt of pension income (yes/no), investment income (yes/no) and income below or above a means-tested cut-off, but without noting the amount of income from each of these sources.[190] Another study, with no access to income data, used data on public health insurance status. 'Preferential insurance status' required a low income, and was thus considered a proxy indicator of socioeconomic status.[191] Although these measures reflect pragmatic decisions based on available data, the use of dichotomised measures is unlikely to be optimal for capturing variations in older adults' socioeconomic status.

As previously observed by Grundy & Holt (2001), there was evidence that not only were income data difficult to collect, but also that this problem may be socially patterned. In Hancock and colleagues' (2002) study, some resistance to providing income data (self and spouse combined) was observed.[124] Such unwillingness to provide income data was associated with home ownership. Consequently, the authors suggest that their measure of income may have underrepresented those in the most advantaged positions.[124]

Two further observations can be made about measures of income, from studies that examined inequalities in older adults' access to social care, according to this indicator. First, Rodrigues and colleagues (2018)[187] note the importance of distinguishing 'income' from 'wealth' in older populations. In their study, two measures were used: net income and net wealth, where the latter included both income and housing wealth. For both measures, access to home care was typically biased towards those with lower levels of net wealth and lower levels of net income,

across the countries studied. Yet these associations were weaker for net wealth. Rodrigues and colleagues argue that this is because net wealth, which includes housing wealth, may capture the potential for richer older individuals to use more home care as a way of avoiding use of housing wealth to fund care home residency.[187] Net income, which did not include housing wealth, would not capture this and therefore show a stronger pro-poor trend. Thus, measures of income alone may show a different pattern to a measure that includes housing wealth.

Second, the association between income and access to social care was not as large as that for home ownership in two studies that used models adjusted for both.[186,253] This would suggest that income alone is not sufficient to measure variations in older adults' economic circumstances that may shape inequality in access to social care.

3.7.2. Measures of income in studies of inequalities in older adults' access to healthcare

Twelve studies of inequalities in older adults' access to health services used a measure of income.[193,194,196-198,200,201,203,204,206,208,212] Typically, these studies did not provide a theoretical justification for using income as a measure of socioeconomic status. In three studies, income was situated as an enabling factor that reflected the older person's economic circumstance.[193,200,203] Even then, however, it was not clear if the measure of income was used to assess inequality in access to fee-based care. Individual,[201] household,[193,194,200,203] and family,[196,197,204,212] income were measured. Yet, as observed earlier, there was insufficient description of these measures to assess whose incomes were included in household and family measures, and whether these different beyond terminology alone. One study indicated that all family members incomes were included in the measure.[197] Most studies categorised income into pre-set bands,[197,200,203,208] or split income into quintiles or deciles based on sample data (i.e. relative).[193,198,212] One study placed income in deciles based on an external population standard.[196] In another study, it was not clear if income quintiles were relative or absolute.[194] Three studies dichotomised income as above or below a given threshold, although it was not clear how these thresholds were determined.[201,204,206]

Non-report of (household) income was observed in one study, this time from those with poorer health and lower levels of educational attainment.[193] This is in contrast to the study by Hancock and colleagues, where non-report of income was associated

with home ownership and thus those more advantaged.[124] Even so, it underlines the difficulties of obtaining accurate income data and the potential for this to be socially patterned, resulting in some groups underrepresented.

Finally, and similar to Rodrigues and colleagues' study of access to social care, Allin and colleagues (2009) made a careful point of distinguishing net wealth (including house value) from (household) income in older populations, explicitly comparing the two.[194] Evidence indicated only slightly larger effect sizes using the measure of net wealth, compared to the measure of income. This might suggest that net wealth is a more sensitive measure of variations in older adults' economic circumstance than income alone. However, full data were not provided on this analysis in the publication and it is therefore impossible to judge this reliably.

3.7.3. Measures of income in studies of health inequalities (self-rated health)

Measures of income were used in 18 studies of inequalities in self-rated health.[206,215-217,220-224,226-228,231,234-236,240,241] Income was typically categorised into pre-set bands,[215-217,220-222,227,228,235,241] or quintiles or quartiles based on sample data (i.e. relative).[231,236] Two studies used a count measure of income,[223,234] and three studies dichotomised income as above or below a given threshold, although again, it was not clear how these thresholds were determined.[206,224,240] In one study, a graded scale was used. However, it was not clear if the scale corresponded with monetary values.[226] Studies used measures of individual,[206,215,216] household,[217,222,223,227,228,235,236,241] family,[221,226] and self and spousal,[224,231,234] income. There was, however, no description about whose incomes were included. Thus, it was not possible to assess whether there was any meaningful distinction between family, household, and self and spousal measures.

Measures of income were not consistently described as indicators of socioeconomic status but were used in the context of understanding the role of economic resources on inequalities in health outcomes. Where studies described income as an indicator of socioeconomic status, it was rarely justified and the limitations of applying this measure in older populations given almost no consideration. In a minority of studies, income measures were justified as: the most commonly used measure of socioeconomic status,[227] a measure capturing material circumstance,[231] and, measuring a different aspect of socioeconomic status than education.[236] One study

argued that (household) income was a weaker measure compared to home ownership and assets for capturing the accumulated wealth of older adults.[241]

Categorised income measures observed a hierarchical structure in most studies. However, a gradient was not observed consistently across these studies. Non-report of (household) income data was reported in one study, with missing data most likely amongst those over 75 years.[217]

3.7.4. Measures of income: summary

Income-based measures were commonly used indicators of socioeconomic status in studies of inequalities in older populations. Yet, income may be a less sensitive measure of economic circumstance in older populations than measures of assets and home ownership. This may be a particularly important distinction in studies of inequalities in access to social care where income, housing wealth and accumulated assets may play a role in determining financial eligibility for state assistance. The use of a measure dichotomising income according to a social care means-tested threshold may offer a highly context-specific approach.

Concerns regarding data collection were confirmed. Whilst only a small number of studies actively reported difficulties with non-report of income, this does not necessarily mean that other studies did not face such problems. Most importantly, missing data were socially patterned. However, evidence differed regarding whether it was those in lower or higher socioeconomic groups who would be less likely to provide this data. Further, one study indicated that these difficulties collecting income data were due to a resistance to provide this information. This reflects the difficulties highlighted by others about the private and sensitive nature of this type of data.[170,251,254]

Finally, the use of a household or family income measure in older populations makes two assumptions that should be challenged. First, attributing household or family income to an individual assumes that older adults have the capacity to benefit from family and household members' incomes, thus enhancing their position of advantage. However, it may be precarious to assume that older adults can benefit from the incomes of other, possibly younger, family or household members. Indeed, the reverse may also be possible. That is, younger household and family members may benefit from the income of older family members, thus potentially depleting this resource. Second, a household or family measure of income, where this is based on

the participant and spouse, assumes income is equally shared. Yet this is not always so.[255] Thus, family and household measures of income may be an unreliable indicator of an older person's income. Studies rarely specified whose incomes were included in such household and family measures (one study reported all family members' incomes were included). This lack of detail about whose incomes were included limited further critical assessment.

3.8. Measures of housing wealth and housing tenure

Measures of home ownership and housing wealth are used as indicators of socioeconomic status because they give an indication of accumulated wealth.[170] Housing tenure data has the advantage of being easy to obtain.[170] Further, if distinguishing private from social renters, as well as home owners, this measure could identify the relative poorest in samples of older adults. For older cohorts in the UK whose working age coincided with a period of an accessible housing market in the mid to late 20th century, those who are social renters may be a particularly reliable indicator of the most economically disadvantaged.

However, as Grundy and Holt (2001) point out, a key drawback of housing tenure as an indicator of socioeconomic status is that most current cohorts of older adults, in the UK at least, are home owners. Current UK estimates suggest that three quarters of older person households are owner-occupiers.[81] This potentially makes housing tenure a largely homogenous measure. Further, a dichotomised measure of home ownerships (i.e. owned or rented) masks the huge variation in the value of housing assets, particularly in the UK where there are substantial regional differences in house prices.[256]

Housing wealth builds on measures of home ownership by measuring the estimated house value. This information may be obtained from individuals, but could also be accessed from housing market websites that estimate local house prices based on recent sales. Thus, data could be relatively easy to access. However, the extent to which house value has added benefits over home ownership alone is underexplored.

Measures of housing tenure and housing wealth were used in eight studies of inequalities in access to social care, two studies of inequalities in access to healthcare, and three studies of health inequalities (self-rated health).

3.8.1. Measures of housing wealth and housing tenure in studies of inequalities in older adults' access to social care

Home ownership, housing tenure and house value were used in eight studies of inequalities in access to social care.[121,123,124,185,186,190-192] Similar to income, measures of home ownership were often positioned as indicators of economic circumstance that were hypothesised to drive inequalities in access to care. Most studies examined home ownership as a binary variable; there was, therefore, no opportunity for a hierarchy to assess a socioeconomic gradient. However, these studies typically showed an association in the expected direction: that home owners had a lower probability, and renters a greater probability, of entering a care home.[121,123,124,185,186,190] Associations for home ownership tended to be larger than associations for income in studies that adjusted for both. This would suggest home ownership is a stronger measure of economic circumstance in older populations than measures of income.

McCann and colleagues (2011) also examined house value band, but found no clear gradient in terms of the risk of care home entry. Therefore, house value band may not add any further discriminatory merit as a measure of economic circumstance.

There was also some evidence that home ownership may lack heterogeneity due to high levels of home ownership in older populations (Appendix B). Where studies reported descriptive data about this, samples were biased towards home owners (between 68% and 83% of the sample).[121,123,186,190] One exception was Hancock's study (UK), where the split between home owners and non-home owners was even.[124]

3.8.2. Measures of housing wealth and housing tenure in studies of inequalities in older adults' access to healthcare

Home ownership was used as a measure of socioeconomic status in two studies of inequalities in access to healthcare.[201,203] Both studies justified this measure as an indicator of economic circumstance, but also that home ownership could influence institutionalisation and preferences for alternative care by older adults. Associations with healthcare use outcomes were smaller for this measure compared to other measures of socioeconomic status in these studies, including assets,[201] income and education.[203] This is in contrast to what was observed in studies of inequalities in

access to social care. There was also evidence of homogeneity, with the majority of the sample being home owners (Appendix B).[201,203]

3.8.3. Measures of housing wealth and housing tenure in studies of health inequalities (self-rated health)

Three studies used a measure of home ownership as an indicator of socioeconomic status. These were dichotomous measures (i.e. owned or rented) with no third category describing social or private renters.[214,224,241] One study argued that home ownership may better reflect accumulated wealth in older populations than traditional measures of income, occupation and education.[241] A theoretical justification for using a measure of home ownership was not detailed in the remaining studies. As these measures were binary there was no opportunity to assess a socioeconomic gradient, revealing a key limitation of this measure. Further, the majority of participants were home owners in study samples from the US, UK, Spain and Italy (between 72% and 90% of the samples).[214,241] For study samples from Poland and Germany, home owners were still a majority, but with a more even split between home owners and renters (between 54% and 66%).[214,241] This suggests that the homogeneity of home ownership as a measure of socioeconomic status is likely to be context dependent.

3.8.4. Measures of housing wealth and housing tenure: summary

Measures of home ownership may be useful for capturing older adults' accumulated wealth in studies of access to social care, where such housing wealth could be a factor shaping access to care. However, a single study indicated the actual house value may add no further discriminatory benefit. Home ownership may also be *less* sensitive to variations in economic circumstance than a measure of assets, as indicated in studies of healthcare use. Earlier concerns that the majority of older adults are home owners was also apparent in some study samples, but not others.

3.9. Measures of combined wealth or assets

Measures of combined wealth and assets as indicators of socioeconomic circumstance may be used when materialist mechanisms are proposed to drive inequalities in the health outcome. This measure takes into account economic resources beyond income alone, such as housing wealth or savings. For older adults, whose economic circumstances may reflect the accumulation of resources over the life course, this measure may be particularly advantageous. Some studies use

measures of *net* assets and wealth, which account for financial outgoings and debt. This approach may provide a more confident estimation of economic circumstance than measures of assets that do not account for such outgoings.

Despite the advantages of this measure, accurate data are difficult to access. A measure of combined wealth and assets would inevitably require collection of data that is not only extensive in nature (for example, income, house value, businesses and savings, debts, financial outgoings as well as any other financial resource deemed necessary) but often regarded as sensitive.[254]

Measures of combined wealth and assets were used in one study of inequalities in access to social care, two studies of inequalities in access to healthcare, and four studies in inequalities in self-rated health.

3.9.1. Measures of combined wealth or assets in studies of inequalities in older adults' access to social care

One study examined inequalities in access to social care using a measure of net wealth.[187] This was a measure of the net total of all debt, income, outgoings and housing assets, and was compared to a measure of net income. As described earlier, both net income and net wealth indicated access to home care was biased towards those with lower levels of income and wealth, but with weaker associations for the latter. Rodrigues and colleagues suggest this reflects the inclusion of housing wealth within the measure of net wealth, which may capture a wider picture of older adults' economic circumstance.

3.9.2. Measures of combined wealth or assets in studies of inequalities in older adults' access to healthcare

Two studies examined inequalities in access to healthcare using a measure of combined wealth/assets.[194,201] One study used net wealth, which was a measure of the net total of all financial outgoings, income, housing wealth, business wealth, car value, other real estate, any other financial assets, and life insurance.[194] The second used non-housing assets, although it was not reported what assets this referred to other than it excluded housing wealth.[201]

These measures were used as indicators of economic resources, and in one study was hypothesised to be a more sensitive measure of this in older populations than

income alone. However, whilst slightly larger effect sizes were reported for the measure of net wealth, it was impossible to fully judge the sensitivity of the measure due to the lack of data presented for the sample aged 65 years and over.[194]

3.9.3. Measures of combined wealth or assets in studies of health inequalities (self-rated health)

Four studies used a measure of combined wealth/assets in studies of inequalities in self-rated health.[231,234,235,241] Assets typically referred to owned property, savings, other cash and financial resources. Only one study used a *net* measure (accounting for debt and outgoings).[231] All but two measures estimated a summed amount of cash assets, split into categories. One study used a binary measure of whether or not participants had real estate and stocks.[241] A second created an index of wealth based on household items, but the unit of measurement was unclear.

Typically, studies justified a measure of assets and combined wealth because they captured accumulated wealth in older populations.[231,234,235,241] These studies also used other measures of socioeconomic status, including income. However, due to the way that data were reported, it was not always possible to compare the effect sizes of the assets measures with the other socioeconomic measures used. Where it was possible to make this comparison, one study showed larger associations with self-rated health for the measure of net assets (summed and split into quintiles) compared to income.[231] In contrast, the study using a binary (yes/no) measure of having stocks and real estate demonstrated a smaller association for this measure compared to a measure of income.[241] This suggests that a measure of summed net assets could be more sensitive to variations in economic circumstance than a measure of income in older populations. However, a clear socioeconomic gradient was not consistently observed across these studies.

Problems accessing data were observed in two studies, with 12% and 9.9% missing data observed for their asset measure.[234,235] This confirms the concerns outlined earlier regarding difficulties collecting the required data. In one of these studies, authors noted that those with missing data were significantly different from those who provided data, on a number of outcomes, but these were not reported. Thus, missing data on this measure has the potential for some groups to be under-represented.

3.9.4. Measures of combined wealth or assets: summary

Measures of combined wealth and assets were used in a minority of studies, and different approaches to measuring this were used. Measures of *net wealth and assets* in particular demonstrated larger associations with outcomes than measures of income where these comparisons were possible. This suggests measures of net wealth may be particularly sensitive to variations in older adults' economic circumstance. However, in some studies, authors highlighted problems with missing data for these measures. Thus, whilst a measure of net wealth may capture older adults' economic circumstance, the application of this measure may be challenging.

3.10. Area deprivation measures

Measures of area deprivation are commonly used indicators of socioeconomic status. Nationally derived and validated measures are available and easy to access, such as the Indices of Deprivation in England,[257] or the Index of Relative Socioeconomic Disadvantage in Australia.[258] Such measures are typically based on multiple indicators, such as income deprivation and living environment quality.[259] Yet the application of area deprivation measures to older populations may be problematic: they often include data from the whole adult population, and draw upon indicators not appropriate to older adults (e.g. income and employment).[170] As such, it is possible that such measures will represent a level of disadvantage that does not necessarily reflect the circumstances of older adults. Similarly, areas with a greater proportion of older adults may be ranked higher in deprivation because such measures are partially-based on these working-age relevant indices.[259] Area deprivation measures are also often based on census data that are collected at intervals, and may thus become outdated. The Indices of Deprivation in England, for example, are collected every 10 years. Most importantly, area deprivation measures are prone to the ecological fallacy of assuming that phenomena that occur at the area level are also true for individuals living in that area. That is, not everyone living in a poor area may be poor themselves.

However, if environment and social circumstances are considered important to health, then area deprivation measures will have merit. Also, measures of area deprivation may give some indication of relative house value: less deprived areas may be more likely to include houses with greater market values. House value is an important component of older adults' accumulated wealth, and thus area deprivation

could have some value as a measure of socioeconomic circumstance in older populations.

Six studies of healthcare use and five studies of self-rated health used a measure of area deprivation. None of the studies of social care use included area deprivation measures of socioeconomic status.

3.10.1. Area deprivation measures in studies of inequalities in older adults' access to healthcare

Six studies used area deprivation measures in relation to healthcare use outcomes.[195,202,204,207,209,211] These included: socioeconomic characteristics at zip-code level;[207] a regional deprivation index based on the Carstairs Index;[204] the Australian Bureau of Statistics Index of Relative Socioeconomic Disadvantage;[202] average household income at zip-code level;[211] whether a resident lived in a zip-code with a median household income at or below the 15th percentile of income;[209] and, the proportion of those aged 65 years and over with no known qualifications per defined area.[195] These measures were used either as the only indicator of socioeconomic status,[195,202,207,211] or alongside other indicators.[204] Reasons for using area deprivation measures included an absence of individual socioeconomic data;[207] locating area deprivation as an enabler of healthcare access based on Andersen's model;[204] to specifically examine the role of area disadvantage on healthcare use;[202] and, to compare different area deprivation measures in older samples, although data for just one measure are reported for healthcare use outcomes.[195]

These studies did not typically consider the limitations of applying area deprivation measures to older samples. However, one study examined the validity of an area measure (proportion of those aged 65 years and over with no known qualifications per defined area) in older adults due to the limitations of measures based on working age populations. The authors report that this measure observed a strong relationship with the outcome, rate of emergency admissions. However, little data were reported to judge this, and their analysis did not adjust for any other socioeconomic indicators. Therefore, it is not clear to what extent this measure was a valid indicator of socioeconomic status in older adults.

3.10.2. Area deprivation measures in studies of health inequalities (self-rated health)

Four studies used a measure of area deprivation in studies of self-rated health,[195,226,227,234] and one further study stratified their analysis by four regions with different levels of socioeconomic disadvantage.[237] Measures of area deprivation included: a community socioeconomic disadvantage index based on three neighbourhood indicators;[234] Australian Bureau of Statistics Index of Relative Socioeconomic Disadvantage[227] whether or not areas had more than 30% of residents claiming income support (a means-tested benefit indicating low income);[195] the proportion of residents aged 60 years and over claiming income support;[195] the proportion of residents aged 65 years and over with no or unknown qualifications;[195] the proportion of residents aged 65 years who did not own homes;[195] and, a neighbourhood socioeconomic disadvantage index based on six neighbourhood indicators.[226] Three studies used this measure alongside measures of income and education.[226,227,234]

The reason for using an area measure of socioeconomic status was not clear in three studies.[226,227,234] Considerations of applying area deprivation measures to older populations were not evident, except for one study, which sought to explore the validity of four area deprivation measures in older samples.[195] In this study, three of the four measures were specifically based on data for older populations (60+ and 65+). The measures with the strongest associations with self-rated health were: the proportion of residents aged 65 years and over with no or unknown qualifications, and the proportion of residents aged 65 years who did not own homes, for the 65-74 age group. For the 75+ age group, the proportion of residents aged 65 years and over with no or unknown qualifications showed the strongest association. However, these analyses did not adjust for each of the other indicators explored. Therefore, it is not possible to judge the independent strength of each of these measures.

In four studies, it was not possible to assess a gradient.[195,226,227,234] It was, however, possible to compare measures in one study: the measure of area deprivation observed the weakest of three socioeconomic measures used (income and education).[227]

3.10.3. Area deprivation measures: summary

Although area deprivation measures are usually widely used in studies of health inequalities, few studies in this review used these measures. This may be because this review was restricted to three types of outcomes (self-rated health, healthcare use and social care use). Area deprivation measures may have been used more widely in studies of other types of health outcomes. Typically the reasons for using these measures in studies of older adults were not made explicit, with only one study stating this was a pragmatic decision based on a lack of individual-level data. The comparison of area deprivation measures specifically for older adults in one study was an interesting and novel approach. However, it was not possible to assess the independent contribution of each measure, nor was it possible to assess a gradient. Further, due to the way that measures were used and data reported, it was difficult to appraise the value of these measures in older populations.

3.11. Subjective measures of economic circumstance

Measures of socioeconomic status such as income, education and occupational classification represent objective classifications of individuals' circumstances. Yet in the studies identified for this review, several chose to use subjective assessments of economic circumstance when studying health inequalities. Subjective assessments of socioeconomic status are not new, but these measures have typically been used in working age or child populations (for example, the McArthur Scale of Subjective Social Status[260]). Applied to older populations, a subjective measure may overcome some of the key challenges observed with objective measures: accessing reliable data and having a measure that can capture accumulated housing wealth and financial resources in older age groups.

Despite these potential advantages, it is not clear to what extent subjective measures of socioeconomic status represent a valid measure that is able to capture variations in disadvantage in older populations. Price (2008) argues that older people typically rate their economic situation as better than it objectively appears, and thus may be an unreliable assessment of financial resources.[255] Gender biases may also exist, where current cohorts of older women face greater financial insecurity than men, due to lower levels of workforce participation and the associated consequences for later life pensions.[252] In relation to the wider population (i.e. not specifically older adults) Glei and colleagues (2018) also argue that subjective assessments of one's

economic situation can also vary depending on the macro-economic context, including the degree of income inequality and economic recessions.[261] These limitations are equally relevant to older populations. Subjective assessments of economic circumstance may also be compounded by the health of the individual. For example, those in better health may rate their economic circumstances more optimistically than those in poorer health.

Despite these complications, a subjective assessment could be equally as legitimate as an objective assessment in older populations. Self-rated health is a subjective assessment yet one of the most reliable and consistent predictors of health outcomes. Thus, a subjective assessment of socioeconomic status may also be valid.

Four used a subjective measure of socioeconomic status in studies of self-rated health.[228,232,233,239] Four further studies also used subjective measures of economic circumstance but did not explicitly refer to these as measures of socioeconomic status. Rather, they were used in the context of understanding variations in economic disadvantage in relation to inequalities in self-rated health.[215,217,230,240] Subjective measures were not reported in studies of inequalities in access to healthcare or social care.

3.11.1. Subjective measures in studies of health inequalities (self-rated health)

Four studies reporting the outcome self-rated health used a subjective measure of socioeconomic status.[228,232,233,239] A further four studies also used subjective measures of economic circumstance but did not explicitly label these as measures of socioeconomic status.[215,217,230,240] This is not entirely surprising, given that even many of the studies using more traditional and objective measures, such as income and occupation, did not refer to these as socioeconomic status indicators.

These subjective measures included: self-rated economic resources, measured as very good/adequate and scarce/insufficient;[232] subjective financial wellbeing, measured on a scale of 1-6;[233] perceived financial preparedness for the future, measured as unprepared, somewhat prepared, and very prepared;[215] financial strain, measured as yes/no;[217] perceived economic security, measured as secure and not secure;[230] perceived adequacy of income, measured as rather or very good, and average or less;[228,239] and, reported financial problems, measured as always, after aged 65 only, before aged 65, and never.[240] Thus, these measures related to

satisfaction and wellbeing,[233] the perceived adequacy of resources,[215,228,232,239] and financial security, strain and problems.[217,230,240]

Three studies did not explain reasons for using subjective measures.[228,230,240] Across the remaining studies, reasons for using a subjective measure of economic circumstance included: a lack of income data;[232] subjective measures can better capture income adequacy than an objective measure of income;[233] subjective measures are predictive of older people's economic situation;[239] subjective measures capture the psychological stress resulting from economic hardship, which plays a contributory role in health outcomes;[217] and, the study focus was specifically financial resources.[215]

It was possible to assess a gradient in only two of these studies, with mixed findings observed.[215,240] It was also possible to compare the subjective measure to objective socioeconomic status measures in three studies.[228,232,239] However, there was no consistent pattern as to whether subjective measures demonstrated larger, equivalent or smaller associations compared to objective measures. This offers no firm evidence of the validity of a subjective measure of socioeconomic status in these older samples.

3.11.2. Subjective measures: summary

Subjective measures of socioeconomic status were used in place of, or alongside, objective measures. This is an interesting development; such measures may overcome the challenges of applying objective measures of socioeconomic status in older populations. Yet from a small sample of studies that used this measure, there was no clear evidence to support the validity of this measure. Where studies chose to dichotomise their measures, this prevented the opportunity to assess a socioeconomic gradient. Further investigation may help clarify the value of this measure in older populations.

3.12. Other measures of socioeconomic status

In addition to the measures described above, other measures of socioeconomic status were described in two studies of social care use, one study of healthcare use, and four studies of self-rated health.

3.12.1. Other socioeconomic measures in studies of inequalities in older adults' access to social care

In studies of social care use, other measures of socioeconomic status included car ownership,[186] and preferential insurance status.[191] Car ownership was used as a measure of socioeconomic status on the grounds that it may indicate material wealth.[186] This measure was associated with a reduced risk of admission to a care home independent of age, living arrangements and other socioeconomic variables, and showed the largest associations of all measures used (income and home ownership). However, the authors note that car ownership may also indirectly signal health, with healthier individuals more likely to still retain and use a car. As the above analyses did not adjust for any measures of health, it is impossible to judge this from this study alone.

Preferential status for public health insurance was used in a second study as a proxy for income; to have 'preferential status' signalled low income.[191] The authors acknowledge the dichotomised nature of this measure prevented observation of a socioeconomic gradient.

3.12.2. Other socioeconomic measures in studies of inequalities in older adults' access to healthcare

One study examined income inequality (Gini Coefficient) in relation to healthcare use outcomes.[205] This was not referred to as a measure of socioeconomic status but used as an indicator of inequalities that could lead to poorer health outcomes. The use of a measure of income inequality, may provide an assessment of the gap between the richest and poorest at an area level. However, applied in older populations it bears the same limitations as area-based measures; income data are drawn from the whole population, rather than older adults, and thus may not accurately represent older adults' disadvantage.

3.12.3. Other socioeconomic measures in studies of health inequalities (self-rated health)

In studies of self-rated health, car ownership,[214] poverty status,[223] and housing conditions[232] were used as indicators of socioeconomic status. In a further study, income inequality (Gini Coefficient) was used in relation to self-rated health but not

described as a socioeconomic status measure.[216] This measure bears the limitations outlined in the previous section.

Car ownership was used as one of two indicators of material wealth (the other being home ownership) in a multiple country study, and measured as owning no, one and two or more cars.[214] Gradients were observed for some countries but not others. This may suggest that car ownership reflects material wealth in some contexts better than others. However, as noted above, car ownership is complicated by its potential to also capture health and independence to carry out activities of daily living in older age.

Poverty status was chosen to reflect financial hardship in one study, and was a dichotomised measure (above or below the national poverty threshold in the Republic of South Korea).[223] As expected, being below the poverty line was associated with poor self-rated health. However, as with many other dichotomised measures, this offers little to capture variations in socioeconomic circumstance.

Finally, one study created an index of housing conditions based on a set of housing characteristics.[232] This was used in place of housing tenure, and measured as *very good/adequate* and *not very good*. Housing conditions was used alongside two other measures of socioeconomic status (perceived economic strain and educational attainment). Of the three, housing conditions observed the weakest association with self-rated health. This suggests it is not an optimal measure of socioeconomic status in older populations.

3.12.4. Other measures of socioeconomic status: summary

Car ownership, poverty status, preferential insurance status, and housing conditions were used as measures of socioeconomic status. Some of these are also included in composite measures of socioeconomic status, such as the Townsend Deprivation Index[262] or the Index of Multiple deprivation.[263] However, in these studies they were used as isolated indicators. All were argued to reflect economic circumstance, and appeared to be used primarily in place of other, more traditional measures where data were reported as unavailable. All but one were dichotomised (e.g. did or did not own a car), limiting the capacity for these measures to capture variations in socioeconomic circumstance. Further limitations are also observed for measures of car ownership. First, car ownership may reflect more than material wealth, but also health and independence, which may compound any observed effects on health and

access to care outcomes. Second, there is evidence that car usage declines in older age,[264] and thus car ownership will likely fall too. Therefore, car ownership is not an optimal measure of socioeconomic status in older populations.

3.13. Discussion

In this section, the key findings of this critical scoping review are summarised and the considerations for future research with older populations described.

3.13.1. Key findings

A key finding of this review is that, typically, studies did not consider the limitations of applying their chosen measures of socioeconomic status in older populations, nor did they provide theoretical justifications for their measures. There were exceptions, particularly in studies of social care where debates about the best measures to capture older adults' economic circumstance were evident. Measures of socioeconomic status were thus typically chosen to capture these economic circumstances, to examine the potential for inequality in accessing paid-for social care. Measures of income, home ownership and combined wealth were common in these studies. Thus, the selection of measures was driven by the theoretical mechanism for inequality and related to the outcome. This is an important finding. The potential for inequalities in older adults' access to care and health outcomes will increase as populations age. Thus, it is critical that such inequalities are measured in the most meaningful way possible.

Measures of net combined wealth may be a promising approach to measuring socioeconomic status in older populations. These measures have the advantage of capturing a range of financial resources in later life, including wealth accumulated over the life course, whilst accounting for outgoings. This is important in older populations, whose economic circumstance may reflect a combination of sources. Even so, difficulties and sensitivities around collecting monetary information means there is potential for missing data with this measure. Strategies are thus required to optimise data collection. Measures of net combined wealth observed the strongest associations with outcomes when compared to measures of income. However, comparisons of measures were possible in a minority of studies. Further investigation could explore this by comparing measures of net combined wealth with other socioeconomic measures in terms of the strength and gradient of associations.

Measures of educational attainment were most commonly used, but also the most inconsistently conceptualised and applied. That is, educational attainment was conceptualised both within, and separate to, constructs of socioeconomic status, or not at all. This conceptual inconsistency may be symptomatic of the ambiguity of this measure in older populations. As discussed earlier, education may be an important indicator of the educational capital that can influence behavioural and lifestyle choices. However, it may not be the best approach to measuring *economic* circumstance in older populations. It is also questionable whether this measure offers any discriminatory value beyond identifying only the most advantaged, although the potential for homogeneity on this measure may vary by country. The use of measures of educational attainment may have been pragmatic (e.g. if only educational data were available). However, most studies used educational attainment alongside other measures (typically income). Therefore, the widespread but inconsistent use of educational attainment in studies of health-related inequalities in older populations must be questioned in terms of its added value and conceptual justification.

Seldom used measures were also identified: subjective individual socioeconomic status and highest educational attainment within the household. These measures may have advantages. For example, data about subjective socioeconomic status may be easy to collect, and could thus overcome problems of missing data observed for some other measures. This is promising, yet few studies used these measures and there remain two important but unanswered questions: to what extent can a subjective measure capture variation in disadvantage in older adults, and is it as good as (or better) than objective measures? Highest educational attainment in a household could overcome problems of homogenous levels of schooling in older cohorts, but rests on the assumption that older adults can benefit from younger household members' education in a way that reduces their own disadvantage. Similar arguments may also apply to couple households where educational attainment differs between partners. Further work should explore these issues in older cohorts.

Area deprivation measures, although widely used in studies of health inequalities, were used in only a minority of studies identified for this review. This may reflect the review criteria, which focused on three types of outcomes (self-rated health, social

care use and healthcare use). Area deprivation measures may be more widespread in studies examining other types of health outcomes.

3.13.2. Key considerations for future research

All measures of socioeconomic status have limitations when applied to studies of older populations, and no single measure was identified that could be considered ideal in its own right. However, as demonstrated in studies of social care use, and studies that used measures of combined net wealth, selection of measures was most meaningful when driven by the hypothesised mechanism for inequality, and related to the outcome of study. Thus, the best measures of socioeconomic status for studies of older populations are those that are most theoretically relevant. Further, selection of measures will be shaped by data availability, and thus a degree of pragmatism is necessary. In my empirical analysis, which is described in the following chapters, measures were selected based on their proposed ability to capture some element of an older person's financial resources that may determine the extent to which social care costs pose barriers to access.

A critical caveat to the outcomes of this scoping review is that the drivers of socioeconomic status are constantly changing. Thus, the nature of socioeconomic circumstance, and the best ways to measure it, will inevitably differ for future older cohorts. Changing educational, employment and home ownership opportunities in current working age populations mean that measures of these in future research could take on greater significance, or alternatively accrue further limitations. For example, it is likely that current cohorts of older adults in the UK will have income *and* assets from housing and potentially savings. Yet for younger cohorts, for whom home ownership rates are falling and pensions are obtained later,[265] economic circumstance in their later life may look very different and require an alternative measurement approach. This example is perhaps more pertinent to UK populations where home ownership is the norm. However, economic trends over time in other countries may equally determine the strength and limitations of different measures of socioeconomic status for future older populations.

Similarly, for current cohorts of older adults, most measures of socioeconomic status will not escape gender bias, with women experiencing greater financial insecurity than men.[252] Yet this gender bias may change for future cohorts of older adults as

women's educational and workforce participation matches that of men, although a considerable gender pay gap remains in the UK.[266] Thus, it is critical to regularly review and appraise the best ways to measure socioeconomic status in older populations in recognition of the continually changeable nature of this construct.

A second important consideration is that measures are context dependent. For example, the argument that education may be a largely homogenous measure in older populations, with only the most advantaged discriminated, may have more relevance for some countries than others. In the studies identified for this review, there was some evidence that there was more heterogeneity across levels of education in US samples. Samples from some European studies tended to demonstrate less variation, with larger proportions of participants concentrated in the lowest education categories. Gender bias was also observed, with larger proportions of females than males falling into the lowest education categories. Thus, the potential for homogeneity of educational attainment may be context specific. However, this is a tentative observation as data were not available from every study using a measure of education to consistently compare the spread of samples between categories of educational attainment. Even so, it is important to recognise that the potential lack of discriminatory power of educational attainment when applied to older populations may be more pertinent in some contexts than others.

Home ownership and house value offer a measure of economic circumstance in societies where home ownership is common, such as the UK. But in some high-income countries (e.g. Germany[267]), home ownership is not the norm. Inter-country and cultural differences may also be particularly relevant to measures that are based on household resources such as income. Inter-generational households for example, are more common in some ethnic groups than others. Thus, it is important to consider how household, rather than individual, measures may influence the resultant socioeconomic status, and the potential for this to be context specific.

Finally, due to the way that data were presented and/or analysed, it was not consistently possible to a) compare the strength of associations for measures *within* studies (e.g. if multiple measures were used but not standardised to facilitate comparison of an effect size within a model) and b) assess the presence of a socioeconomic gradient (e.g. if measures were dichotomised). Thus, it was not possible to say with confidence which measure was the strongest in statistical terms.

This is an important component of assessing the validity of measures in older populations. Future studies could optimise opportunities to make these assessments.

3.14. Chapter summary

This scoping review has identified and critically appraised measures of socioeconomic status that have been used in studies of health inequalities in older populations. Measures of combined net wealth may be a promising approach to capturing a range of financial resources, including those accumulated over the life course, in older populations. This approach was rarely used in the studies identified here, and could be explored in future cohort studies with older populations. Notably, similar data are available the English Longitudinal Study of Ageing[268] and the Survey of Health, Ageing & Retirement in Europe.[269] Subjective measures may overcome the challenges of measuring objective socioeconomic status, but further investigation is needed to clarify the validity of these approaches in older populations. Overall, no single approach is without limitation. Selection of measures should be driven by the hypothesised mechanism for inequality and the outcome of study, but also may be pragmatic depending on available data. This was the case for the main study of this thesis, which drew upon existing cohort data. The next chapter describes the rationale, methods and analytical approach used for this study.

Chapter 4: Rationale and Methods for Empirical Data Analysis

4.1. Chapter overview

The primary question of this research is *how does access to social care influence healthcare utilisation by older adults?* Key gaps in evidence were identified from the systematic reviews in chapter 2 regarding the influence of equitable access to social care on healthcare utilisation. To address these gaps, this study aimed to address the question, *what is the role of older adults' financial resources in the relationship between access to social care and healthcare utilisation?* Analyses were carried out using data from the Newcastle 85+ study.[270] This chapter sets out the rationale for this study and describes the methods and analytical approach used.

4.2. Rationale and study objectives

As described in Chapter 1, equitable access to social care in this research is conceptualised as those with the same level of need being able to access the same level of social care regardless of their ability to pay for such care. This applies a horizontal definition of equitable access.[99] Almost no evidence was identified about the relationship between equitable access to social care and healthcare utilisation by older adults. In light of the scope for inequitable access to social care in England and Wales,[271,272] this gap in evidence is especially critical.

The absence of evidence on this topic thus informed the focus of the main analysis of this thesis. The objective of this study was to explore the role of older adults' financial resources in the relationship between their access to social care and their healthcare utilisation, using data from the Newcastle 85+ study. In this analysis, *access* was defined as the utilisation of social care. As outlined in chapter 1, access to care is a multifaceted concept and extends beyond utilisation of care. However, for the purpose of this analysis, it was necessary to define access in terms of *utilisation* in order to explore the role of financial resources, and thus *equity* of access.

4.3. Justification of data source

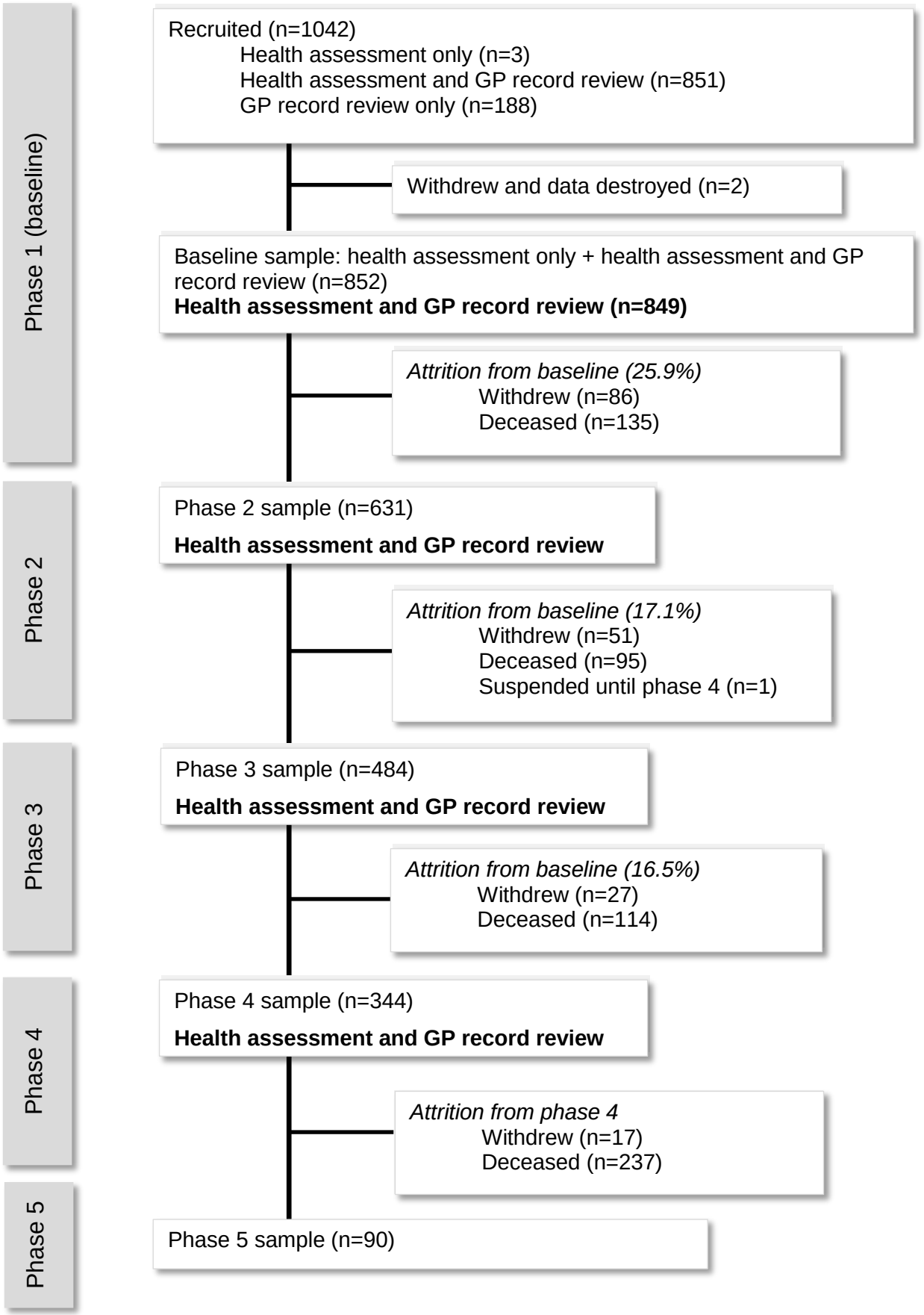
The analysis reported here used data from the Newcastle 85+ study, a longitudinal cohort dataset developed to expose the spectrum of health in the very old in the Newcastle upon Tyne area.[270,273] This dataset was selected as it contained the data required to answer the research question. That is, it contained data regarding: use of different types of social care services, healthcare utilisation outcomes (secondary and primary care), proxy measures of financial resources, and extensive data on socio-demographics, living circumstances, health, and dependency.

Other datasets were explored for analysis, including the Cognitive Function and Ageing Study (CFAS II)[274] and the English Longitudinal Study of Ageing (ELSA).[268] The CFAS II dataset is rich in information regarding older adults' health (particularly dementia and cognitive functioning). CFAS II also contains data relevant to this research question (social care utilisation, healthcare utilisation, socioeconomic status, and measures of need), and has the advantage of a larger sample size that is drawn from four regions of the UK. The ELSA study has the advantage of extensive data regarding financial resources and health, and draws upon a national sample. However, the Newcastle 85+ dataset contained more variables relating to social care usage and proxy measures of financial resources, and was thus chosen for this analysis.

4.4. Study sample

Eligible participants for the Newcastle 85+ study were those aged 85 years in 2006 and who were registered with a general practice in Newcastle upon Tyne and North Tyneside.[270] This criteria identified 1470 eligible participants from 53 participating general practices, of whom 1042 agreed to participate.[273] This represents a recruitment rate of 70.8%. Two individuals later withdrew and requested their data be destroyed, leaving a baseline sample of 1040 participants. Participant recruitment and retention at each phase is summarised in Figure 4.1. The analysis drew upon the sample of those with data available from both the health assessment interview and GP record review at baseline (n=849).

Figure 4.1 Recruitment and attrition across phases 1 to 5 of the Newcastle 85+ study



4.5. Data collection

Baseline data were collected between June 2006 and October 2007. Follow up data were collected at 18 months (2008/2009), 36 months (2009/2010), 60 months (2011/2012) and 10 years (2017/2018) post baseline.[275] Participants were interviewed in person at their place of residence (home or care home) where a research nurse conducted a health assessment interview. This interview collected data on socio-demographics, education, employment and finances, living arrangements, health and disability, medication usage, use of health and social care services, and social participation and support. Functional status tests were also administered (e.g. the Standardised Mini-Mental State Examination, hand grip strength), and biometric data obtained (e.g. blood pressure). Further, with participants' consent, data were extracted from GP records regarding diagnosed diseases, current prescriptions and GP use in the previous year. Full interview schedules and all tests administered are available at https://research.ncl.ac.uk/85plus.

A record of informed consent was obtained prior to each wave of data collection. Where the research nurse responsible for data collection judged an individual to lack capacity to give informed consent, approval was sought from a 'consultee' (close relative or carer).[270] People with cognitive impairment were not excluded from the Newcastle 85+ cohort. For participants unable to provide information due to cognitive impairment, data were collected from proxy informants. As research ethics approval was obtained for the Newcastle 85+ study at its inception, no further ethical approvals were sought for the analysis reported here.

4.6. Data selected

4.6.1. Financial resources

The previous chapter identified the challenges of measuring financial resources in older populations. No single approach is without limitations, but measures of combined net wealth with a monetary value appeared promising. Such measures were not available in the Newcastle 85+ dataset. Non-monetary proxy indicators *were* available and selected instead. These included: income sources (state pension, welfare benefits, occupational pension, private pension and savings and investments); housing tenure (social renters, private renters, owned or mortgaged) for those living in the community; the National Statistics Socio-Economic

Classification (NSSEC3), a classification of occupation when employed;[247] and deprivation score from the 2004 Indices of Multiple Deprivation.[257]

Variables describing income source were selected and used to create a classification that could identify the relative poorest in terms of income. The first category comprised those whose only income source was a state pension, with or without welfare benefits. Those in this category thus represented the relative poorest in the sample in terms of income. The second category included those with income from the state pension (with or without welfare benefits), as well as other pensions (private and/or occupational), but not savings and investments. The third category, representing the relative richest, included those with savings and investments on top of pension(s). This category thus included those with a state pension, a private and/or occupational pension, *and* savings and investments, or those with a state pension and savings and investments but no additional pensions. Those with a state pension and savings and investments, but not an occupational or private pension, were classified in the third (richest) category in order to separate non-pension capital (savings and investments) from pensions.

Occupational classification was selected as this may give an indication of lifetime earnings and current pension-related income. The NSSEC3 uses individual's main occupation when employed, and classifies people into those with routine or manual occupations, those with intermediate occupations, and those with professional or managerial occupations. Women who reported no employment were classified based on their husband's occupation. Housing tenure was selected as this is a proxy for housing wealth and discriminated between the relative poorest and richest (social renters and home owners). Finally, the area deprivation score was selected as this may give some indication of variations in area-level housing wealth and income deprivation.

As outlined in Chapter 3, each of these measures have limitations when applied to older populations. However, they were the best measures available and were combined to create a score of financial resources (see section 4.9.1).

4.6.2. Social care utilisation

Seventeen variables were available that described use of social care at baseline. Variables describing community based social care services were originally ordinal, depicting how often participants had come into contact with each service in the four weeks previous. However, due to the small numbers of participants reporting contact

with each service, these variables were recoded into binary responses. Some types of social care were distinguished based on the provider – social services, voluntary agency and private help. The latter may reflect private agency provision or privately employed help not via an agency; no further detail was available to ascertain this. One variable described participants' residency. For this, a distinction was available between those resident in a care home with nursing and those in a care home without nursing. Due to the small numbers reporting these residencies, these were combined into one category (care home residency). The remaining 16 variables described community based social care provision. Thirteen of these variables were applicable to the sample of participants not resident in a care home. Three variables (day centre visit, luncheon club use and social worker contact) were applicable to the whole sample, that is, those living in their own home and those in care home.

Where variables distinguished between social services, private and voluntary providers, these were combined into single variables (e.g. use of any social services, private or voluntary home care).

4.6.3. Healthcare utilisation

Fourteen variables describing healthcare utilisation were available at baseline. Most of these variables could be grouped into use of urgent care (e.g. emergency ambulance), and planned care (e.g. day treatment). Some variables could represent either planned or urgent care, but no distinction of this was available in the dataset. Primary care use outcomes included contacts with GP and a practice nurse/nurse practitioner (henceforth referred to as practice nurse). Measures of healthcare utilisation outcomes were binary (i.e. whether or not a service was used) and count (i.e. number of contacts or number of nights). Variables describing the number of inpatient admissions and number of A&E attendances were recoded into categorical variables (0, 1 and 2+ admissions/attendances) due to the small range of values.

Nine variables described services that could be provided by either the NHS or by social services, or which may have integrated both health and social care provision (Table 4.1). No further detail was available regarding whether these services were provided by health or social care, or whether services included both types of care. Without this detail, these variables could not be reliably positioned as either social care or healthcare. For this reason, these variables were excluded from the analysis.

One variable described use of a ‘caring for cancer’ team. However, this type of healthcare has little relevance to the research question being explored here. The premise that access to social care may influence healthcare utilisation is based on the potential for health to deteriorate if care needs are not met (thus increasing the use of healthcare), or the potential for social care to signpost individuals to relevant healthcare when needed. Use of a cancer care team is likely to be influenced by factors more relevant than access to social care. Therefore, this variable was not selected for this analysis.

Table 4.1 Services representing care that could be either provided by the NHS or social care, or integrate both types of provision

Variable	Measure
Occupational therapist contact	Binary (Yes/No)
Intermediate care contact	Binary (Yes/No)
Rapid response team contact	Binary (Yes/No)
Emergency access team contact	Binary (Yes/No)
Hospital at home contact	Binary (Yes/No)
Community stroke team contact	Binary (Yes/No)
Orthopaedic discharge team contact	Binary (Yes/No)
Community rehabilitation team contact	Binary (Yes/No)
Day hospital contact	Binary (Yes/No)

4.6.4. Covariates

Potential confounders of each social care and healthcare utilisation were selected and explored as potential covariates. These included sociodemographic variables, measures of health and dependency, and variables that would indicate informal care opportunities, social isolation and loneliness.

Sociodemographic variables selected included sex and years in education. Sex was selected given that patterns of health outcomes and healthcare utilisation differ between men and women.[276,277] Years in education was selected given the known links between educational attainment and health and disability outcomes in older age groups.[278,279] Less certain is the association between educational attainment and healthcare *utilisation*,[181] which is the outcome of interest in this study. However,

given there is some evidence to support this link, years in education was selected and explored as a covariate.

To better understand the association between social care utilisation and healthcare utilisation independent of *need*, four measures were selected that could give an indication of the capacity to benefit from care. These measures included presence of a longstanding illness disability or infirmity, self-rated health, disease count and dependency level. Presence of a longstanding illness disability or infirmity was a binary variable (yes/no). Self-rated health was measured on an ordinal scale of poor, fair, good, very good and excellent. Disease count described the number of health conditions, from a range of 18 possible disease groups, participants had, and was calculated from data derived from the GP record review and health assessment.[273] This variable has been used in previous analyses of the Newcastle 85+ dataset.[273] Dependency was measured using Isaac and Neville's Interval of Need classification, which uses information about a person's continence, cognitive status, and the interval of time between which they require help for activities of daily living.[280] This classification described four increasing levels of dependency based on the length of time an individual can maintain independence: independent, long interval (help is required less than daily), short interval (help is required daily at regular intervals), and critical (help is required 24 hours daily, at any time or as constant supervision).[276]

Some adjustment for indicators of informal support opportunities was also deemed necessary, as this may influence the use of social care and healthcare. For example, those with informal care opportunities, such as spouses or family members, may be less likely to use formal social care.[281] This may in turn influence healthcare utilisation. Indeed, some evidence indicates that those unmarried, divorced and widowed have higher risk of admission to care homes,[282] whilst being a widower has been demonstrated as a risk factor for use of home care.[283] Evidence also supports a link between living alone and increased risk of care home entry,[185] use of home care and personal care,[284] and increased risk of hospitalisation.[285] Indicators of informal care opportunities explored here were living arrangements (living alone or with others), and marital status (single, separated or divorced/widowed/married or re-married).

Finally, there is mixed evidence regarding the influence of social isolation and loneliness on older adults' healthcare utilisation.[286] A measure of loneliness was selected as a covariate to explore. This was a self-report measure comprising four

levels (never, sometimes, often, and always lonely). The indicators of informal care opportunities, marital status and living arrangements, also served as indicators of social isolation.

4.7. Recoded data

Data were recoded so that variables contained only complete data. That is, observations for all selected variables were coded as missing if participants responded 'don't know' or refused to answer, or if questions were omitted/not asked. Data from twelve participants were also recoded with respect to the variable describing whether or not they had a state pension. In this instance, data from seven participants indicated they did not have the state pension, and data from five participants indicated they were uncertain if they had this income source. It is unlikely that an individual would *not* have a state pension; only where the individual had made insufficient national insurance contributions would this be the case.[287] Married women born before 1953 who paid the lower rate of national insurance contributions (the 'small stamp') are still eligible for a state pension, but at a reduced value.[288] Data for those uncertain if they had, or reporting no receipt of, the state pension were examined to ascertain the reliability of recoding these responses:

- Five reported having a state pension at phase 4, thus it was likely they had the state pension at phase 1
- Five were resident in a nursing or care home; it is likely they were not aware they had a state pension if it was being paid directly to the home
- Three were in receipt of welfare benefits; those eligible for such payments would also be eligible for the state pension
- One individual lived in a religious order

All but the one participant living in a religious order were therefore assumed to have a state pension and their data for this variable recoded accordingly.

Data were not available for those living in a care home for the variable *living alone*. This variable was thus recoded so that care home residents were coded as not living alone.

Three variables were also re-categorised in order to be used meaningfully in the analysis. For the variable *marital status,* the categories *married* and *remarried* collapsed into single category, as were the categories *separated, divorced*, and

single, due to the small number of observations in each. *Self-reported loneliness* comprised four categories (always, often, sometimes, and never). Due to the small numbers of participations reporting they were *always* and *often* lonely, these were collapsed into a single category. This approached has been used in a previous analysis of this variable from the Newcastle 85+ dataset.[289] *Area deprivation score* was split into quintiles for the purpose of the exploratory bivariate analysis and tertiles for use in a created score of financial resources (see section 4.9.1). *Occupational classification* included a category describing those whose occupations were unclassifiable; this category was removed and only the three known classifications used (routine and manual, intermediate, professional and managerial).

4.8. Measures of social care use, healthcare use and financial resources

To examine the role of older adults' financial resources in the relationship between social care utilisation and healthcare utilisation, scores of each financial resources, social care utilisation, and healthcare utilisation were created.

4.8.1. Measure of financial resources

A score of financial resources was generated based on the variables area deprivation score, housing tenure, income classification and occupational classification, where each variable had three categories weighted as 0 (low), 1 (medium) and 2 (high) (Table 4.2). Exploratory bivariate analyses between these variables confirmed the validity of these weightings (Appendix C). These values were summed to give a score. The range of possible scores was 0-8, with higher scores reflecting greater financial resources.

Those in a care home had no data on housing tenure, which initially resulted in their exclusion from the score. In order for data from this group to be included in the overall financial resources score, scores were attributed to housing tenure for those in a care home based on their income classification score. Income classification was used as the basis for rescoring housing tenure for this group, as more complete data was available for this variable than occupational classification. That is, income classification data was available for 77 of 88 care home participants, whilst occupational classification data was available for 71 for the 88 participants. Eleven of the 88 care home participants (12.5%) had no income classification data and their housing tenure scores could not be recoded.

In order to explore the moderating role of financial resources, the score was split into three categories: low (scores 0-2) medium (scores 3-5) and high (scores 6-8) financial resources.

Table 4.2 Variables and weighting for financial resources score

Variable	Category	Weighting applied
Income classification	State pension only	0
	State pension + other pension	1
	State pension, other pension + savings	2
Housing tenure	Social renters	0
	Private renters	1
	Home owners	2
Occupational classification	Routine/manual	0
	Intermediate	1
	Managerial/professional	2
Area deprivation	High deprivation	0
	Medium deprivation	1
	Low deprivation	2

4.8.2. Measure of social care utilisation

A score of social care utilisation was created from seven binary variables describing community social care contact, and one variable describing residency in a care home (Table 4.3). Each community social care variable was given a value of 1 to indicate contact, and 0 to indicate no contact. With only these community social care variables, the highest possible score was 7. As residency in a care home could indicate a greater intensity of social care usage, the value of this variable was given a greater weighting. That is, residency in a care home was given a value of 8. These values were summed to give a score. The range of possible scores was 0-9, with nine representing those in care homes who also reported social worker contact. Due to the observed distribution of this score (see section 5.6.2), it was categorised into those reporting no social care contact (a score of 0), those reporting use of between

1 and 7 community based social care services (a score of 1-7), and those living in a care home with or without social worker contact (a score of 8 or 9).

Table 4.3 Variables and weighting for social care utilisation score

Variable	Category	Weighting applied
Warden contact	Yes	1
	No	0
Contact with any social services, voluntary, or private home care	Yes	1
	No	0
Contact with any social services, voluntary, or private day sitter	Yes	1
	No	0
Contact with any social services, voluntary, or private night sitter	Yes	1
	No	0
Contact with any social services, voluntary, or private meals provision, or luncheon club attendance	Yes	1
	No	0
Day centre attendance	Yes	1
	No	0
Social worker	Yes	1
	No	0
Residency: care home (residential or nursing)	Yes	8
	No	0

4.8.3. Measure of healthcare utilisation

A score of healthcare utilisation was generated from 14 variables describing use of primary and secondary health services (Table 4.4). Eight variables were binary (contact with the service) with a value of 1 indicating contact, and 0 indicating no contact. Six variables described the amount of care used, and were split into low, medium and high, weighted as 0, 1 and 2 respectively. These values were summed to give a score. The range of possible scores was 0-20, with higher scores representing greater healthcare utilisation.

Table 4.4 Variables and weighting for healthcare utilisation score

Variable	Category	Weighting applied
A&E Attendance	Yes	1
	No	0
NHS Direct contact	Yes	1
	No	0
Emergency ambulance	Yes	1
	No	0
Inpatient admission	Yes	1
	No	0
Outpatient attendance	Yes	1
	No	0
Day patient attendance	Yes	1
	No	0
GP contact	Yes	1
	No	0
Practice nurse contact	Yes	1
	No	0
Number of A&E attendances	Low	0
	Medium	1
	High	2
Number of inpatient admissions	Low	0
	Medium	1
	High	2
Number of outpatient visits	Low	0
	Medium	1
	High	2
Number of GP contacts	Low	0
	Medium	1
	High	2
Number of practice nurse contacts	Low	0
	Medium	1
	High	2
Length of stay	Low	0
	Medium	1
	High	2

4.9. Statistical analysis

4.9.1. Exploratory analysis

Initial univariate analysis was used to examine the scope and completeness of the data. Bivariate associations between all covariates (described in section 4.6.4) and each variable describing social care use and healthcare use were then examined. The purpose of this was to explore the characteristics associated with each type of social care and healthcare service and identify potential confounders. Covariates that demonstrated strong associations with the social care use and healthcare use variables in these exploratory analyses were selected to explore further in the main analysis. Bivariate associations between each indicator of financial resources (income classification, housing tenure, occupational classification and area deprivation) and each variable describing social care use and healthcare use were also conducted, to explore patterns in these relationships. Effect sizes and 95% confidence intervals of these bivariate associations were obtained using logistic (binary outcomes), ordinal (ordered outcomes), multinomial (non-ordered categorical outcomes) and negative binomial (skewed count outcomes) regression. Estimates are reported as the odds ratio (OR) for logistic and ordinal regression, relative risk ration (RRR) for multinomial regression, and incident rate ration (IRR) for negative binomial regression.

Further bivariate associations between each social care utilisation and healthcare utilisation variable at baseline were explored, using the relevant regression approach. The purpose of this was twofold. First, it allowed initial exploration of the relationships between each social care variable and healthcare variable prior to modelling these together in the next stage of analysis. Second, this process identified whether any variables could not be modelled due to rare outcomes. That is, where variables demonstrated very little variation in responses when, for example, most participants reported they had not used a service. Part of the relationship between social care and healthcare utilisation would likely be accounted for by need for care. To better understand the magnitude and direction of these relationships independent of need, the above analysis was repeated, adjusting for four measures of need (presence of a longstanding illness disability or infirmity, self-rated health, dependency, and disease count).

4.9.2. Main analysis

Linear regression was used first to estimate the relationship between the exposure (the social care utilisation score) and the outcome (the healthcare utilisation score) in a cross-sectional analysis of data at baseline. Covariates that were identified from the exploratory bivariate analyses were then explored by adding these to the model one at a time. Effect sizes and 95% confidence intervals were obtained to assess the size, direction and statistical certainty of the association between the scores of social care use and healthcare use. Once a main effects model was identified with all relevant covariates, the moderating role of financial resources was explored. Moderation assesses how one variable can change the relationship between another predictor variable and an outcome variable.[290] To examine this moderation, an interaction between social care utilisation (none, community, care homes) and financial resources (low/medium/high) was generated and added to the main effects model. For this interaction model, effect sizes and 95% confidence intervals were obtained to assess the size, direction and statistical certainty of the association between the scores of social care use and healthcare use according to each level of the financial resources score. All estimates for the main analysis are reported as coefficients. A likelihood ratio test was used to compare the fit of this interaction model to the model without the interaction.

Analyses were conducted on complete data, using Stata 14 and 15.[291,292]

4.10. Chapter summary

This chapter has described the rationale, methods and analytical approach for the main study of this research. In the next chapter, the findings of this analysis are presented.

Chapter 5: Findings of Empirical Data Analysis

5.1. Chapter overview

The question driving this study was: *what is the role of older adults' financial resources in the relationship between social care use and healthcare utilisation by older adults?* In this chapter, findings are presented that address this question. First, findings from the exploratory analysis about the general trend of relationships between individual variables describing financial resources, social care and healthcare use are summarised. The results of the main analysis are then presented: a model of the association between scores of each social care use and healthcare utilisation, adjusted for relevant covariates, and how this association is moderated by a score of financial resources.

5.2. Sample characteristics

Table 5.1 describes the characteristics of the study sample at baseline. A greater proportion were female (62%), widowed (58.9%) and lived alone (54.6%). A minority (12.7%) had income from only the state pension (with or without welfare benefits). Around half were classed as having routine or manual occupations (52.0%) and 63.5% were home owners. Similar proportions were observed for each area deprivation quintile, although the most deprived had the smallest proportion of participants (18.9%). Most reported having a longstanding illness, disability or infirmity (80.2%), and two fifths were classed as being independent using the need interval scale (41%). Self-rated health was mostly very good (29.7%) or good (37.6%); 18.6% rated their health fair, and a minority poor (3.5%).

Use of social care was infrequent (Table 5.2). For community dwelling participants (i.e. not living in a care home), the most commonly reported type of social care used was home care, which was reported by 20% of participants. Very few participants reported using a day sitter, a night sitter, or meals provision. Social worker contact was reported by a minority (3.9%). Most participants lived in the community in their own home (76.4%), and 13.2% lived in sheltered accommodation. A minority (10.3%) lived in a care home.

Participants' use of healthcare is summarised in Table 5.3. The majority of participants reported contact with their general practitioner (93.8%) or a practice nurse (76.4%). Around a fifth (22.0%) reported an inpatient admission, with a minority (6.2%) reporting two or more admissions. The length of stay in hospital ranged between 0 and 154 nights. Approximately one third (31.8%) reported an outpatient department visit, and treatment as a day patient was reported by 11.6% of participants. A minority of participants reported use of urgent and unplanned healthcare services such as NHS direct (1.3%), emergency ambulance (5.0%) and A&E (6.9%).

Table 5.1 Study sample characteristics at baseline

SAMPLE CHARACTERISTICS	N	%
Female	526	62.0
Marital status		
Single, separated or divorced	93	11.0
Married/re-married	254	30.1
Widowed	498	58.9
Lives alone	463	54.6
Deprivation quintile		
1 (Least deprived)	174	20.5
2	170	20.0
3	169	19.9
4	176	20.7
5 (Most deprived)	160	18.9
Income classification		
State pension only (+/- benefits)	105	12.7
Above + occupational/private pension	134	16.1
Above + savings and investments	590	71.2
Occupational classification		
Managerial or professional	272	33.9
Intermediate	113	14.0
Routine or manual	417	52.0
Housing tenure		
Social renters	258	34.0
Private renters	26	3.4
Home owners	474	62.5
Has a longstanding illness/disability/infirmity	671	80.2
Dependency		
Independent	332	41.0
Long interval	321	40.0
Short interval	95	11.7
Critical interval	62	7.7
Self-rated health		
Excellent	86	10.5
Very Good	244	29.7
Good	309	37.6
Fair	153	18.6
Poor	29	3.5
Self-reported loneliness		
Always/often lonely	83	10.0
Sometimes lonely	286	34.4
Never lonely	462	55.6

Table 5.2 Social care use at baseline

SOCIAL CARE USE		N	%
Warden[a]		89	84.76
Any home care		151	17.87
Social services home care		102	13.47
Voluntary agency home care		5	0.66
Private home care		58	7.66
Any day sitter		7	0.83
Social services day sitter		4	0.53
Voluntary agency day sitter		5	0.66
Private day sitter		2	0.26
Any night attendant		4	0.47
Social services night attendant		3	0.40
Voluntary agency night attendant		2	0.26
Private night attendant		3	0.40
Any meals provision of luncheon club		103	12.16
Social service meals provision		27	3.57
Voluntary agency meals provision		8	1.06
Private meals provision		18	2.51
Luncheon club		58	6.86
Day centre		33	3.91
Social worker		33	3.92
Residency	Own home	648	76.42
	Sheltered accommodation	112	13.21
	Care home	88	10.38

[a]For those living in sheltered accommodation

Table 5.3 Healthcare use at baseline

HEALTHCARE USE		N	%
Inpatient stay		187	22.08
Contacted NHS direct		11	1.31
Used emergency ambulance		42	4.95
A&E attendance		58	6.86
Outpatient attendance		267	31.75
Day patient treatment		98	11.64
GP contact		796	93.76
Nurse practitioner/ practice nurse contact		649	76.44
Number of inpatient admissions			
0		660	78.11
1		133	15.74
2-10		52	6.15
Number of A&E attendances			
0		788	93.25
1		52	6.15
2-4		5	0.59
	Median[a]	**Range**	**IQ range**
Length of stay in hospital (nights)	0	0 – 154	0
Number of outpatient visits	0	0 – 38	1
Number of GP contacts	5	0 – 39	6
Number of practice nurse contacts	2	0 – 24	3

[a]Median and IQR reported due to skew of distribution

5.3. Patterns of financial resources and social care use

A clear picture of the relationship between financial resources and social care use is central to understanding not only equitable access to care, but also how financial resources may moderate the association between social care use and healthcare use in the later analysis. Bivariate analyses were used to explore the associations between each proxy indicator of financial resources and each social care variable. The objective here was to understand these relationships independent of the outcome (healthcare utilisation), before proceeding with the main analysis. In this section, the findings from this analysis are summarised.

Tables 5.4 - 5.8 detail these bivariate associations. This analysis demonstrates that those in the lowest categories of the financial resources indicators (social renters, routine and manual occupations, state pension only, highest deprivation quintile) were typically more likely to use social care services, compared to those in the

highest categories. This was not consistent across every type of social care and every indicator of financial resources. Where outcomes were rare (e.g. day sitting, night attendant and meals services), some associations could not be modelled.

The strongest associations were observed for housing tenure and income classification. For example, compared to home owners, social renters were three times more like to use social services home care (OR=3.15, CI: 2.03, 4.87) and almost three times more likely to use voluntary agency home care (OR=2.79, CI: 0.46, 16.79). Social renters were also five times more likely to use private (OR=5.38, CI:1.91, 15.11) and voluntary agency meals services (OR=5.62, CI: 1.13, 28.04), and twice as likely to use a luncheon club (OR=2.02, CI: 1.16, 3.51). Compared to those in the highest income classification, those with only a state pension were 3.5 times more likely to use social services home care (OR=3.52, CI: 2.02, 6.13), three times more likely to use a day centre (OR=3.00, CI: 1.36, 6.61), and almost three times as like to report social worker contact (OR=2.69, CI: 1.14, 6.36). Those with only a state pension were also nearly three times more likely to live in sheltered accommodation (IRR=2.74, CI: 1.56, 4.81) and six times more likely to live in a care home (IRR=6.68, CI: 3.74, 11.96).

This demonstrates a trend that fewer financial resources were associated with a greater likelihood of using most of the types of social care examined here. This pattern in all likelihood reflects greater levels of morbidity and need in lower socioeconomic groups. This pattern also indicates some potential for financial resources to moderate any association between social care use and healthcare use. In the next section, the bivariate relationships between financial resources and healthcare use is summarised.

Table 5.4 Bivariate associations between indicators of financial resources and social services, private and voluntary agency home care, and warden contact

INDICATOR OF FINANCIAL RESOURCES	Social Services Home Care[a]			Private Home Care[a]			Voluntary Agency Home Care[a]			Warden Contact[a]		
	OR[b,c]	95% Lower CI	95% Upper CI	OR[b,c]	95% Lower CI	95% Upper CI	OR[b,c]	95% Lower CI	95% Upper CI	OR[d,c]	95% Lower CI	95% Upper CI
Deprivation quintile												
1 (Least deprived)	Ref			Ref			Ref			Ref		
2	0.86	0.42	1.76	0.47	0.21	1.06	NA			0.69	0.14	3.53
3	0.97	0.48	1.93	0.73	0.36	1.51	1.09	0.15	7.85	0.52	0.11	2.39
4	1.62	0.86	3.04	0.5	0.23	1.10	0.53	0.05	5.89	0.68	0.16	2.84
5 (Most deprived)	1.88	0.98	3.62	0.31	0.11	0.85	NA			NA		
Income classification												
State pension only	3.52	2.02	6.13	1.36	0.61	3.01	NA			1.73	0.35	8.66
+ occupational/private pension	1.44	0.81	2.58	0.76	0.34	1.75	1.21	0.13	10.91	1.15	0.29	4.67
+ savings and investments	Ref			Ref			Ref			Ref		
Occupational classification												
Managerial or professional	Ref			Ref			Ref			Ref		
Intermediate	1.63	0.78	3.39	0.61	0.22	1.66	0.83	0.09	8.09	1.41	0.22	8.99
Routine or manual	2.19	1.30	3.70	1.03	0.57	1.86	0.23	0.02	2.20	1.68	0.45	6.26
Housing tenure												
Social renters	3.15	2.03	4.87	1.31	0.75	2.28	2.79	0.46	16.79	0.71	0.08	6.17
Private renters	1.96	0.64	5.98	1.11	0.25	4.90	NA			0.38	0.03	5.17
Home owners	Ref			Ref			Ref			Ref		

[a]In four weeks previous; [b]Logistic regression; [c]NA indicates association could not be modelled

Table 5.5 Bivariate associations between indicators of financial resources and social services, private and voluntary agency day sitter, and day centre attendance

INDICATOR OF FINANCIAL RESOURCES	Social Services Day Sitter[a]			Private Day Sitter[a]			Voluntary Agency Day Sitter[a]			Day Centre[a]		
	OR[b,c]	95% Lower CI	95% Upper CI	OR[b,c]	95% Lower CI	95% Upper CI	OR[b,c]	95% Lower CI	95% Upper CI	OR[b,c]	95% Lower CI	95% Upper CI
Deprivation quintile												
1 (Least deprived)	Ref			Ref			Ref			Ref		
2	NA			NA			1.11	0.07	17.84	2.81	0.73	10.80
3	0.54	0.05	6.00	1.02	0.06	16.44	2.18	0.20	24.32	2.48	0.63	9.75
4	0.53	0.05	5.88	NA			1.06	0.07	17.15	3.07	0.82	11.54
5 (Most deprived)	NA			NA			NA			2.26	0.56	9.21
Income classification												
State pension only	NA			NA			NA			3.00	1.36	6.61
+ occupational/private pension	NA			NA			1.20	0.13	10.82	0.66	0.19	2.25
+ savings and investments	Ref			Ref			Ref			Ref		
Occupational classification												
Managerial or professional	Ref			Ref			Ref			Ref		
Intermediate	0.83	0.09	8.09	2.51	0.16	40.59	0.62	0.07	5.63	2.47	0.70	8.71
Routine or manual	NA			NA			NA			3.13	1.17	8.23
Housing tenure												
Social renters	1.84	0.26	13.16	NA			1.84	0.26	13.16	1.35	0.65	2.81
Private renters	NA			NA			9.4	0.82	107.19	2.11	0.46	9.61
Home owners	Ref			Ref			Ref			Ref		

[a]In four weeks previous; [b]Logistic regression; [c]NA indicates association could not be modelled

Table 5.6 Bivariate associations between indicators of financial resources and social services, voluntary and private night attendant, and social worker contact

INDICATOR OF FINANCIAL RESOURCES	Social Services Night Attendant[a]			Private Night Attendant[a]			Voluntary Agency Night Attendant[a]			Social Worker Contact[a]		
	OR[b,c]	95% Lower CI	95% Upper CI	OR[b,c]	95% Lower CI	95% Upper CI	OR[b,c]	95% Lower CI	95% Upper CI	OR[b,c]	95% Lower CI	95% Upper CI
Deprivation quintile												
1 (Least deprived)	Ref			Ref			Ref			Ref		
2	NA			1.04	0.06	16.77	NA			1.03	0.25	4.19
3	1.08	0.07	17.49	1.02	0.06	16.44	1.01	0.06	16.34	1.81	0.52	6.31
4	1.06	0.07	17.15	NA			NA			1.50	0.42	5.41
5 (Most deprived)	NA			NA			NA			3.43	1.08	10.86
Income classification												
State pension only	NA			3.59	0.32	40.07	NA			2.69	1.14	6.36
+ occupational/private pension	NA			NA			NA			1.48	0.58	3.81
+ savings and investments	Ref			Ref			Ref			Ref		
Occupational classification												
Managerial or professional	Ref			Ref			Ref			Ref		
Intermediate	1.25	0.11	13.97	2.51	0.16	40.59	2.51	0.16	40.59	1.03	0.35	2.99
Routine or manual	NA			0.69	0.04	11.03	NA			0.64	0.29	1.46
Housing tenure	Ref											
Social renters	NA			3.69	0.33	40.94	NA			1.18	0.50	2.76
Private renters	1.08	0.07	17.49	NA			NA			2.71	0.58	12.60
Home owners	1.06	0.07	17.15	Ref			Ref			Ref		

[a]In four weeks previous; [b]Logistic regression; [c]NA indicates association could not be modelled

Table 5.7 Bivariate associations between indicators of financial resources and social services, private and voluntary meals provision, and luncheon club attendance

INDICATOR OF FINANCIAL RESOURCES	Social Services Meals[a]			Private Meals[a]			Voluntary Agency Meals [a]			Luncheon Club[a]		
	OR[b,c]	95% Lower CI	95% Upper CI	OR[b,c]	95% Lower CI	95% Upper CI	OR[b,c]	95% Lower CI	95% Upper CI	OR[b,c]	95% Lower CI	95% Upper CI
Deprivation quintile												
1 (Least deprived)	Ref			Ref			Ref			Ref		
2	0.88	0.23	3.34	0.55	0.10	3.03	NA			0.91	0.34	2.40
3	1.55	0.48	4.99	0.81	0.18	3.67	1.64	0.27	9.94	1.66	0.70	3.94
4	1.51	0.47	4.86	1.62	0.45	5.85	1.06	0.15	7.65	1.46	0.61	3.51
5 (Most deprived)	1.09	0.29	4.13	1.37	0.34	5.57	0.67	0.06	7.53	1.79	0.75	4.27
Income classification												
State pension only	1.02	0.29	3.49	0.95	0.21	4.22	NA			1.49	0.72	3.08
+ occupational/private pension	0.45	0.10	1.95	0.63	0.14	2.80	0.80	0.09	6.67	1.02	0.48	2.15
+ savings and investments	Ref			Ref			Ref			Ref		
Occupational classification												
Managerial or professional	Ref			Ref			Ref			Ref		
Intermediate	3.02	1.06	8.55	3.43	0.75	15.60	0.83	0.09	8.09	1.36	0.63	2.94
Routine or manual	1.09	0.42	2.84	2.57	0.71	9.29	0.92	0.20	4.13	0.84	0.46	1.53
Housing tenure												
Social renters	1.59	0.70	3.59	5.38	1.91	15.11	5.62	1.13	28.04	2.02	1.16	3.51
Private renters	4.61	1.23	17.30	NA			NA			1.38	0.31	6.13
Home owners	Ref			Ref			Ref			Ref		

[a]In four weeks previous; [b]Logistic regression; [c]NA indicates association could not be modelled

Table 5.8 Bivariate associations between indicators of financial resources and residency

INDICATOR OF FINANCIAL RESOURCES	Residency					
	Sheltered accommodation			Care home		
	RRR[a,b,c]	95% Lower CI	95% Upper CI	RRR[a.b,c]	95% Lower CI	95% Upper CI
Deprivation quintile						
1 (Least deprived)	Ref			Ref		
2	1.93	0.88	4.23	4.24	1.53	11.74
3	2.25	1.05	4.84	3.30	1.16	9.40
4	3.18	1.53	6.61	3.86	1.37	10.82
5 (Most deprived)	5.21	2.51	10.80	12.15	4.60	32.12
Income classification						
State pension only (+/- benefits)	2.74	1.56	4.81	6.68	3.74	11.96
+ occupational/private pension	1.87	1.10	3.16	2.89	1.56	5.34
+ savings and investments	Ref			Ref		
Occupational classification						
Managerial or professional	Ref			Ref		
Intermediate	2.08	1.04	4.17	1.88	0.84	4.21
Routine or manual	2.54	1.51	4.26	2.13	1.17	3.86

[a]Multinomial regressions, base outcome=own home; [b]NA indicates association could not be modelled; [c]No association with housing tenure as no data for those in a care home

5.4. Patterns of financial resources and healthcare use

The premise of this study is that financial resources may moderate the association between older adults' use of social care and their use of healthcare, because social care typically requires older adults to pay for some or all of their care. It is also important to examine the relationship between financial resources and healthcare use. In England, use of healthcare may not vary by financial resources for the reasons it may do for social care; unlike social care in England, healthcare is free at the point of use. Nonetheless, understanding any patterns in the associations between financial resources and healthcare use may assist with interpreting the findings of the main analysis. This section therefore summarises findings about the bivariate associations between each proxy indicator of financial resources and each healthcare utilisation variable.

Tables 5.9 - 5.12 detail these bivariate associations. Most associations between the indicators of financial resources and the healthcare use variables were small in magnitude. Some exceptions were observed: those with routine and manual occupations were twice as likely as those with professional and managerial occupations to report NHS Direct contact (OR=2.30, CI: 0.47, 11.15) and use an emergency ambulance (OR=2.28, CI: 1.02, 5.11). There was also little consistency in the *direction* of association across indicators of financial resources for most healthcare use outcomes. The exception was practice nurse contact and number of practice nurse contacts. That is, across all four indicators of financial resources, those in the lowest categories (state pension only, social renters, routine and manual occupations, high area deprivation) were less likely than those in the highest categories to report a practice nurse contact and have a lower rate of contacts. Again, however, these associations were typically small in size.

Two points can be drawn from this analysis. First, there is an inconsistent picture about the direction of associations between the proxy indicators of financial resources and different types of healthcare use in this sample. Second, associations were typically small, suggesting that any association between a broader score of financial resources and healthcare use in the main analysis may also be small. This might suggest that if a score of financial resources moderates an association

between social care use and healthcare utilisation, it may reflect a link with social care use, rather than with healthcare use.

Table 5.9 Bivariate associations between indicators of financial resources and emergency healthcare use

INDICATOR OF FINANCIAL RESOURCES	NHS Direct Contact[a]			Emergency ambulance[a]			A&E Attendance[a]			Number of A&E attendances[a]		
	OR[b,c]	95% Lower CI	95% Upper CI	OR[b,c]	95% Lower CI	95% Upper CI	OR[b,c]	95% Lower CI	95% Upper CI	OR[d,c]	95% Lower CI	95% Upper CI
Deprivation quintile												
1 (Least deprived)	Ref			Ref			Ref			Ref		
2	0.52	0.09	2.85	0.79	0.29	2.16	0.69	0.29	1.66	0.69	0.29	1.66
3	0.77	0.17	3.51	0.79	0.29	2.18	0.62	0.25	1.52	0.61	0.25	1.52
4	0.49	0.09	2.72	1.10	0.44	2.79	1.25	0.58	2.68	1.24	0.58	2.67
5 (Most deprived)	NA			1.10	0.43	2.84	1.02	0.45	2.30	0.95	0.41	2.18
Income classification												
State pension only	1.62	0.33	7.92	1.26	0.51	3.14	0.66	0.25	1.71	0.67	0.26	1.74
+ occupational/private pension	1.26	0.26	6.15	1.32	0.59	2.98	1.06	0.52	2.17	1.10	0.54	2.25
+ savings and investments	Ref			Ref			Ref			Ref		
Occupational classification												
Managerial or professional	Ref			Ref			Ref			Ref		
Intermediate	1.21	0.11	13.45	1.21	0.36	4.11	0.84	0.32	2.19	0.83	0.32	2.17
Routine or manual	2.30	0.47	11.15	2.28	1.02	5.11	1.17	0.63	2.16	1.12	0.60	2.08
Housing tenure												
Social renters	0.68	0.18	2.60	0.71	0.32	1.55	0.69	0.36	1.33	0.63	0.32	1.24
Private renters	NA			1.63	0.36	7.32	1.68	0.48	5.89	1.67	0.48	5.83
Home owners	Ref			Ref			Ref			Ref		

[a]In three months previous; [b]Logistic regression; [c]NA indicates association could not be modelled; [d]Ordinal regression

Table 5.10 Bivariate associations between indicators of financial resources and inpatient admission, outpatient and day patient attendance

INDICATOR OF FINANCIAL RESOURCES	Inpatient admission[a]			Outpatient Attendance[a]			Daypatient attendance[a]			Number of inpatient admissions[a]		
	OR[b,c]	95% Lower CI	95% Upper CI	OR[b,c]	95% Lower CI	95% Upper CI	OR[b,c]	95% Lower CI	95% Upper CI	OR[d,c]	95% Lower CI	95% Upper CI
Deprivation quintile												
1 (Least deprived)	Ref			Ref			Ref			Ref		
2	0.77	0.47	1.27	0.76	0.49	1.20	0.98	0.55	1.77	0.75	0.46	1.23
3	0.73	0.44	1.20	0.84	0.54	1.32	0.64	0.34	1.22	0.72	0.44	1.19
4	0.82	0.50	1.33	0.86	0.55	1.33	0.47	0.24	0.93	0.83	0.51	1.35
5 (Most deprived)	0.63	0.37	1.06	0.58	0.36	0.93	0.49	0.24	0.99	0.61	0.36	1.03
Income classification												
State pension only	1.24	0.76	2.02	0.62	0.38	1.01	0.81	0.40	1.63	1.24	0.77	2.02
+ occupational/private pension	1.22	0.78	1.89	0.84	0.56	1.26	1.11	0.63	1.97	1.21	0.78	1.87
+ savings and investments	Ref			Ref			Ref			Ref		
Occupational classification												
Managerial or professional	Ref			Ref			Ref			Ref		
Intermediate	1.26	0.73	2.15	0.78	0.48	1.27	0.82	0.42	1.60	1.25	0.73	2.16
Routine or manual	1.36	0.93	1.99	1.08	0.78	1.50	0.69	0.43	1.10	1.36	0.93	1.99
Housing tenure												
Social renters	1.24	0.86	1.78	0.85	0.61	1.18	0.73	0.46	1.18	1.27	0.88	1.83
Private renters	1.47	0.60	3.59	1.01	0.44	2.32	0.25	0.03	1.87	1.55	0.64	3.78
Home owners	Ref			Ref			Ref			Ref		

[a]In three months previous; [b]Logistic regression; [c]NA indicates association could not be modelled; [d]Ordinal regression

Table 5.11 Bivariate associations between indicators of financial resources and GP contact, practice nurse contact, and number of contacts

INDICATOR OF FINANCIAL RESOURCES	GP Contact[a]			Practice Nurse Contact[a]			Number of GP Contacts[a]			Number of Practice Nurse Contacts[a]		
	OR[b,c]	95% Lower CI	95% Upper CI	OR[b,c]	95% Lower CI	95% Upper CI	IRR[d,c]	95% Lower CI	95% Upper CI	IRR[d,c]	95% Lower CI	95% Upper CI
Deprivation quintile												
1 (Least deprived)	Ref			Ref			Ref			Ref		
2	1.10	0.42	2.93	0.86	0.50	1.49	0.80	0.68	0.94	0.96	0.76	1.20
3	0.71	0.29	1.74	0.72	0.42	1.23	0.87	0.74	1.02	0.91	0.72	1.14
4	1.01	0.39	2.61	0.64	0.38	1.09	0.89	0.76	1.05	0.84	0.67	1.05
5 (Most deprived)	0.53	0.22	1.24	0.39	0.23	0.64	0.77	0.65	0.92	0.79	0.63	1.00
Income classification												
State pension only	0.91	0.39	2.10	0.31	0.20	0.49	1.05	0.89	1.23	0.74	0.59	0.94
+ occupational/private pension	0.90	0.42	1.92	0.67	0.43	1.04	0.85	0.73	0.99	0.95	0.78	1.17
+ savings and investments	Ref			Ref			Ref			Ref		
Occupational classification												
Managerial or professional	Ref			Ref			Ref			Ref		
Intermediate	0.64	0.31	1.33	0.90	0.52	1.57	0.96	0.81	1.15	0.91	0.72	1.15
Routine or manual	1.85	0.97	3.55	0.72	0.49	1.05	0.97	0.86	1.09	0.98	0.84	1.15
Housing tenure												
Social renters	0.84	0.45	1.54	0.71	0.48	1.05	0.97	0.86	1.10	0.88	0.75	1.02
Private renters	0.75	0.17	3.35	0.51	0.21	1.26	0.89	0.65	1.22	0.74	0.49	1.11
Home owners	Ref			Ref			Ref			Ref		

[a]In year previous; [b]Logistic regression; [c]NA indicates association could not be modelled; [d]Negative binomial regression

Table 5.12 Bivariate associations between indicators of financial resources and number of outpatient visits and length of stay

INDICATOR OF FINANCIAL RESOURCES	Number of outpatient visits[a]			Length of stay (nights)[d]		
	IRR[b,c]	95% Lower CI	95% Upper CI	IRR[b,c]	95% Lower CI	95% Upper CI
Deprivation quintile						
1 (Least deprived)	Ref			Ref		
2	1.23	0.81	1.88	0.79	0.33	1.85
3	0.77	0.50	1.19	0.78	0.33	1.83
4	0.71	0.46	1.10	1.03	0.44	2.40
5 (Most deprived)	0.66	0.42	1.05	1.78	0.75	4.24
Income classification						
State pension only	0.42	0.25	0.68	1.64	0.71	3.78
+ occupational/private pension	0.74	0.50	1.09	1.92	0.90	4.09
+ savings and investments	Ref			Ref		
Occupational classification						
Managerial or professional	Ref			Ref		
Intermediate	0.66	0.41	1.05	1.72	0.70	4.22
Routine or manual	0.80	0.58	1.09	2.12	1.13	3.98
Housing tenure						
Social renters	0.73	0.53	1.00	2.02	1.11	3.67
Private renters	1.22	0.57	2.62	1.53	0.32	7.24
Home owners	Ref			Ref		

[a]In previous three months; [b]Negative binomial regression; [c]NA indicates association could not be modelled; [d]In previous year

5.5. Patterns of social care and healthcare use

Bivariate analyses were also used to explore associations between each social care use variable and healthcare use variable. This was important for two reasons. First, examining each pair of social care and healthcare variables revealed which were amendable to modelling. Second, these analyses permitted an assessment of what each individual association looked like, and whether there were any patterns across these, before combining each set of social care and healthcare variables into scores for the main analysis. As described in Chapter 3, these bivariate analyses were repeated, adjusting for presence of a longstanding illness disability or infirmity, self-rated health, dependency, and disease count, in order to examine what these associations looked like independent of need. These analyses are reported in the tables in Appendix D, and two key findings summarised here.

First, a trend was observed where those in care homes were less likely to use, or had a lower rate of use, of most types of healthcare after adjusting for measures of need. The outcomes odds of GP contact and rate of GP contacts were the exception. A much less consistent picture was observed regarding the size and direction of associations between the remaining social care services and each type of healthcare use outcome. For all healthcare use outcomes, some types of social care were associated with a greater odds of the outcome, and others a lower odds. However, there was no pattern as to which types of social care were positively or negatively associated with each outcome.

Second, many of these associations could not be modelled due to the rarity of responses to some types of social care and healthcare. Where pairs of variables could be modelled, confidence intervals were in some cases very wide. Again, this was due to the rarity of responses. This inability to model some outcomes prompted the use of a score based approach for the main analysis. This meant that all social care and healthcare variables could be used in a score of each, without the limitations associated with rare outcomes. These scores are described next.

5.6. Scores of financial resources, social care use and healthcare use

As detailed in Chapter 4, scores of each financial resources (moderator), social care use (exposure), and healthcare use (outcome) were created. This section describes these scores.

5.6.1. Financial resources

Using the variables income classification, housing tenure, occupational classification and area deprivation tertile, a score of financial resources was available for 812 (95.6%) participants. Low, medium and high financial resources were observed for 20.6%, 37.4%, and 42.0% of the sample respectively (Figure 5.1).

Figure 5.1 Proportion of participants with a score of low, medium and high financial resources at baseline

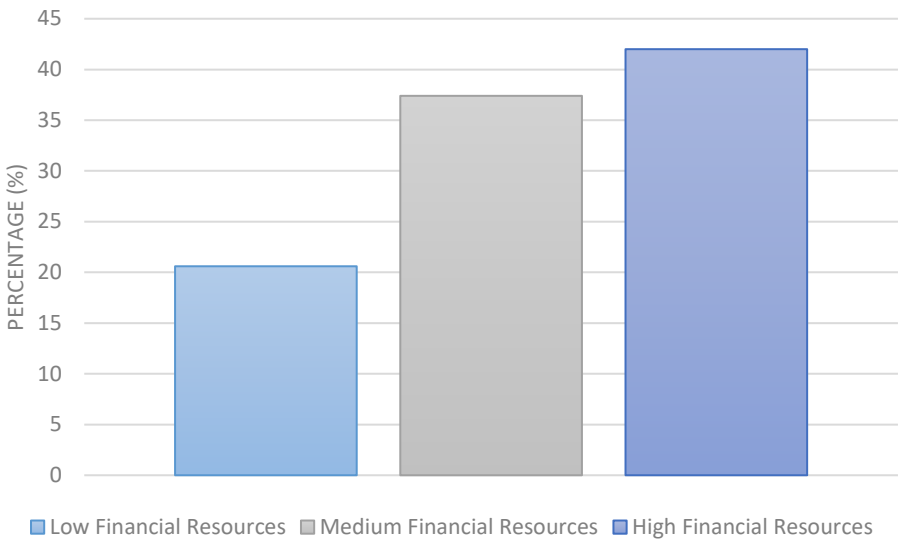
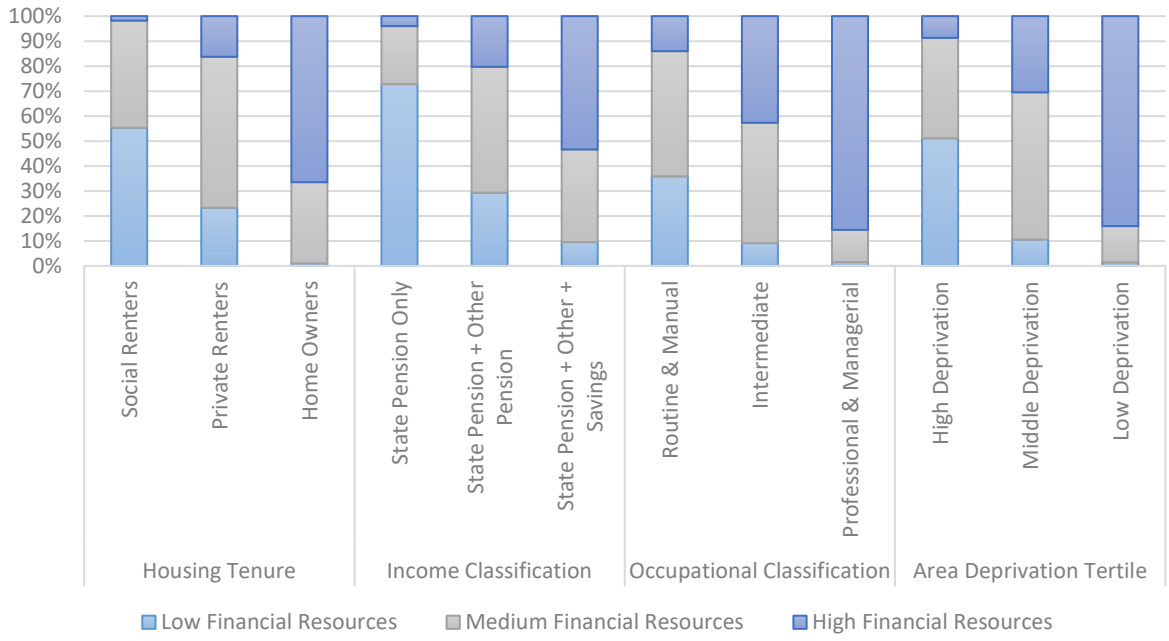


Figure 5.2 summarises the proportion of participants in each category of the variables income classification, housing tenure, occupational classification and area deprivation tertile that were captured by each level of the financial resources score. The low financial resources category captured 72.7% of those with only a state pension, compared to 9.5% of those in the highest income classification. The low category also captured 55.3% of social renters compared to 1.0% of home owners, and 35.8% of those with routine or manual occupations compared to 1.5% of those with professional and managerial occupations. This category also included 51.1% of those living in the highest area deprivation tertile, compared to 1.4% of those in the lowest area deprivation tertile.

By contrast, the high financial resources category captured 53.4% of those in the highest income classification compared to 4.0% of those with only a state pension, and 66.5% of home owners compared with 1.8% of all social renters. The high category also included 85.6% of all those with professional and managerial occupations compared to 14.0% of those with routine and manual occupations, and

84.0% of those living in the lowest area deprivation tertile compared to 8.7% of those in the highest. This pattern confirmed that the financial resources score held a high degree of validity. That is, the low scores (0-2) and high scores (6-8) best represented the expected groups of the four proxy variables comprising this measure.

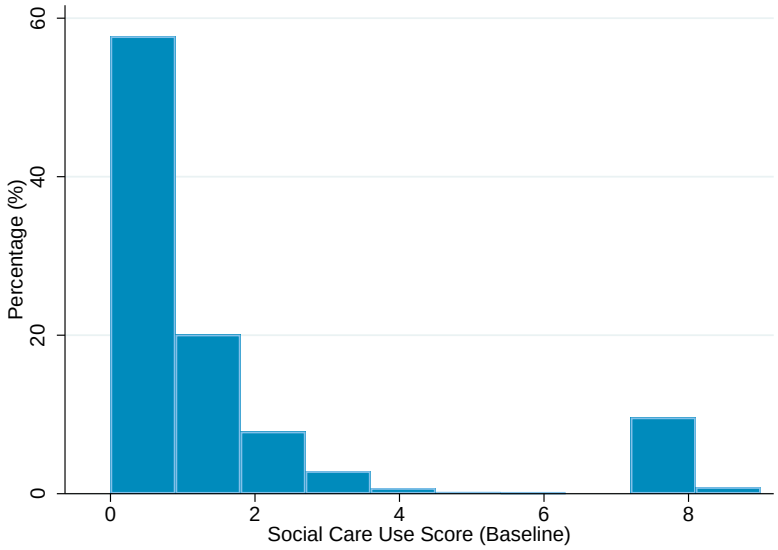
Figure 5.2 Proportion of participants in each variable comprising low, medium and high financial resources



5.6.2. Social care use

A score of social care use was available for 842 participants (99.2% of the baseline sample). This score demonstrated a bimodal distribution (Figure 5.3). The first distribution contains those reporting no social care use, and those reporting use of between 1 and 7 community social care services. The second distribution is accounted for by those living in a care home, with or without social worker contact, who were given a greater weighting in the scoring approach (see Chapter 4). This score was thus split into those with no social care contact (a score of 0), those reporting use of between 1 and 7 community social care services, and those living in a care home with or without social worker contact (a score of 8 or 9). Using this split, 57.7% reported no social care use, 31.8% reported use of the community social care services, and 10.5% lived in a care home.

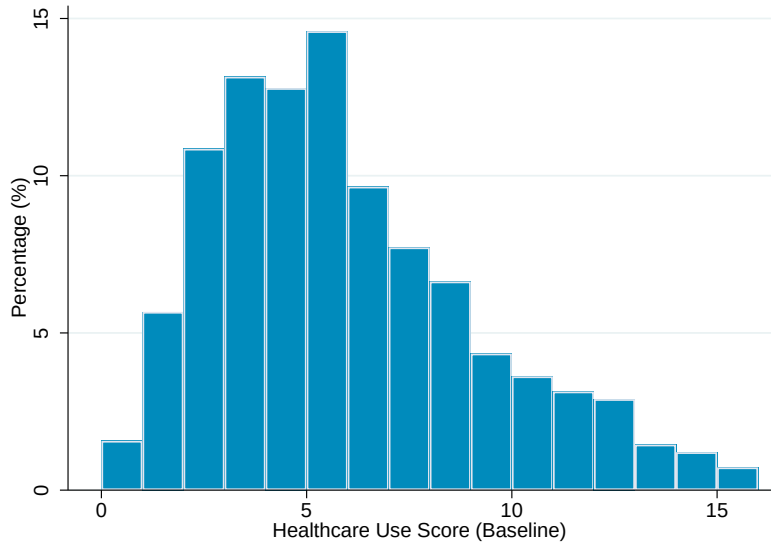
Figure 5.3 Distribution of the social care use score at baseline



5.6.3. Healthcare use

A score of healthcare use was available for 829 (97.6%) participants (Figure 5.4). The range of observed scores was 0-16, out of a maximum possible score 20. A minority (1.6%) scored 0, and 0.1% scored the highest observed score, 16. The mean healthcare use score was 5.47 (SD=3.24).

Figure 5.4 Distribution of healthcare use score at baseline



These scores were used as the basis for examining the role of financial resources in the association between social care use and healthcare utilisation; the findings of this analysis are described next.

5.7. Association between social care use and healthcare use

In the following sections, findings are presented to address the key question driving this study: what is the role of older adults' financial resources in the association between social care use and healthcare utilisation by older adults.

First, the association between social care use and healthcare use was estimated in a main effects model. The main effects model was developed by adding and assessing each potential covariate one at a time, in three groups in the following order: *measures of need for healthcare* (presence of a long-standing illness, disability or infirmity, and self-rated health); *socio-demographics* (sex and years in education); and *indicators of loneliness, isolation and informal care opportunities* (self-reported loneliness, marital status and living arrangements). Covariates were explored in these groupings in order to identify potential co-linearity. These variables were selected as potential covariates based on their hypothesised confounding influence on the outcome, as described in Chapter 4, and/or because they demonstrated some association with healthcare utilisation in exploratory bivariate analyses (Appendix E).

Tables 5.13 - 5.15 show the results of this model building process: each linear regression model of the association between social care use and healthcare use, with each covariate added in sequence. To understand the relative strength of the association in each model, standardized beta coefficients are also provided alongside the unstandardized coefficients in tables 5.13 - 5.15. The description below refers to the unstandardized coefficients unless otherwise specified.

Model 1 estimates the association between social care use and the healthcare use score, with no adjustments for covariates. Compared to those not using social care, those using community social care demonstrated greater healthcare use (coef= 0.59, CI: 0.11, 1.07), whilst those in care homes had lower healthcare use (coef= -1.45, CI: -2.21, -0.69). Model 2 modelled this association again, adjusting for the financial resources score. After this adjustment, the association between each type of social care (community and care homes) and healthcare use retained the same direction. However, the coefficient for community social care increased (coef= 0.69, CI: 0.19, 1.20) whilst the coefficient for care homes decreased in size (coef= -1.24, CI: -2.10, -0.38). This indicates that financial resources attenuated the association between social care and healthcare use. Compared to those with the lowest financial resources, healthcare use was greater for those with greater financial resources

(high financial resource coef= 0.50, CI: -0.14, 1.14; medium financial resources coef= 0.05, CI: -0.59, 0.68).

Models 3-9 in tables 5.13 – 5.15 show the subsequent adjustment of each covariate sequentially. The addition of covariates *presence of a long-standing illness, disability or infirmity, self-rated health, sex* and *marital status* improved overall model fit and accounted for some outcome variance by reducing the size of other estimates. They were thus retained and formed the main effects model (model 8, table 1.15). *Years in education, living arrangements* and *self-reported loneliness* did not improve model fit and appeared to account for little outcome variance. These variables were, therefore, omitted.

As shown in tables 5.13 - 5.15, the coefficients for the association between each level of the social care score and healthcare use remained relatively stable with each adjustment, indicating the final main effects model was robust. In this main effects model, greater healthcare use was observed for those using community social care compared to those not using any social care (model 8: coef= 0.64, CI: 0.14, 1.15). By contrast, care home residency was associated with lower healthcare use (model 8: coef= -0.85, CI: -1.84, 0.14). Next, the analysis explored if and how financial resources moderated these associations.

Table 5.13 Linear regression of association between social care use and healthcare use (outcome), with each added covariate in sequence (main effects models 1-3)

PREDICTOR	Model 1					Model 2					Model 3				
	Beta	Coef	95% Lower CI	95% Upper CI	Adj. R^2	Beta	Coef	95% Lower CI	95% Upper CI	Adj. R^2	Beta	Coef	95% Lower CI	95% Upper CI	Adj. R^2
Social care use					0.03					0.02					0.04
None		Ref					Ref					Ref			
Community	0.09	0.59	0.11	1.07		0.10	0.69	0.19	1.20		0.08	0.58	0.08	1.09	
Care home	-0.13	-1.45	-2.21	-0.69		-0.10	-1.24	-2.10	-0.38		-0.11	-1.33	-2.23	-0.42	
Financial resources															
Low		-					Ref					Ref			
Medium		-				0.01	0.05	-0.59	0.68		0.01	0.08	-0.56	0.71	
High		-				0.08	0.50	-0.14	1.14		0.08	0.51	-0.13	1.14	
Longstanding illness, disability or infirmity		-				-					0.13	1.06	0.49	1.63	
Self-rated health											-				
Excellent		-				-					-				
Very good		-				-					-				
Good		-				-					-				
Fair		-				-					-				
Poor		-				-					-				
Female		-				-					-				
Years in education		-				-					-				
Living alone		-				-					-				
Marital status															
Married		-				-					-				
Single, separated or divorced		-				-					-				
Widowed		-				-					-				
Loneliness															
Never lonely		-				-					-				
Sometimes lonely		-				-					-				
Often/always lonely		-				-					-				

Table 5.14 Linear regression of association between social care use and healthcare use (outcome), with each added covariate in sequence (main effects models 4-6)

	Model 4					Model 5					Model 6				
PREDICTOR	**Beta**	**Coef**	**95% Lower CI**	**95% Upper CI**	**Adj. R^2**	**Beta**	**Coef**	**95% Lower CI**	**95% Upper CI**	**Adj. R^2**	**Beta**	**Coef**	**95% Lower CI**	**95% Upper CI**	**Adj. R^2**
Social care use					0.05					0.06					0.06
None		Ref					Ref					Ref			
Community	0.08	0.55	0.05	1.06		0.09	0.59	0.09	1.09		0.09	0.61	0.10	1.11	
Care home	-0.07	-0.98	-1.96	-0.01		-0.07	-0.89	-1.86	0.08		-0.07	-0.94	-1.93	0.04	
Financial resources															
Low		Ref					Ref					Ref			
Medium	0.04	0.27	-0.37	0.91		0.04	0.28	-0.35	0.92		0.04	0.28	-0.35	0.92	
High	0.12	0.78	0.14	1.43		0.11	0.74	0.09	1.38		0.12	0.78	0.09	1.46	
Longstanding illness, disability or infirmity	0.11	0.87	0.29	1.45		0.10	0.83	0.25	1.41			0.89	0.30	1.47	
Self-rated health															
Excellent	-0.21	-2.25	-3.64	-0.86		-0.22	-2.38	-3.77	-0.99		-0.22	-2.36	-3.75	-0.97	
Very good	-0.25	-1.75	-3.03	-0.48		-0.26	-1.86	-3.13	-0.59		-0.26	-1.85	-3.11	-0.58	
Good	-0.24	-1.63	-2.88	-0.37		-0.26	-1.71	-2.96	-0.46		-0.26	-1.75	-3.00	-0.50	
Fair	-0.08	-0.70	-2.01	0.60		-0.09	-0.77	-2.08	0.53		-0.09	-0.78	-2.08	0.52	
Poor		Ref					Ref								
Female		-				-0.09	-0.60	-1.06	-0.13		-0.08	-0.55	-1.01	-0.08	
Years in education		-				-					-0.00	-0.00	-0.14	0.13	
Living alone		-				-					-				
Marital status															
Married		-				-					-				
Single, separated or divorced		-				-					-				
Widowed		-				-					-				
Loneliness															
Never lonely		-				-					-				
Sometimes lonely		-				-					-				
Often/always lonely		-				-					-				

Table 5.15 Linear regression of association between social care use and healthcare use (outcome), with each added covariate in sequence (main effects models 7-9)

	Model 7					Model 8[a]					Model 9				
PREDICTOR	**Beta**	**Coef**	**95% Lower CI**	**95% Upper CI**	**Adj. R^2**	**Beta**	**Coef**	**95% Lower CI**	**95% Upper CI**	**Adj. R^2**	**Beta**	**Coef**	**95% Lower CI**	**95% Upper CI**	**Adj. R^2**
Social care use					0.06					0.07					0.07
None		Ref					Ref					Ref			
Community	0.08	0.56	0.04	1.07		0.09	0.64	0.14	1.15		0.09	0.58	0.07	1.09	
Care home	-0.06	-0.85	-1.86	0.17		-0.06	-0.85	-1.84	0.14		-0.07	-0.99	-2.00	0.03	
Financial resources															
Low		Ref					Ref					Ref			
Medium	0.04	0.28	-0.36	0.91		0.05	0.32	-0.32	0.96		0.05	0.32	-0.32	0.96	
High	0.11	0.71	0.07	1.36		0.12	0.79	0.14	1.44		0.11	0.74	0.09	1.39	
Longstanding illness, disability or infirmity	0.10	0.83	0.25	1.42		0.09	0.74	0.16	1.33		0.09	0.72	0.13	1.30	
Self-rated health															
Excellent	-0.23	-2.40	-3.80	-1.00		-0.23	-2.39	-3.78	-0.99		-0.22	-2.33	-3.72	-0.93	
Very good	-0.27	-1.87	-3.15	-0.60		-0.27	-1.88	-3.15	-0.61		-0.26	-1.85	-3.12	-0.58	
Good	-0.26	-1.72	-2.97	-0.46		-0.25	-1.69	-2.95	-0.44		-0.25	-1.68	-2.93	-0.43	
Fair	-0.10	-0.81	-2.12	0.49		-0.09	-0.74	-2.04	0.56		-0.09	-0.77	-2.07	0.54	
Poor		Ref					Ref								
Female	-0.09	-0.63	-1.12	-0.14		-0.07	-0.50	-1.00	0.00		-0.08	-0.54	-1.04	-0.04	
Years in education		-					-					-			
Living alone	0.01	0.08	-0.43	0.60			-					-			
Marital status		-													
Married		-					Ref					Ref			
Single, separated or divorced		-				-0.09	-0.92	-1.76	-0.09		-0.09	-0.99	-1.83	-0.16	
Widowed		-				-0.02	-0.13	-0.68	0.41		-0.05	-0.32	-0.89	0.24	
Loneliness															
Never lonely		-					-					Ref			
Sometimes lonely		-					-				0.06	0.41	-0.11	0.93	
Often/always lonely		-					-				0.07	0.79	-0.01	1.59	

[a]Chosen as main effects model

5.8. The moderating role of financial resources

To explore the moderating role of financial resources in the association between social care use and healthcare use, an interaction was fitted between social care (none, community, care home) and financial resources (low, medium, high) in the main effects model. Table 5.16 and Figure 5.5 summarise the results of this model, and the findings described below.

Compared to those not using social care with low financial resources: those using community social care demonstrated greater healthcare use, but only for those with low (coef=0.61, CI: -0.50, 1.73) and medium (coef=0.22, CI: -1.14, 1.57) financial resources. *Lower* healthcare use was observed for those using community social care with high financial resources (coef= -0.12, CI: -1.50, 1.26). Care home residency was associated with lower healthcare use across low (coef= -0.56, CI: -2.22, 1.10) medium (coef= -0.10, CI: -2.42, 2.21) and high financial resources (coef= -1.08, CI: -3.69, 1.52). Finally, more healthcare use was observed for those with greater financial resources who were not using social care (medium financial resources coef= 0.27, CI: -0.72, 1.25; high financial resources coef= 0.87, CI: -0.08, 1.82).

The wide confidence intervals indicate substantial statistical uncertainty in these associations. However, the pattern of findings indicates that the association between social care use and healthcare use is different for those with the most financial resources. That is, those with the most financial resources who were not social care users demonstrated more healthcare use than those with the least financial resources. Those with the most financial resources who were using community social care or care homes used *less* healthcare. Even so, the pattern of this interaction does not appear particularly strong (Figure 5.5). That is, the size and direction of the associations between social care use and healthcare use differed across low, medium and high financial resources, but not to a considerable degree. The overlap of confidence intervals also indicates that no interaction is possible. Confidence intervals were particularly wide for the care home category; this may reflect the small numbers of participants in this group. Financial resources may, therefore, exert only a weak moderating influence.

A likelihood ratio test indicated this model was not a statistically significant better fit than the main effects model (chi^2=1.11, p=0.89). Thus, whilst the interaction model

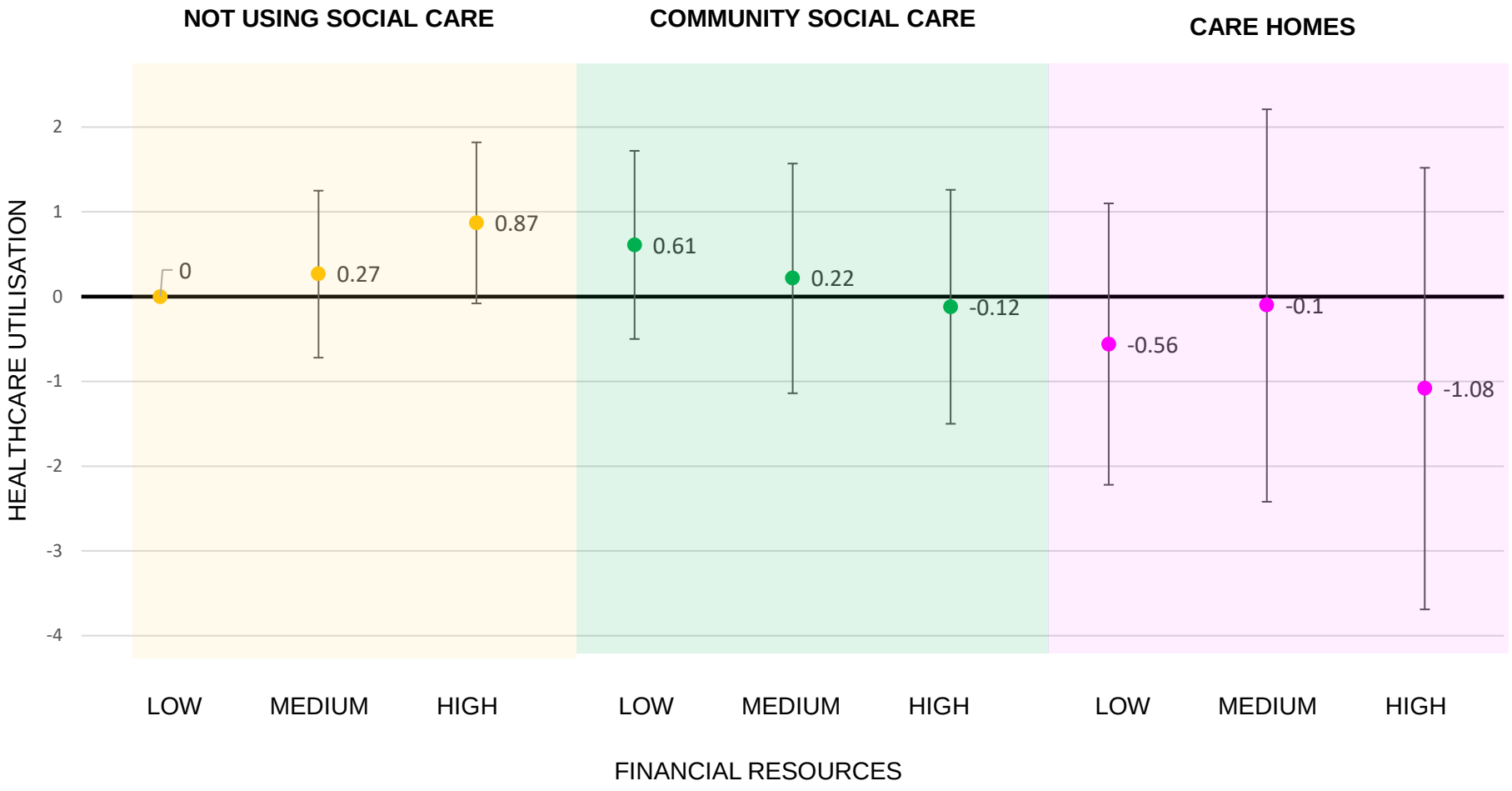
can offer some insight into the possible role of older adults' financial resources, the interpretation of these findings should be made with caution.

Table 5.16 Linear regression of association between social care use and healthcare use (outcome), moderated by financial resources (interaction model) [a]

PREDICTOR	Beta	Coefficient	95% Lower CI	95% Upper CI	Adj. R^2
Interaction:					0.06
No social care + Low Financial resources		Referent			
No social care + Medium Financial resources	0.04	0.27	-0.72	1.25	
No social care + High Financial resources	0.13	0.87	-0.08	1.82	
Community social care + Low Financial resources	0.09	0.61	-0.50	1.73	
Community social care + Medium Financial resources	0.02	0.22	-1.14	1.57	
Community social care + High Financial resources	-0.01	-0.12	-1.50	1.26	
Care homes + Low Financial resources	-0.04	-0.56	-2.22	1.10	
Care homes + Medium Financial resources	-0.00	-0.10	-2.42	2.21	
Care homes + High Financial resources	-0.04	-1.08	-3.69	1.52	
Longstanding illness, disability or infirmity	0.09	0.73	0.14	1.31	
Self-rated health					
Excellent	-0.22	-2.41	-3.81	-1.01	
Very good	-0.27	-1.89	-3.15	-0.60	
Good	-0.25	-1.70	-2.96	-0.44	
Fair	-0.09	-0.74	-2.06	0.57	
Poor		Referent			
Female	-0.07	-0.49	-0.99	0.01	
Marital status					
Married		Referent			
Single, separated or divorced	-0.09	-0.91	-1.75	-0.07	
Widowed	-0.02	-0.14	-0.68	0.41	

[a] N=764

Figure 5.5 Interaction model: unstandardized coefficients and 95% confidence intervals for association between social care and healthcare utilisation by level of financial resources[a]



[a]Referent: No social care use + low financial resources

5.9. Chapter summary

This chapter has presented findings about the role of older adults' financial resources in the association between social care use and healthcare utilisation, using data from the Newcastle 85+ cohort.

Community social care was associated with greater use of healthcare, whilst care homes were associated with lower healthcare utilisation. Financial resources appeared to exert a small degree of influence on each of these associations; differences in the size and direction of associations were observed for those with the most financial resources. Specifically, those with the most financial resources using either community social care or care homes used less healthcare than those not using any social care. Despite this pattern, there was a large degree of statistical uncertainty for the estimates in the model, particularly the care home group. These findings should, therefore, be interpreted with caution and considered *indicative* of how older adults' financial resources may influence the relationship between their use of social care and their use of healthcare.

In the next chapter, these findings are considered in greater detail in the context of what is already known, how they can be interpreted, and what new questions may be prompted by this analysis.

Chapter 6: Discussion

6.1. Chapter overview

My research set out to address the question, *how does access to social care influence healthcare utilisation by older adults?* A series of studies were undertaken: two systematic reviews of international evidence, an analysis of a cohort dataset, and a critical scoping review. This chapter integrates the evidence generated from these studies, and sets out the key findings. These findings are situated within what is already known and key theoretical perspectives. The strengths and limitations of this work are then considered and implications for health and care policy, both in the UK and internationally, discussed. Finally, an agenda for future research is proposed with key questions prioritised.

6.2. Interpretation of key findings

Drawing upon the evidence generated through the two systematic reviews, the main analysis, and the critical scoping review, three headline findings are observed:

1. Access to social care is associated with lower demand for healthcare by older adults.
2. Taking into account need and other relevant factors, social care recipients with the greatest financial resources used the least healthcare. However, the moderating role of financial resources was weak, which may reflect a number of factors.
3. Associations between social care and healthcare utilisation were larger for care homes than community based social care.

This section discusses these three headline findings, locating and interpreting them within the context of existing evidence and theoretical perspectives. Table 6.1 summarises these key findings and interpretations set out in this chapter.

Table 6.1. Summary of headline findings and key interpretations

Headline finding 1: Access to social care is associated with lower demand for healthcare by older adults	
Studies	*Interpretation*
Systematic reviews N85+ analysis	• Receipt of social care that supports and maximises independence with activities of daily living will prevent deterioration in health and thus use of healthcare. • Social care may also substitute hospital care, in addition to providing a preventative function • The conditions and ease of access to both social care and healthcare shapes the nature of the relationship between the two. When social care is hard to access, demand on free-to-use healthcare will rise.
Headline finding 2: Taking into account need and other relevant factors, social care users with the greatest financial resources used the least healthcare. However, the role of financial resources was weak and statistically uncertain.	
Studies	*Interpretation*
N85+ analysis, critical scoping review	• Older adults with more financial resources may have greater access to social care, which in turn exerts a greater influence on healthcare use. 'Greater' access to social care may reflect the quantity of care, the quality of care or a greater degree of consumer choice and control over their care. • The weak influence of financial resources may be because: selective mortality reduces variations in socioeconomic status in older populations; the ability to pay for care does not translate to willingness to pay for care; the measure of financial resources was insufficient to capture variations; the sample may be underpowered (too small to detect subtle differences).
Headline finding 3: Associations between social care and healthcare use were larger for care homes than community based social care	
Studies	*Interpretation*
Systematic reviews N85+ analysis	• This may reflect the volume and regularity of care: community based care is episodic whilst care homes represent a more continuous form of care. • This may reflect a larger volume of evidence for care homes compared to community based social care. • Care homes may be better equipped than community forms of social care to manage health deterioration at the point that it occurs.

6.2.1. How does access to social care influence healthcare utilisation by older adults?

Headline finding 1: Access to social care is associated with lower demand for healthcare by older adults

My research indicates that access to social care has the potential to reduce demand for healthcare by older adults. Caveats are attached to this finding, which are discussed further below. Overall, however, the evidence from each of the systematic reviews and the Newcastle 85+ analysis demonstrates a pattern that supports this finding.

Evidence for this relationship was strongest and most consistent in the review of availability and supply of social care, with care home residency having the greatest impact on secondary healthcare utilisation.[293] In particular, greater availability and supply of care home beds was associated with fewer delayed discharges, hospital readmissions, shorter length of stay, and reduced healthcare expenditure. The influence of home care availability was less clear. A limited quantity of evidence from the review of social care utilisation also demonstrated that care home residency was associated with a reduced risk of hospital admission. However, evidence was mixed for other healthcare use outcomes. Finally, the analysis of Newcastle 85+ data indicated that care home residency was associated with lower healthcare utilisation, with the largest association observed for those with the most financial resources. There was a high degree of statistical uncertainty in this finding. However, the direction of this association fits with the wider pattern of evidence demonstrated in the systematic reviews.

Clearly, the relationship between access to social care and healthcare use by older adults is nuanced. Access, when defined in terms of the availability and supply of care, demonstrated a much clearer and consistent pattern than when defined in terms of its usage. This may reflect two factors.

First, the evidence regarding the availability and supply of social care was larger in quantity and more homogenous in context (i.e. most of the studies identified were carried out using English data) than the evidence of social care utilisation. By comparison, social care utilisation was examined using three different approaches

(amount, type and whether or not it was used) and within each of these approaches, the quantity of evidence per outcome was small. Between-country differences in health and social care systems may have added further heterogeneity. Thus, the clearer, more consistent, message observed for evidence about the availability and supply of social care may simply reflect the greater volume and homogeneity of evidence identified for this domain.

A second factor that may account for the more consistent evidence observed for social care availability and supply may be that utilisation of care is more susceptible to a complex web of confounding influences.[93-95] These include, for example, expectations of care;[294] receipt of informal care, which often supplements, or even replaces, formal social care provision;[295,296] and the processes of care within a care system.[297-299] Consequently, the study and measurement of utilisation of care is more complicated than the study and measurement of the mere presence of care. It may thus be reasonable to expect that evidence about social care utilisation is less consistent than evidence about social care availability and supply. Even so, the association between greater supply of social care and reduced healthcare utilisation assumes that at some point, the use of care has been realised.

To interpret the finding that greater access to social care is associated with lower healthcare demand by older adults, consideration of both the mechanisms of care, and the context in which that care takes place, is required.

Access to social care may reduce use of healthcare through two mechanisms: prevention and substitution. In terms of prevention, evidence suggests that the receipt of care that supports and maximises independence with activities of daily living prevents deterioration in health. Home care programmes, for example, can prevent functional decline.[300] Further, unmet needs relating to activities of daily living predict greater rates of hospital admissions and mortality.[64,65,67,301-304] Those living with greater independence in activities of daily living have better self-rated health.[52] There is a logical argument, therefore, that social care prevents healthcare utilisation, by preventing deterioration in health status. This interpretation would be strengthened by evidence of reduced unplanned healthcare use. Indeed, evidence from both systematic reviews demonstrated fewer, and a reduced risk of, hospital admissions and readmissions.

Substitution of hospital care for care homes may also explain the association between greater access to social care and lower healthcare utilisation.[74] This is partially supported by evidence of shorter lengths of hospital stay for areas with greater care home bed supply in the review of availability and supply. However, evidence for this outcome was limited and mixed from the review of social care utilisation.

Overall, both prevention and substitution mechanisms are possible and likely, but the context in which these mechanisms take place is equally important. Here, context refers to the systems of care, and the conditions of access imposed on these systems by welfare and health policies.[93] Such conditions of access include, for example, eligibility criteria, universalism, and means-testing. The ease of access to each social care and healthcare, set by these conditions, will inevitably influence the nature of the relationship between the two sectors.

In England and Wales, for example, limited access to social care may increase need for, and demand on, a universal, free-at-the-point-of-use health sector. By contrast, when social care has fewer barriers to access, the demand for healthcare may be lower. Thus, the mechanisms of prevention and substitution may be augmented by the conditions of access to each care system. These interpretations would be strengthened by comparative, international evidence about the relationship between access to social care and healthcare utilisation by older adults. However, whilst the review identified evidence from a number of countries, this was insufficient to make a robust comparison. Further research could compare international care systems where the conditions of access to social care and healthcare vary, and examine if and how this shapes the relationship between the two. A comparison of the four UK nations, each of which differ slightly with respect to conditions of access to social care, would offer particularly valuable evidence in this respect.

Inherent within these interpretations is the assumption of causation: that greater access to social care causes a reduction in demand for healthcare by older adults. Both the systematic reviews comprised observational studies, and the main analysis was also observational, using a cross sectional design. Causation cannot be determined from such observational designs[305] and indeed, no argument is made here that access to social care unilaterally causes healthcare utilisation outcomes. However, it is possible to *infer* from these studies that access to social care has the potential to exert some degree of influence on older adults' use of healthcare,

through the mechanisms outlined above, as well as within the context of other confounding factors. In terms of the direction of this effect, it makes more sense that greater access to social care influences healthcare utilisation, rather than the reverse. This is because, in the context of England and Wales at least, social care is subject to more access barriers than healthcare.

Confounding influences are also a key consideration in observational studies.[305] The finding that greater access to social care is associated with reduced healthcare utilisation should thus be considered in light of these other influences. To make further sense of this, it is necessary to locate this finding within Gulliford's (2002, 2003)[94,95] and Andersen's (1995)[93] models of access to care.

Throughout iterations of his work, Andersen proposed that access to care was a multi-layered concept. Healthcare systems, environmental factors, predisposing characteristics, enabling resources, need, behaviours and attitudes interact to shape access to care and the associated outcomes.[93] Gulliford and colleagues (2002, 2003) also relate this complexity, but add equity and quality as aspects of access and distinguish between the availability and take up of care. Applied here, a range of factors will influence older adults' access to social care and how this may then moderate demand for healthcare. Andersen's concepts of *enabling resources*, and *behaviours and attitudes* are particularly relevant here.

An important enabling resource to consider is that of informal care opportunities. Such unpaid care, provided by partners, adult children or others, can supplement or replace formal social care provision.[295,306] In England and Wales for example, it is estimated that 5.8 million adults provide unpaid care,[307] and that over two million adults aged over 65 years provide informal care to other older adults.[81] Receipt of informal care may influence the need for, and take up of, formal social care provision,[281,308,309] which may in turn influence healthcare use. The main analysis explored two indicators of informal care opportunities (living arrangements and marital status) and adjusted for one of these (marital status) to account for this potential confounding influence. Financial resources are also a critical enabling resource for accessing paid-for social care provision, and which may influence the relationship with healthcare use; this is discussed further in section 6.2.2.

Behaviours and attitudes are also important factors that may influence the relationship between access to social care and healthcare use by older adults. In

particular, older adults' expectations about need and how this should or could be met,[310,311] and attitudes towards paying for care,[115,116,118,119,312] may shape their decisions to use social care. This, in turn, may then shape healthcare utilisation. For example, acceptance of the need for care is closely tied to notions of relinquishing control and independence in older age.[310] Older adults, despite having a need for support for day to day independence, may resist formal care provision to maintain a sense of self-reliance.[310]

Ultimately, the finding that greater access to social care is associated with lower healthcare utilisation should not be considered an isolated relationship. Rather, it is deeply rooted in, and likely influenced by, a range of factors, as per Andersen's and Gulliford's models of access.[93-95] Despite the value of these models for understanding contextual influences, they do not clearly account for the potential interdependence between two care systems, and how access to one may shape access to and use of another. My findings indicate that this interdependence should be added to these models.

Figure 6.1 depicts the proposed theoretical advancement of these models, which is informed by my research findings and interpretations discussed here. In this revised theoretical framework of access to care, each of the factors described in Andersen's (1995) and Gulliford and colleagues' (2002, 2003) models are present for both social care and healthcare. That is, access to both social care and healthcare is influenced by environmental factors, predisposing characteristics, enabling resources, need, behaviours and attitudes. In Figure 6.1, environmental factors are summarised as care system factors because, as argued earlier, these are especially relevant for understanding these research findings.

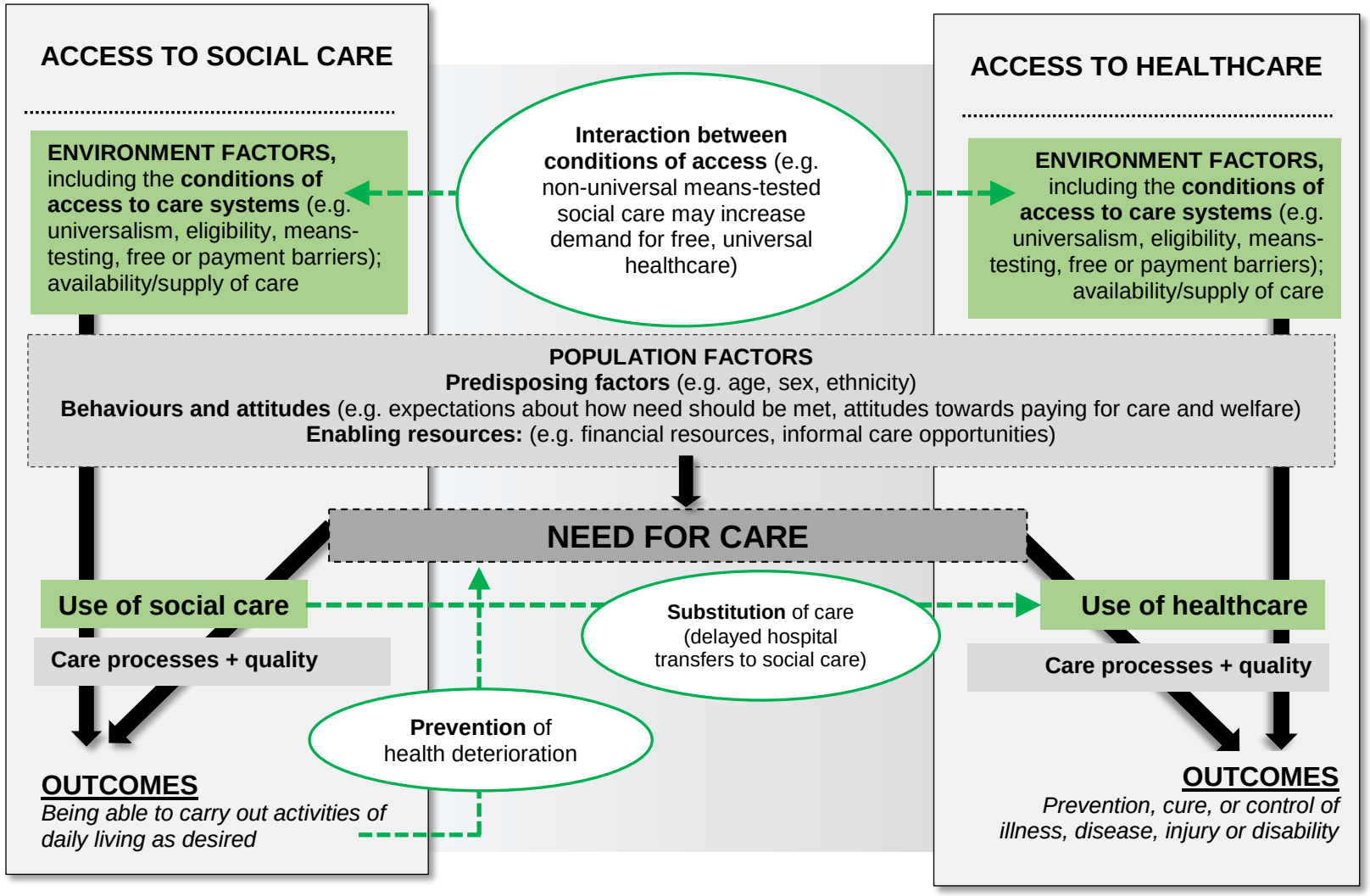
The key revision to these models reflects how these factors may interact in a way that shapes outcomes (highlighted in green in Figure 6.1). Three types of interaction are specified based on the interpretations made here regarding the mechanisms and contexts of care.

First, the role of conditions of access (e.g. means testing, universalism) to each social care and healthcare is located as an interaction between care systems. That is, a free and universal healthcare system may absorb the consequences of a social care sector with greater access barriers. Second, the role of social care in preventing health deterioration is located as an interaction between the outcomes of access to

social care and need for healthcare. Third, substitution is located as an interaction between the utilisation of social care and the utilisation of healthcare. Developing these concepts of access means that a more rounded theoretical representation of the relationship between access to social care and healthcare use is achieved.

In summary, my research demonstrates that access to social care has the potential to reduce healthcare utilisation by older adults. This may occur through mechanisms of prevention and substitution, and is shaped by systemic conditions of access to each sector. The interdependence between social care and healthcare should not be understood as an isolated interface, but one that is embedded within a wider context of factors shaping access to care. Such understandings augment existing models of access to care. Next, the discussion turns to the role of older adults' financial resources, and whether this is important for moderating the relationship between access to social care and healthcare utilisation.

Figure 6.1. The interaction between access to social care and healthcare utilisation by older adults: a development of existing models[93-95]



6.2.2. The role of older adults' financial resources

Headline finding 2: Taking into account need and other relevant factors, social care users with the greatest financial resources used the least healthcare. However, the role of financial resources was weak and statistically uncertain.

My analysis of the Newcastle 85+ dataset set out to understand the role of older adults' financial resources in the relationship between their use of social care and their use of healthcare. A pattern was observed where healthcare use was lower for social care users (both community social care users and care home residents) with the greatest financial resources compared to those with the fewest financial resources not using any social care, adjusting for measures of need and other covariates. Conversely, healthcare use was higher for *non*-social care users with greater financial resources, and community social care users with fewer financial resources. This suggests that the relationship between access to social care and healthcare use differed by older adults' financial resources. Whilst this finding may point to inequitable access to care, the moderating role of financial resources was weak (see Figure 5.4, chapter 5) and the wide confidence intervals indicate substantial statistical uncertainty. These findings must therefore be interpreted with balance and caution.

This section attempts to understand the pattern of these findings, the magnitude of the moderation effect, and the statistical uncertainty. The findings are then considered in relation to what is already known about equitable access to care for older populations.

The first consideration must be why the association between social care use and healthcare utilisation appeared to differ for people with the most financial resources in the sample. There is already evidence to support the argument that greater access to social care has the potential to reduce healthcare utilisation by older adults. The findings from this analysis also indicate this association was strongest for those with the most financial resources. Therefore, this may indicate that older adults with more financial resources have *greater* access to social care than those with the least resources. Intrinsic to this interpretation is the assumption that any moderating role of older adults' financial resources is a function of the relationship with social care use, rather than with healthcare utilisation. This is congruent with the context of the English care studied in the main analysis: social care has considerable scope for

inequitable access due to payment barriers, whilst healthcare is free at the point of use. This leads to the question of what 'greater access' to social care may look like for those with the most financial resources. Three possibilities are explored here: the amount of care, the quality of care, and the exertion of consumer choice and control over care.

In terms of the amount of care, it is reasonable to argue that one facet of greater access to social care is the volume of care used. In particular, older adults with more financial resources may be able to purchase and top up their care as needed through accessing the private care market, and thus use a greater quantity of care. Whilst there is evidence that older adults who are better off are more likely to use private care,[313,314] there is no evidence to determine whether they use a greater *quantity* of care. Even so, this may be possible. In turn, accessing a greater quantity of social care may then moderate healthcare utilisation.

There was some evidence from the systematic review of social care utilisation to demonstrate that the amount of social care was associated with lower healthcare demand. However, this evidence was specific to one type of social care (length of stay in a care home with nursing) and one outcome (risk of hospital admission). Inconsistent and limited evidence was observed for other healthcare utilisation outcomes, and there was no evidence regarding the amount of community social care used. Thus, whilst the amount of social care received may be an important component of facilitating greater access for the most financially advantaged older adults, more evidence is needed to ascertain this.

Alongside the quantity of care, the quality of care may also be an important facet of access.[93-96] That is, opportunities to purchase additional care through the private care market may also translate to accessing care that is of higher quality. However, this is a precarious assumption. In England, the adult social care market is largely privatised and profit driven,[315] and the Care Quality Commission has raised persistent concerns about the quality of care in this market, with staffing a key contributing factor.[22] Evidence also suggests that workforce instability is more problematic in the private adult social care market, compared to public providers.[316] Thus, whilst the quality of care may be an important facet of access to care,[93-96] it may not necessarily underlie *greater* access to such care.

Finally, greater access to social care for older adults with the most financial resources may reflect that they have more consumer choice and control over their care. Greater consumer choice may facilitate flexibility in tailoring care to meet needs,[317,318] which may then moderate later need for healthcare. Those without the means to top up their state-funded social care through accessing the private market would arguably have fewer choices about their care, and less control over how their needs are met. There is indeed evidence suggesting that the receipt of private care is more likely by those better off, whilst the poorest are most likely to depend on state care.[313,314]

This possibility that older adults with more financial resources are able to exercise greater consumer choice and control rests upon the assumption that older adults, or their carers, are pro-active consumers of care. Indeed, Rees Jones and colleagues (2008) argue that consumerism is inherent in later life in the UK, as older adults engage in a highly marketised care sector.[319] Yet older adults and their carers also experience difficulty navigating social care,[320,321] and exerting choice in care can be burdensome.[322,323] Economic models of consumer choice in care also challenge the assumption that greater choice results in successful decision making: the reality is far more complex.[324]

For example, the concept of consumer choice and control was central to UK policy on individual budgets and personalised, direct payments across health and social care.[325] These policies made similar arguments: that affording patients greater consumer choice and control would enable a greater fit of care to their needs.[326,327] In practice, however, consumer choice also meant increased responsibility and burden that did not consistently translate to positive outcomes.[328,329] Choice in the context of self-funding care is also compounded by the availability of, and access to information about, services.[321] Returning to the argument made here, whilst older adults with more financial resources may have the potential for greater consumer choice and control over their care, such choice may not necessarily be realised, nor result in access to care that meets their needs.

Even so, this possibility should not be ruled out. A life-course perspective would point to the fact that this particular cohort of 85 year olds from the Newcastle 85+ study were also those first to experience the emergence of consumerism in the mid to late 20th century.[319] Those with greater financial resources over the life course may, in fact, be experienced consumers, capable of navigating a care market and exploiting

choice to their advantage. Yet this assumes in later life, older adults will remain active consumers, but this may not necessarily be the case if impeded by illness.[330] Without further evidence, it is difficult to ascertain whether older adults with greater financial resources are better able to engage with care markets, and if this in turn enhances their access to social care.

Overall, if older adults with greater financial resources do indeed experience greater access to social care, a number of factors may underpin this. Evidence about the processes of accessing social care, and the socioeconomic patterning of this, may elucidate these mechanisms.

At this point in the discussion, it is important to acknowledge that these interpretations rest upon the assumption that older adults who are better off *can* and *do* use their financial resources to overcome payment barriers to social care, whilst those with the fewest resources may be more dependent on state provided care. These are not unreasonable assumptions but evidence would suggest a more complicated picture. That is, the *ability* to pay for care may not be matched by a *willingness* to pay for care. For example, there can be resistance to paying for care, especially when payment draws upon housing wealth.[116,119] The accumulated capital of home ownership in particular has been framed as a "hard-earned" source of wealth, and not one to be readily relinquished to fund care.[116 (p.58)] Some older adults may also struggle to adopt the role of a consumer in relation to social care if there are expectations, shaped over the life-course, that later life will be supported by the state.[330,331] This may be particularly relevant for the cohort of older adults in this analysis, whose lives have paralleled the emergence and development of post-war state welfare.[330]

Similarly, an *inability* to pay for care by those with fewer financial resources may not translate to immediate acceptance of state provided social care. For example, perceived stigma associated with state welfare can shape reluctance to use such support.[118,330] The key point to take from this is that whilst older adults with greater financial resources may have the means to buy care, and thus potentially experience greater access to social care, they may not readily use such resources for these purposes. Indeed, this may partly explain why the moderating role of financial resources in the relationship between social care use and healthcare utilisation appeared particularly weak.

So far, the discussion of this finding has focused on the pattern observed for the moderating role of financial resources. Next, the discussion turns to the strength of role of financial resources, and whether this is important. As described earlier, the moderating role of financial resources appeared weak. That is, the size and direction of the associations between social care use and healthcare utilisation differed according to the levels of the financial resources score, but such differences were subtle. An important reflection here is *why* the moderating role of older adults' financial resources was particularly weak in this analysis.

One interpretation may be that older adults' financial resources are not an important factor in the relationship between access to social care and healthcare utilisation. This seems unlikely in light of what is already known about the scope for inequitable access to social care.[313,332,333] A more balanced interpretation may be that whilst such resources do play a role in this relationship, they are not as important as *need* for care. In particular, financial resources may not wield a substantial influence on the relationship between access to social care and healthcare use *specifically for the oldest old.* Variations in socioeconomic position in older ages are relatively small in scale due to selective mortality in lower socioeconomic groups.[334-337] Thus, financial resources, and any potential inequity arising from variations in such, may simply exert a weaker influence in the oldest populations. Whilst the score of older adults' financial resources used in the analysis did observe some variation for this sample of 85 year olds, such variation may still be relatively small. This hints at an age-as-leveller interpretation, and presents the question of whether financial resources may exert a stronger influence in a sample of younger old people, where the effects of selective mortality may be weaker.

Another argument may be that the moderating role of financial resources was weak due to the confounding influence of other factors closely tied to this in older populations. Informal care and gender are particularly relevant in this respect. For example, there is evidence that those in lower socioeconomic groups are more likely to depend on informal caregiving.[187,192,338,339] Similarly, accumulated financial resources in older ages contain inherent gender biases due to differences between men and women in workforce participation across the life-course.[111,170] However, the analysis adjusted for both sex and an indicator of informal care opportunities (marital status). Thus, any compounding influence of these was minimised and may not be sufficient to explain the weak role of financial resources. As detailed earlier, the role

of older adults' financial resources may also be compounded by resistance to paying for care.

A further explanation concerns the measurement of financial resources in this analysis, and whether this was sensitive enough to capture variations within the sample. The concept of financial resources, as applied in this research, is situated within the construct of socioeconomic status. The critical scoping review completed as part of this work highlighted the myriad of approaches to measuring these types of financial resources and socioeconomic status more broadly in older populations. Yet no single approach is without limitations, and measuring financial resources in older populations is notoriously challenging.[170] Limited evidence from the scoping review suggested that measures of combined net wealth were promising. Such measures may capture the range of older adults' financial resources and capital (e.g. income, savings, accumulated housing wealth), whilst accounting for outgoings. These measures were not available in the Newcastle 85+ dataset, and a score of financial resources was calculated instead from proxy indicators.

This score of older adults' financial resources was based on a classification of income, housing tenure, occupational classification and the Indices of Deprivation score: each could theoretically give some indirect indication of these resources. However, it is possible that the score created was not sufficiently sensitive to capture variations in older adults' financial resources. The score did indeed demonstrate some variation, with a slight bias towards those with the most resources as expected given that most were home owners. Even so, there remains the question of whether a stronger moderating role of financial resources would be observed if a measure of combined net wealth was used. This signals an important consideration for future inquiry: measures of combined net wealth may optimise investigations into the relationship between equitable access to social care and healthcare utilisation by older adults.

A final explanation for the weak moderating role of older adults' financial resources is that the study may have been underpowered. That is, the sample may have been too small to detect the subtle differences observed. The care home sub-group sample, which observed the widest confidence intervals of estimates in the final model, was particularly small, accounting for approximately 10% of the baseline sample. The application of an interaction term will have further reduced statistical power. A larger

sample size is needed to adequately detect how these resources moderate the relationship between older adults' use of social care and their use of healthcare.

A critical part of this discussion is whether the relatively weak role of older adults' financial resources is still important. This is impossible to judge from this analysis, because the outcome cannot be judged in terms of clinical importance (e.g. days in hospital). This should be explored further in future research to estimate whether any moderating role of financial resources may create a degree of inequity in healthcare utilisation outcomes that is clinically relevant. However, what should be questioned is whether any moderating role of older adults' financial resources on the relationship between access to social care and healthcare utilisation changes in magnitude over time.

It has already been suggested earlier that a measure of financial resources may exert a stronger influence at earlier old age when the effects of selective mortality are weaker. Thus, if those with the most financial resources have greater access to care at an earlier stage of older age, do the potential benefits of this (i.e. maintaining independence, preventing health deterioration) accumulate over time and contribute to healthier longer life expectancy, and less dependence on social care, in more economically advantaged populations? This is highly speculative, but important nonetheless; future research should seek to explore this further.

A final reflection on these findings is what they can add to current evidence regarding inequities in access to care in older populations. Evidence regarding social care suggests there is indeed scope for inequitable access, although this varies depending on the type of social care used.[187,313,332,333] A less consistent picture is observed regarding evidence of inequities in access to healthcare by older populations.[180,194,340,341] Such inconsistency may reflect the type of health system investigated,[342] whether healthcare is urgent or preventative,[180,181] and difficulties adjusting for need and other factors influencing healthcare utilisation.[96]

The findings from my analysis add a tentative new dimension to this picture: inequity in access to social care may extend to the interdependency between the two sectors in the English context. Specifically, inequity in access to social care may follow through to inequitable healthcare use outcomes. As cautioned earlier, the uncertainty observed in the estimates means these findings should be considered indicative, rather than conclusive. Further evidence is needed to more confidently assert how

financial resources may shape the relationship between older adults' use of social care and healthcare.

In summary, my analysis was not able to provide a clear and confident answer to the study question. Instead, the findings can offer a preliminary picture of how older adults' financial resources may moderate the association between their access to social care and healthcare utilisation. In the absence of any other evidence about this, these findings are an important step forward.

6.2.3. The importance of the type of social care

Headline finding 3: Associations between social care and healthcare utilisation were larger for care homes than community based social care

As argued earlier, the relationship between access to social care and healthcare utilisation is highly nuanced. Another aspect of such nuance may reflect the *type* of social care, and whether this is important for moderating healthcare use. My research did not set out to compare types of social care. However, a pattern was observed regarding the impact of care homes and community social care. Specifically, care homes with and without nursing observed larger associations with healthcare use than community social care (e.g. domiciliary care). This was observed primarily in the systematic reviews. The pattern was also observed in the analysis of the Newcastle 85+ cohort, where lower healthcare utilisation was observed for those residing in care homes, and community social care users with the most financial resources. Again, however, there was much uncertainty in the estimates.

A cursory consideration of this finding may infer that care homes are better at moderating healthcare use than community based social care. An important reflection here is that care home residents have greater levels of dependency than those living in the community,[276] and are thus likely to need more healthcare. It may, therefore, be easier to detect a potential impact on healthcare in care home populations. Furthermore, care homes may observe a larger impact on healthcare use because they are *designed* for individuals with greater dependency and complexity of need. They are, therefore, better equipped to detect and manage deterioration in an older person's health when it first occurs. For example, care homes can have access to specialist health staff,[343] links to primary care,[344] and designated care protocols[345]: features that could help prevent transfer to hospital in

the event that an older person's health deteriorates. By contrast, home care is often delivered by individual or small groups of care workers working without specialist health expertise and links to primary care. If an older person's health deteriorates during a home care visit, it is more likely that they will be signposted to hospital.

Thus, the type of social care (care homes and community social care) may be important for moderating healthcare use because the populations using each are very different in terms of their health and care needs. However, as argued earlier, social care has the capacity to prevent deterioration in health through enabling independence in activities of daily living.[64,65] This applies equally to care delivered at home or in a care home. A more careful analysis of this finding may, therefore, suggest it is not simply the *type* of care that is important for moderating healthcare use (through prevention of deterioration in older people's health). In addition, the volume and regularity of care received may explain why care homes appeared to observe a greater impact on healthcare utilisation.

Community based social care is episodic, whilst residency in a care home reflects a more uninterrupted form of care. In theory, those resident in care homes should have access to staffing for assistance 24 hours a day. The reality may be somewhat different: chronic workforce pressures persist in social care both in the UK and in other countries, with retention of care staff notably problematic.[22,346] Even so, the continuous presence of care staff in care homes means that there should be more opportunities for assistance with carrying out activities of daily living (such as washing, dressing) when required. In turn, this may prevent deterioration in health that may result from difficulties undertaking these activities.[64,65]

The continuous presence of staff in care homes may also mean greater opportunities for observing the health of residents and thus more opportunity to intervene to prevent deterioration. Such continuity may also foster responsive relationships between care staff and residents, which is an important facet of high-quality care in care homes.[347,348] Thus, it may be the uninterrupted form of care in care homes, and the continuous opportunities to respond to the needs of residents, that are important for moderating healthcare use. This does, however, rest upon the assumption that care homes are sufficiently staffed. As highlighted earlier, this is not always the case.[22,346]

If the regularity of social care contact *is* important for moderating healthcare utilisation, then this should equally apply to community social care, and would support arguments for greater provision of social care to older adults in community settings. Very few studies identified in the systematic reviews examined the amount of community social care used, and it was not possible to examine the amount of each type of social care used by older adults in the main analysis. It is notable, however, that those with the most financial resources using community social care also used the least healthcare in the main analysis. This could reflect a number of factors, as discussed in the previous section. One possibility is that this group were able to purchase a greater volume of care. This would strengthen the argument that the amount of social care used is important for moderating healthcare. However, this is highly speculative given the statistical uncertainty observed in the main analysis.

Finally, the finding that care homes observed larger associations with healthcare use than community social care may simply reflect the volume of evidence identified for each type of care. Most of the evidence identified from the systematic reviews concerned the supply and use of care homes. Comparatively little evidence was identified about the supply and use of community social care. Thus, to confidently assess the influence of community social care on healthcare utilisation by older adults, future research should focus on this type of care.

To summarise, the findings of this research point to strong evidence that care homes may moderate healthcare utilisation by older adults, but less certain evidence about the potential impact of community social care. However, interpretations that care homes are more effective than community based care at moderating healthcare utilisation should be resisted. The characteristics of such care, and the populations they serve, as well as an imbalance in the volume of evidence identified, may account for this pattern. To clarify this, future research should give greater attention to the influence of community based social care, including the volume and regularity of such care.

6.3. Strengths and limitations

My research set out in this thesis represents the best attempt to answer the study question, *how does access to social care influence healthcare utilisation by older adults?* This section considers the strengths and limitations of this work, and the implications of these for understanding the study findings.

6.3.1. Systematic reviews

A major strength of the reviews is my application of Gulliford and colleagues' (2002, 2003) dimensions of access to care to guide the evidence synthesis. This was a novel application of this framework, which enabled the development of a clear picture of what is known about the relationship between access to social care and healthcare utilisation by older adults. The separation of social care availability and supply from social care utilisation is especially crucial given the two represent related but different facets of access to care. The robust approaches to the systematic reviews also ensured the high-quality of this work. Searches were broad and comprehensive to maximise capture of evidence, and clear review criteria meant evidence was context relevant (high-income countries), contemporary (published after 2000) and could be reliably interpreted in relation to the review question (adjustment for need for studies of social care utilisation). Searches were rerun twice during the period of undertaking the reviews (April 2017, May 2018) to ensure evidence was current.

Although these syntheses offer a robust picture of evidence about two facets of access to social care and healthcare utilisation, three key limitations should also be considered.

First, the inclusion of quality of social care as a domain of access in this review was experimental given the known difficulties in defining care quality,[127-129] and the absence of detail on this in Gulliford's (2002, 2003) model (see chapter 1).[94,95] Conceptualisation and measurement of social care quality varied across studies, and including these studies would have resulted in an inconsistent synthesis. Exclusion was thus necessary. However, this also means that evidence about the relationship between the quality of social care and older adults' healthcare utilisation remains ambiguous. Further research should seek to redress this, but work is needed first to agree on relevant indicators of social care quality and ensure these do not result in circular reasoning. That is, if examining the impact of social care quality on healthcare utilisation outcomes, then healthcare use outcomes must not be a quality indicator.

A second limitation concerns the comparability of social care across countries. This review focused only on studies carried out in OECD listed high-income countries.[349] The majority of included studies were carried out in the UK using English data (n=10), followed by the US (n=8), Canada (n=3), Norway and Italy (n=2 each).

Variations in systems of health and social care between countries may have introduced variation in the synthesised evidence. However, in the synthesis of studies examining the availability and supply of social care, there was a consistent pattern across most studies and no discernible pattern of evidence *between* countries. For the synthesis of studies examining social care utilisation, there was a less consistent pattern of evidence. However, there were too few studies per outcome to assess whether between-country differences accounted for this mixed pattern.

Finally, integrated health and social care services were excluded if the impact of the social care component could not be isolated. This may seem arbitrary given that, despite the administrative, financial and cultural boundaries between health and social care,[3] the two sectors are moving towards greater integration in England. However, excluding integrated services was necessary in order to isolate and identify the independent influence of social care on healthcare utilisation. The consequence of this is that the impact of social care may have been underestimated in the evidence synthesis.

6.3.2. Analysis of Newcastle 85+ dataset

My focus for the empirical analysis was informed by a critical gap in evidence identified by the systematic reviews, and thus represents an important and novel contribution. Data from the Newcastle 85+ study were used to address the study question (what is the role of financial resources in the relationship between social care use and healthcare utilisation by older adults). As detailed in Chapter 4, this dataset was chosen because it contained data relevant to the study, with a notably extensive range of indicators of health and social care use. Of the datasets available, it was considered the most appropriate to answer the research question. However, no dataset is without limitations, and a number of shortcomings were evident with the Newcastle 85+ dataset. These are set out below.

First, the dataset is over 10 years old at the point of writing, presenting questions about the generalisability of the sample to current cohorts of older adults. Comparison of sample trends at baseline (2007) with available population statistics suggests few differences, and certainly none that are particularly concerning. For example, approximately 10% of the baseline sample (aged 85) were resident in care homes. This is not dramatically different to the proportion of those aged *85 and over*

living in care homes in 2018, which Age UK estimates to be around 14%.[81] At baseline in 2007, 63.5% of the 85-year-old sample were home owners. The most recent data available are for those aged 75+ in 2012, placing home ownership at 72.9%.[350] Similarly, around 56% of the baseline sample lived alone, whilst data for 2016 indicate this living arrangement for 47.7% of those aged 75 and over.[351] Thus, whilst the sample is relatively old, it is not necessarily outdated. Key messages from this analysis are therefore relevant to current cohorts of older adults.

The conditions of access to social care have also changed since baseline data were collected in 2007, although this does not present a substantial shortcoming to the findings. The change from Fair Access to Care criteria to the 2014 Care Act criteria[352] resulted in an estimated increase of 1.6% eligible older adults.[353] Means-testing thresholds have remained the same. Thus, changes to social care eligibility that have occurred between the time of the baseline sample and the present are fairly inconsequential and arguably would not invalidate the findings of this analysis.

A more important limitation of this dataset is the absence of detailed monetary data regarding older adults' financial resources, particularly in terms of income, house value and outgoings. Such data would enable a monetary measure of net wealth, which the critical scoping review suggests would offer the most sensitive measure of older adults' economic circumstances. This represents a key limitation of the dataset for this analysis, and the non-monetary score used instead may partly account for the weak moderating role of financial resources that was observed. Another dataset (ELSA) *did* contain detailed monetary data. However, it did not offer the same breadth of social care use data as that of Newcastle 85+, which was equally necessary to undertake this analysis. For example, from wave 3, the ELSA interviews included questions for those reporting difficulties with activities of daily living about who provides help. Responses include paid help or state social care, but there is no further detail on the type of social care services used.[313] By comparison, the Newcastle 85+ dataset contained seventeen variables describing different types of social care service contact. Thus, the Newcastle 85+ dataset was deemed most appropriate to address the research question.

A further consideration of the Newcastle 85+ dataset relates to whether the main predictor variable in this dataset (social care use) can be considered truly independent of the outcome variable (healthcare utilisation). In the Newcastle 85+

study, utilisation of both health and social care were measured retrospectively. Social care use was measured for the month prior to data collection. Healthcare utilisation was measured for the previous three or twelve months, depending on the variable. Thus, it is not possible to determine the direction of the relationship between use of social care and use of healthcare. This is a limitation shared by all cross-sectional analyses.[305] However, a cross-sectional analysis was necessary to begin this investigation, in order to determine the value of a longitudinal analysis. Given the small effect sizes, statistical uncertainty and complexity of the measurement distributions at baseline, a longitudinal analysis with this dataset and sample was deemed inappropriate due to the even smaller sample size from loss to follow up.

The final limitation of this dataset is perhaps the most important: sample size. At baseline, data were available for 849 individuals, but this will have been underpowered to detect a subtle moderating role of older adults' financial resources. An interaction term fitted to the model would have had even less statistical power. This may partly account for the statistical uncertainty of the findings in this analysis. This limitation underlines why it is important to acknowledge the pattern of findings observed, despite this uncertainty. The direction of the associations between social care use and healthcare use fits with what is already in evidence, and the role of older adults' financial resources fits with what is known about the scope for inequitable access to social care. The statistical uncertainty may simply reflect an underpowered sample. Thus, a balanced interpretation argues that these findings are *suggestive* of how older people's financial resources may moderate the relationship between their use of social care and their use of healthcare. Equally, it is important to recognise the statistical uncertainty and need for further research with a larger sample.

Despite these limitations, the Newcastle 85+ dataset was considered most appropriate to answer the research question. This does, however, highlight the critical point that there was no single dataset that contained all the required data in sufficient detail to explore the relationship between (in)equitable access to social care and healthcare utilisation by older adults. In light of the importance of this topic, this gap in data signals a key area of development for future cohort studies of older populations.

6.3.3. Critical scoping review

The critical scoping review of measures of socioeconomic status used in studies of health inequalities in older populations adds a valuable component to this work. It has offered a much needed update to earlier work,[170] identified emerging approaches, and facilitated a deeper understanding of the concepts of financial resources and socioeconomic status, and the challenges of measuring these in older populations. Such critical appraisal of these challenges has informed subsequent thinking and interpretation of the main analysis of this work.

One limitation of this work should be noted. In some US studies of health disparities, 'race' is sometimes used implicitly as a measure of socioeconomic status. In the studies identified for the review, no studies were identified that explicitly used race as a socioeconomic measure, although two studies did examine race alongside socioeconomic status. Whilst the searches identified studies examining race and socioeconomic status, they did not meet the review criteria for population (aged 60+ years) and outcome (social care use, healthcare use, self-rated health). The absence of any included studies in the review using race as an implicit measure or proxy of socioeconomic status is not a major shortcoming. The purpose of this review was to facilitate critical thought about the challenges of measuring the economic aspects of socioeconomic status. This is because measuring older adults' financial resources in the context of social care payment barriers was at the crux of the analysis. By contrast, 'race', as a concept and measure goes beyond economic circumstance and encompasses complexities surrounding race and ethnicity-related inequalities. It was not, therefore, deemed necessary to the objectives of the review to pursue this further.

6.4. Implications for health and care policy

As populations age and people live longer with greater levels of disability,[354] the need to provide appropriate care is a policy priority, both in the UK and across the world.[82,355-357] Older adults may require care for needs relating to both their day to day independence as well as their health. However, these needs are not divisible. Being able to carry out activities of daily living, such as washing, dressing, shopping for groceries and cooking meals, are the foundations of good health.[52] Conversely, health deteriorates when older adults struggle to achieve these tasks.[64,65] It is, therefore, critical to recognise not only the importance of *both* social care and

healthcare in supporting healthy ageing, but also the interdependence between both care sectors. My findings would suggest that such interdependence does indeed exist; social care has the potential to moderate healthcare use. The policy implications of this are discussed below.

First and foremost, these findings support greater investment in social care. This will not only improve the quality of life for older people but also reduce demand on the health sector. In the UK, the imbalance in funding allocated to each social care and healthcare is notable. For example, in 2018, UK healthcare funding totalled 7.3% of national income; social care funding totalled 1.1%.[358] Some of this difference will be appropriate, given the wider breadth and reach of healthcare services. Even so, real term social care funding, and social care funding per head, has fallen by 8% and 13.5% respectively since 2010.[359] The number of people receiving state-funded care has dropped by 27% since 2005.[42] Yet the evidence reported here indicates that such limited access will only generate greater demand for healthcare. Simultaneously, pressure on the NHS continues to grow,[48-50] and efforts to contain avoidable use of health services are a priority for government.[51] Thus, policy makers should recognise the potential role of social care in achieving this goal. This is a particularly timely message in light of the expected social care green paper, which intends to consider policy options for the sector.[360]

The message here is not simply one of curtailing healthcare demand. If greater access to social care can moderate older adults' healthcare use, then by implication it is also supporting their independence. Thus, an investment in social care will not only benefit the health sector but also support wellbeing in later life. This is congruent with evidence that unmet social care needs predict greater rates of hospitalisation and mortality.[64,65,67] In light of recent reports about the widespread unmet social need among older adults in the UK,[43,361] this is a particularly critical message.

The finding that access to social care may reduce healthcare utilisation should also be considered in the context of UK policy moves towards greater integration between the two.[86] Specifically, it should be questioned whether greater integration between social care and healthcare could facilitate access to the former, and thus less dependency on the latter. This may depend on the nature of the integration between the two sectors. Integrated care is highly varied,[362,363] but can be broadly summarised into macro-level (integration of care systems), meso-level (integration of

services) and micro-level (integration of clinical and care processes) approaches.[364,365]

Macro-level integration that combines social care and healthcare into a single structure may facilitate greater access to social care. However, this would depend on whether the conditions of access to both types of care were also harmonised. For example, in Northern Ireland health and social care is commissioned and delivered through single trusts with shared budgets, and thus considered structurally integrated.[366] However, conditions of access are not harmonised between the two: healthcare is universal whilst means-testing and payment barriers remain for some types of social care for older adults. Home care is free for those aged 75 years and over who meet the eligibility criteria for care, whilst care home placements are still subject to fees and means-testing.[88] Thus, the extent to which macro-level integration of health and social care can facilitate access to social care may depend on whether conditions of access – particularly payment barriers and universalism – remain. Further research is needed to better understand the role of differing conditions of access to both social care and healthcare in a structurally integrated care system, and whether this shapes the nature of the relationship between the two.

Meso- and micro-level integration may facilitate greater access to social care for older adults, and thus less dependency on healthcare, by preventing *substitution of care*. A case study of Northern Ireland provides some evidence for this.[367] That is, closer working arrangements between hospital and social care staff, and the absence of funding boundaries within a single integrated trust, were thought to facilitate timelier discharge from, and transition between, hospital and social care.

Such meso- and micro-level integration may also maximise the role of social care in *preventing* deterioration in older adults' health. De Carvalho and colleagues (2017) argue that integration of health and social care at the micro-level is critical, as this is where clinical care processes can be enhanced to promote older adults' functional ability and independence.[368] However, there is no clear evidence as to whether integrated care interventions improve these sorts of outcomes.[363,369] This may reflect difficulties evaluating outcomes and the wide variation in models of integrated care.[370] Also, some have voiced concern that integrated working and care processes between health and social care professionals risks the medicalisation of social care.[371] Brown and colleagues (2003), for example, note the potential for a medical model approach to care to dominate in integrated health and social care teams.[372]

The extent to which this occurs, and whether it has any impact on a) the capacity of social care to prevent deterioration in health through promoting independence, and b) the resultant impact on older adults' healthcare use, is unknown.

In summary, the finding that greater access to social care may reduce healthcare utilisation by older adults could have important implications for integrated care. However, further evidence is needed to elucidate the nature of this relationship within the context of integration between the two sectors.

The evidence from my analysis regarding the role of older adults' financial resources is tentative, and so considerations for policy should be circumspect. Even so, it is equally important to consider these findings in light of what is already known. The requirement for most social care users to make some financial contribution towards their care, as well as the largely privatised care sector, favours greater access for those with greater financial resources. Indeed, evidence shows that those with care needs and higher incomes are more likely to access social care than those with care needs and lower incomes.[42] The pattern of findings observed in this research hints that any inequitable access to social care may follow through with inequitable healthcare use outcomes. Therefore, a balanced policy recommendation would be to urge recognition that the potential consequences of inequitable access to social care may extend to inequitable demand for and use of healthcare. In light of government efforts to curb both avoidable healthcare use and health inequalities,[373,374] these findings should be given due consideration.

In summary, there is a clear message for policy makers: greater investment in social care may curb growth in healthcare demand by older populations. Whilst this is an important and timely message, it is pertinent to recognise that public attitudes may add resistance to any policy efforts to improve access to the care sector. Notably, social care for older adults and investment in the care sector more broadly has received mixed views from the UK public. For example, whilst a free NHS funded by taxation is viewed favourably,[332,375] there is less public consensus regarding the desired coverage and public funding of social care.[376,377] Polling data from Ipsos Mori in October 2017 reported that 80% of those sampled wanted to protect the NHS from spending cuts, whilst only 27% felt the same about social care for older populations.[378]

Bottery and colleagues (2018) note there is a critical misunderstanding of the funding and costs of social care in later life amongst the UK public, and suggest this may underlie resistances to improving the sustainability of the sector.[379] Concerns around inter-generational fairness of taxation may also play a role.[380] Regardless, such resistance indicates that these research findings have relevance for both policy makers *and* the wider public. Thus, efforts should be made to communicate the messages of this work to both audiences.

A final consideration regards how these findings and interpretations may be applied to future cohorts of older populations. This requires some estimation of three 'future' factors: what the population of older adults in the UK, and their associated care needs, will look like; what older adults' financial resources may look like; and, the way in which social care will be organised and whether current barriers to access will remain.

In terms of the population, the number of older adults is expected to grow by 20% by 2024.[31,32] Future generations of older adults will live longer with greater multi-morbidity and disability,[354,381] whilst older adults' need for social care is also expected to double in the next twenty to thirty years.[276,382,383] These population trends should be considered in the context of other demographic changes that indicate fewer informal care opportunities in future older cohorts: more older people will live alone and have fewer or no children by 2039.[384] Alongside this, the financial resources of future older populations in the UK will look very different to current cohorts of older adults, with subsequent generations financially worse off than their predecessors.[385] Falling rates of home ownership across current generations[386] means this form of capital may not be widespread for the subsidisation of care home placements.[387] Stagnating wages for younger generations and the rising costs of living[388] will also limit income-related resources in older age. Retirement incomes are indeed projected to fall for future generations,[389] whilst economic inequality in the UK will widen.[390,391] The third and final 'future' factor to consider is the organisation and accessibility of social care, but this is largely unpredictable.

Thus, based on current projections, it is predicted that future older populations in the UK will have greater need for care but fewer financial resources compared to today's cohorts of older adults. If the current configuration of social care remains, it is likely that access to care will thus become even more inequitable, with potentially even greater demand falling on healthcare. This adds further strength to the argument that

greater investment in social care is needed, not only for current older populations but to enhance the sustainability of both social care and healthcare for future populations.

6.5. Future research directions

My research has addressed important questions and provided new insights into older adults' use of health and social care and the inequalities that may shape this. Equally important, however, are the new questions prompted by these findings. Three strands of inquiry are identified. These are summarised in Table 6.2 and described further below.

6.5.1. System-level interface between social care and healthcare use by older adults

One argument presented in this thesis is that the conditions of access to both social care and healthcare are important for shaping the relationship between the two. In the context of the English care system, access to social care is *not* universal and *is* means-tested, with many people expected to contribute to some or all of the costs of care. These care system barriers to access to social care may increase demand for healthcare, which in England is largely universal and free at the point of use. In other countries, where the conditions of access to social care and healthcare differ to that of England, a different relationship between the two may be observed.

International comparative work of systems of each healthcare and social care is well established (for example, see[90,340,392-397]). A new and worthwhile line of inquiry would be to compare the relationship between access to social care and healthcare utilisation by older adults across differing international systems of care (question 1.1, Table 6.2). This could also offer opportunities to examine how this relationship manifests in a more highly integrated system of health and social care (question 1.2, Table 6.2). Such international comparisons may provide valuable evidence to support and inform a social care sector in England that is both sustainable and harmonised with the public healthcare sector.

6.5.2. Service-level interface between social care and healthcare use by older adults

The main finding of this research is that greater access to social care is associated with a lower demand for healthcare by older adults. Earlier sections of this chapter have attempted to interpret and understand this relationship, and this leaves a number of unanswered but important questions as to the 'why' and 'how'. Four research questions are identified to explore and unpick the mechanisms, processes and context of the relationship between access to social care and healthcare use by older adults. These questions typically concern the interface between the two sectors at the service, rather than system, level.

As discussed earlier, the observed association between access to social care and healthcare use could reflect the capacity of social care to prevent and delay health deterioration, and the substitution of care between sectors. Further research could attempt to explore the extent to which each of these mechanisms drive this relationship (question 2.1, Table 6.2). My research was not able to determine which aspects of social care are most important for moderating healthcare use by older adults. Earlier discussion in this chapter identifies the type, amount and quality of social care as potentially important factors. Understanding which parts of the social care sector, and in what combination, have the most impact on healthcare, is similarly important (question 2.2, Table 6.2). Exploring this question would be beneficial for ensuring investment in social care is appropriately targeted.

Building on this, the review indicated that greater *availability* of social care influenced a range of healthcare use outcomes, whilst limited evidence indicated social care *utilisation* favoured just hospital admissions. The analysis of the Newcastle 85+ examined healthcare use collectively. Further research could build on this and examine which parts of the health sector are influenced most by older adults' use of social care (question 2.3, Table 6.2). Finally, the nature of the relationship between access to social care and healthcare utilisation by older adults may look different within an integrated system of care. One avenue of research could explore the extent to which integration facilitates or impedes the influence of social care on healthcare use (question 2.4, Table 6.2). This would be particularly important as care sectors move towards greater integration.

6.5.3. The role of financial resources and equitable access to care

As discussed earlier, the pattern of findings observed in this study would suggest that older adults' financial resources has the potential to moderate the association between their use of social care and their use of healthcare. This may be due to payment barriers to social care; in the analysis of Newcastle 85+ data, those with the greatest financial resources appeared to benefit the most from accessing social care by using less healthcare. Further research, using larger samples, is needed to add weight and certainty to this finding and interpretation. Three further questions may elucidate the role of financial resources in the relationship between older adults' access to social care and use of healthcare.

First, the analyses carried out here focused on a sample of those aged 85 years in 2007. As described earlier, this may have limitations as variations in financial resources may be smaller in the oldest old, due to premature mortality in lower socioeconomic groups.[335-337,398-401] This prompts a question about the role of financial resources in the association between access to social care and healthcare use by younger old age groups (question 3.1, Table 6.2). That is, those aged between 60 and 85 years, where the chances of survival among lower socioeconomic groups is higher and greater variations in financial resources may exist. The relationship between access to social care and healthcare use, and how older adults' financial resources changes this, is likely to look different in a younger old-age cohort. Greater socioeconomic variations may result in a stronger moderating role of such financial resources. This also presents the question of whether greater access to preventative social care at earlier stages of older age allows those better off to live longer.

Conversely, social care use is less frequent in the younger old.[81] Thus, whilst greater variations in financial resources may exert a stronger moderating influence, social care itself may have a weaker influence on healthcare use if it is used to a lesser degree in these younger groups. It is important to explore these to understand how inequities in access to care may differ and change over the course of old age.

A second question concerns the potential interaction between older adults' financial resources and social care use over the course of old age, and the resultant health and healthcare utilisation outcomes (question 3.2, Table 6.2). Older adults' financial resources may influence access to social care where payment barriers exist. By the same token, long-term use of social care may then deplete these resources over

time, changing their circumstances to pay for care. Further, financial resources and health are closely tied. Socioeconomic circumstance can drive health outcomes, whilst poor health can adversely impact economic circumstance through, for example, loss of employment.[182] Appreciation of this interplay between financial resources, health, and access to care could offer important insights into equitable access to care over the course of older age.

A final question concerns the influence of the English social care sector on health inequalities more broadly. Health inequalities in later life not only persist but may accumulate.[402-404] Outcomes such as self-rated health, mortality and healthy life expectancy all demonstrate socioeconomic gradients.[252] A recent review of evidence from England identified significant socioeconomic variation in a range of health outcomes in older age.[252] Evidence from this research hints at inequitable access to social care, with potential for *unequal outcomes* in healthcare use. If social care can prevent and delay deterioration in older people's health, as some evidence suggests (for example, see[52,64,65,300]), then existing health inequalities may be particularly susceptible to any inequities in access to social care. Thus, further research should explore the extent to which the English social care sector, both state and private, exacerbates or mitigates these health inequalities in older age (question 3.3, Table 6.2). Given the relative lack of evidence regarding the consequences of inequitable access to social care, this particular line of inquiry should be prioritised.

Table 6.2. Future avenues of research

(1) System-level interface between social care and healthcare for older adults 1. What does the relationship between access to social care and healthcare utilisation by older adults look like in a system where there are fewer payment barriers and greater coverage of social care? 2. What would this association look like in a system where health and social care are integrated to a greater degree than that of England?
(2) Service-level interface between social care and healthcare for older adults 1. To what extent is the relationship between access to social care and healthcare utilisation by older adults driven by substitution of care or prevention of deterioration in health? 2. What is most important about access to social care to moderate and reduce healthcare use by older adults: the type of social care, the amount, the nature of support provided, or quality? 3. Which parts of the health sector are influenced most by social care supply and use, and through what mechanisms? 4. To what extent does integration at service/system level facilitate or impede the moderating role of social care on healthcare use?
(3) Role of financial resources and (in)equitable access to social care 1. What is the role of financial resources in the association between access to social care and healthcare use for younger old age groups? 2. What is the interaction between financial resources and social care use over the course of old age, and how does this influence healthcare use? Does social care use deplete older adults' financial resources? Does this shape future use of social care? 3. To what extent does the English social care system mitigate or exacerbate health inequalities in older populations?

6.6. Contribution of this thesis to knowledge

Debates about the coverage and funding of both the NHS and adult social care in England are highly political and the subject of media discourse and rhetoric. References to the 'social care crisis' and the impact of this on the NHS are common (for example, see[20,45]). These debates assume a link between access to social care and healthcare utilisation. This relationship is typically unchallenged in public discourse, yet this is a claim with important policy implications for the funding and delivery of both health and social care. Critically, a clear picture of the evidence in support of the relationship between access to social care and healthcare utilisation by older adults was missing. My evidence syntheses conducted at the outset of this research therefore provided much-needed clarity and offer an important contribution to what is known on this topic.

These systematic reviews identified notable gaps in what is understood about the relationship between older adults' access to social care and their healthcare utilisation. Perhaps most significantly, almost no evidence was identified on equitable access to social care and healthcare utilisation outcomes. The role of financial resources in this relationship is especially relevant given that most social care systems in high-income countries are not free and require payment.[79] Therefore, my analysis of the Newcastle 85+ dataset, which explored the role of older adults' financial resources in the relationship between their use of social care and their use of healthcare, offered a novel addition to the evidence.

My interpretation of these findings has also prompted the augmentation of existing theoretical models of access to care.[93-95] My development of these models offers an original perspective to account for the interdependence between social care and healthcare. My research presented in this thesis has thus made both empirical and theoretical contributions. Finally, my work has shaped a clear research agenda for the future, with a series of questions designed to further elucidate the nature of access to social care and healthcare utilisation by older populations.

6.7. Conclusions

My research set out to address the question, *how does access to social care influence healthcare utilisation by older adults?* Findings confirmed that greater access to social care was associated with reduced healthcare utilisation. Evidence was strongest when access was defined in terms of the availability and supply of

social care, and concerned care homes. There may also exist a small degree of inequity within the relationship between access to social care and healthcare utilisation by older adults. However, further research is needed to clarify this and advance what is known about the role of older adults' financial resources in this relationship.

Overall, the message for policy makers is clear: greater investment in social care for older adults may contain demand for healthcare. As the UK contends with rising healthcare demand and the need to provide sustainable social care to older populations, the significance of this message should not be understated.

Appendices

List of appendices:

- Appendix A: Quality assessment for studies included in the system reviews (Chapter 2)
- Appendix B. Additional tables of study data for critical scoping review (Chapter 3)
- Appendix C: Bivariate analyses between indicators of financial resources (Chapter 4)
- Appendix D: Bivariate analyses between social care and healthcare use variables (Chapter 5)
- Appendix E: Bivariate analyses between covariates and relevant outcome indicators (Chapter 5)

Appendix A: Quality assessments (systematic reviews)

Table of quality assessments of included studies (review of availability and supply of social care)

Table of quality assessments of included studies (review of utilisation of social care)

Appendix table A.1. Quality assessments of included studies (review of availability and supply of social care)

Paper author and date	1. Was the research question or objective in this paper clearly stated?	2. Was the study population clearly specified and defined?	3. Was the participation rate of eligible persons at least 50%?	4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study pre-specified and applied uniformly to all participants?	5. Was a sample size justification, power description, or variance and effect estimates provided?
Bardsley 2010	Yes	Yes	Yes	The data are sourced from the populations from within three PCTs/LAs, which the authors note was opportunistic and not representative of England. The three sites differed in their geographies, and the authors note that one site included a	No sample size justification, but a large number of data observations used.

				significant population of retired individuals. Inclusion/exclusion criteria are not reported, but this may be because the selection of sites was pragmatic. A source of bias.	
Damiani 2009	Yes	Yes	Yes, all eligible data within criteria selected	Yes	No sample size justification, but large number of data observations used.
Gaughan 2013	Yes	Yes	Yes, all eligible data within criteria selected	Yes	No sample size justification, but large number of data observations used.
Gaughan 2015	Yes	Yes	Yes, all eligible data within criteria selected. However, total number of data observations this amounted to was not reported.	Administrative data used; criteria not explicitly reported but it was clear what type of data was selected (data from patients waiting for hospital discharge, where the delay is due to social care, was selected)	No sample size justification, but large number of data observations used.

Imison 2012	Yes	Yes	Yes, all eligible data within criteria selected. However, total number of data observations this amounted to was not reported.	Administrative data used, with inclusion and/or exclusion criteria applied. However, data being compared (health and social care indicators) were not concurrent (i.e. not from the same time period), presenting a significant limitation to the data.	No, and no information on total number of data observations/sample size.
Liotta 2012	Yes	Yes	Yes, all eligible data within criteria selected	Yes	No sample size justification, but large number of data observations used.
Reeves 2004	Yes	Yes	Yes, all eligible data within criteria selected. However, total number of data observations this amounted to was not reported.	Yes	No, and no information on total number of data observations/sample size.
Forder 2009	Yes	Yes	Yes, all eligible data within criteria selected	Yes	No sample size justification, but large number of data observations used.

Fernandez 2008	Yes	Yes	Yes, all eligible data within criteria selected	Yes	No sample size justification, but large number of data observations used.
Herrin 2015	Yes	Yes	Yes, all eligible data within criteria selected	Yes	No sample size justification, but large number of data observations used.
Holmas 2013	Yes	Yes	Yes, all eligible data within criteria selected	Yes	No sample size justification, but large number of data observations used.
Hunold 2014	Yes	Yes	Yes	Yes	No sample size justification, but large number of data observations used.

Appendix table A.1 continued.

Paper author and date	6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	10. Was the exposure(s) assessed more than once over time?
Bardsley 2010	No - cross sectional	No - cross sectional	Continuous	The variable, social care expenditure, is not clearly defined in relation to the analysis of interest, as the authors refer to the social care costs as including "mainly care home residents", but it is not clear what proportion this represents.	No - cross sectional
Damiani 2009	No - cross sectional	No - cross sectional	Categorical	The exposure measures are not clearly defined, and it is not clear why	No - cross sectional

				the researchers chose to combine need and LTC bed supply to create the categorical exposure variable.	
Gaughan 2013	No - cross sectional	No - cross sectional	Continuous	Yes	No - cross sectional
Gaughan 2014	No - cross sectional	No - cross sectional	Continuous	Yes	No - cross sectional
Imison 2012	No - cross sectional	No - cross sectional	Continuous	Yes	No - cross sectional
Liotta 2012	No - cross sectional	No - cross sectional	Continuous	Yes	No - cross sectional
Reeves 2004	No - cross sectional	No - cross sectional	Continuous	Yes	No - cross sectional
Forder 2009	No - cross sectional	No - cross sectional	Continuous variable	Yes	No - cross sectional
Fernandez 2008	No - cross sectional	No - cross sectional	Continuous	Yes	No - cross sectional
Herrin 2015	No - cross sectional	No - cross sectional	Categorical, as quintiles of number of care homes with nursing within 100km.	Yes	No - cross sectional
Holmas 2013	No - cross sectional	No - cross sectional	Continuous	The exposure variables were clearly defined and used consistently, but their validity as proxy variables for social care capacity should be questioned. The variables were number of home and care home receivers relative to the 80+ population in the locale, but	No - cross sectional

				this is more indicative of use rather than capacity.	
Hunold 2014	No - cross sectional	No - cross sectional	Continuous	Yes	No - cross sectional

Appendix table A.1 continued.

Paper author and date	11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	12. Were the outcome assessors blinded to the exposure status of participants?	13. Was loss to follow-up after baseline 20% or less?	14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	Any other quality issues	Overall quality judgement
Bardsley 2010	Yes	Not applicable - using administrative data	NA - cross sectional	The analysis is not described in detail but based on the data presented it can be assumed that confounders were not adjusted for.		Poor Lack of clarity about the exposure variable, and no adjustment for important confounders.
Damiani 2009	It is not clear what defines long length of stay.	Not applicable - using administrative data	NA - cross sectional	No.	Used large amount of data and/or linked multiple datasets.	Poor Exposure and outcome measures are not clearly defined. No adjustment for important confounders.
Gaughan 2013	Yes	Not applicable - using administrative data	NA - cross sectional	Yes. Age, sex, number of diagnoses, number of procedures, area	Used large amount of data and/or linked	Good All eligible data used, adjusted for

				characteristics. Analysis also used a hospital fixed effects model to "allow for unobserved factors common to patients admitted to hospital" (p.7).	multiple datasets.	numerous confounders.
Gaughan 2014	Yes	Not applicable - using administrative data	NA - cross sectional	Yes Area spill-over effects of care supply across local authorities, proportion of area population aged over 65, area deprivation, area mortality over aged 65.	Used large amount of data and/or linked multiple datasets.	Good All eligible data used, adjusted for numerous confounders.
Imison 2012	Yes	Not applicable - using administrative data	NA - cross sectional	No.		Poor All eligible data was used, but data was also non-concurrent; did not adjust for confounders.
Liotta 2012	Yes	Not applicable - using administrative data	NA - cross sectional	The authors note there was no information about health status, functional limitations and socioeconomic resources of the individuals in the	Data not reported as described. Table 3 does not report data for care home bed rates, yet this is a variable	Poor All eligible data used, but no adjustment of important confounders, and unclear reporting of the evidence.

				datasets, so variables relating to deprivation, which may influence access and HCU, were not adjusted for.	referred to in the text. "Bed rates" are reported in the table, but these are referred to separately in the text (i.e. in addition to care home bed rates) implying this is a different variable. This is a reporting issue rather than methodological limitation, but it does make it impossible to use these data as it is not clear what the data are for care home bed rates. Used large and/or multiple linked datasets.	
Reeves 2004	Yes	Not applicable - using administrative data	NA - cross sectional	Parts of analysis controlled for material deprivation.	Used large amount of data and/or multiple linked datasets.	Good All eligible data used, parts of analysis adjusted

						for material deprivation
Forder 2009	Yes	Not applicable - using administrative data	NA - cross sectional	Yes Analysis specific to over 75 population; adjusted for area age structure, rates of limiting long-standing illness, standardised mortality ratios.	Used large amount of data and/or linked multiple datasets.	Good All eligible data used, adjusted for confounders.
Fernandez 2008	Yes	Not applicable - using administrative data	NA - cross sectional	Yes Analysis adjusted for area house prices and earnings, area population income support, area population with a long-standing illness, standardised mortality rates, local authority ONS classification	Used large amount of data and/or linked multiple datasets.	Good All eligible data used and adjusted for confounders.
Herrin 2015	Yes	Not applicable - using administrative data	NA - cross sectional	Yes Area demographics, proportion of residents with increased need for support, hospital characteristics.	Used large amount of data and/or linked multiple datasets.	Good All eligible data used and adjusted for confounders.
Holmas 2013	Yes	Not applicable - using	NA - cross sectional	Unable to account for whether patients received home	Used large amount of data and/or linked	Fair All eligible data used and adjusted

		administrative data		based care before and after admission to hospital. However, the regression was able to account for age, comorbidities and number of surgical procedures.	multiple datasets.	for some important confounders but not others; proxy variables for exposure have limitations.
Hunold 2014	Yes	Not applicable - using administrative data	NA - cross sectional	Yes Sociodemographic characteristics, area population density, distance to nearest emergency department, Medicare hospitalisations.	Used large amount of data and/or linked multiple datasets.	Good All eligible data used and adjusted for confounders.

Appendix table A.2. Quality assessments of included studies (review of utilisation of social care)

Paper author and date	1. Was the research question or objective in this paper clearly stated?	2. Was the study population clearly specified and defined?	3. Was the participation rate of eligible persons at least 50%?	4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study pre-specified and applied uniformly to all participants?	5. Was a sample size justification, power description, or variance and effect estimates provided?
Reeves 2004	Yes	Yes	Yes, all eligible data within criteria selected. However, total number of data observations this amounted to was not reported.	Yes	No, and no information on total number of data observations/sample size.
Carter 2003	Yes	Yes	Records containing missing data for two or more fields were excluded (n = 6,205, 7.9%), leaving 72,319 "person quarters" available for analysis. The authors compared the excluded care homes	Data was matched across data files, and from the same period. No inclusion/exclusion criteria reported.	No sample size justification reported.

			with the included and found "the nursing homes with missing data tended to be slightly newer, serve a lighter case-mix of residents, have fewer Medicare reimbursed days as a percentage of all paid resident days, and be more likely to have recently changed ownership" (p.3). This indicates the data used may not be entirely representative. Imputation was used for records with one missing data field.		
Hutt 2011	Yes	Yes	Yes, all eligible data within criteria selected	Yes	No sample size justification reported.
Amador 2014	Yes	Yes	Yes	Yes	No sample size justification reported.
Deraas 2011	Yes	Yes	Yes, all eligible data selected and used.	Yes	No sample size justification reported.
Grunier 2012	Yes	Yes	Yes, all eligible data selected and used.	Yes	No sample size justification reported.

Sloane 2005	Yes	Yes	The recruitment rate for facilities was 59%, but it is not clear if this was 59% of all eligible, or if 59% of just those approached within the random stratified sample. Participant recruitment rate was 92%.	Yes	No sample size justification reported.
Bardsley 2012	Yes	Yes	Yes, all eligible data selected and used.	Data were taken from four primary care trusts, which differed in terms of population size and deprivation. However, all eligible data within the set inclusion criteria were selected. Still, it is not clear how representative these four PCTs are	No sample size justification reported.
Hollander 2007	Yes	Yes	Yes, all eligible data selected and used.	Yes	No sample size justification reported.
Chappell 2004	Yes	No: it is not clear from where participants were selected (ie. was a random sample of facilities and home	Not clearly reported in the paper	Inclusion and exclusion criteria are reported, and it is clear that participants were selected from a selection of agencies	No sample size justification reported.

		care agencies selected? Was it all facilities and home care agencies in the two cities or just a proportion?)		and facilities, but it is not clear how the agencies and facilities were selected.	
Wysocki 2014	Yes	Yes	Yes for the transition group, but not for the remain group. However, this was due to data matching (and thus only required the same amount in each group).	Yes, but authors note that the data may not be representative of all Medicaid LTC programmes.	No sample size justification reported.
Victor 2000	Yes	Yes	Total number eligible not reported.	Yes	Yes
Blackburn 2016	Yes	Yes	No. After records with missing data were excluded, the sample was 12634, which is 95%. However, matching was only possible for around 20% of the above. Analysis is presented for both matched and unmatched samples, but the unmatched samples differ significantly.	Yes, but the matched sample is skewed towards females, Caucasians and those unmarried. May not be representative.	No sample size justification reported.

Appendix table A.2 continued.

Paper author and date	6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured? (if not prospective should be answered as 'no', even is exposure predated outcome)	7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	10. Was the exposure(s) assessed more than once over time?
Reeves 2004	No - cross sectional	No - cross sectional	Continuous	Yes	No - cross sectional
Carter 2003	Three years of longitudinal data were used (retrospectively) but it is not clear if the outcome was measured at points subsequent to the most recent time point of care home stay. Care home data was from between 1991-1993. Hospitalisation data was from 1990-1994. Essentially cross sectional as there is	No - cross sectional	Continuous	Yes	No - cross sectional

	not reporting of baseline measure or follow up.				
Hutt 2011	No - cross sectional	No - cross sectional	Continuous	Yes	No - cross sectional
Amador 2014	Yes	Yes (1 year)	Continuous	Yes	No
Deraas 2011	No - cross sectional	No - cross sectional (years of data were 2002-2006 but this was not longitudinal. Averages of 2002-06 data used.)	Continuous	Yes	No - cross sectional
Grunier 2012	No - retrospective cohort	No - retrospective cohort, but followed through to first admission over 180 days	Categorical	Yes	No - retrospective
Sloane 2005	Yes	1 year, with measurements quarterly.	Categorical	Yes	No
Bardsley 2012	No - cross sectional	No - cross sectional	Categorical	Four categories of social care use were used, but it is not clear whether the medium and low categories included both home care and care home users or just one of these.	No - cross sectional
Hollander 2007	No - retrospective	No	Categorical	Yes	Not clear, but assumed so given

					data are from a longitudinal study
Chappell 2004	No - cross sectional (data collected though interview survey but it is not clear what period the questions on HCU pertained to and if such HCU followed or overlapped with SCU). Overall, not clear that HCU followed SCU.	No - cross sectional	Categorical	Yes	No - cross sectional
Wysocki 2014	No - retrospective	No - retrospective	Categorical	Yes	No - retrospective
Victor 2000	No - cross sectional	No - cross sectional	Categorical	Yes	No - cross sectional
Blackburn 2016	No - retrospective	NA - retrospective. Follow up of original data collection 1 year.	Categorical	Yes	No

Appendix table A.2 continued.

Paper author and date	11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	12. Were the outcome assessors blinded to the exposure status of participants?	13. Was loss to follow-up after baseline 20% or less?	14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	Any other quality issues	Overall quality judgement
Reeves 2004	Yes	Not applicable - using administrative data	NA - cross sectional	Parts of analysis controlled for material deprivation.	Used large amount of data and/or multiple linked datasets.	Good (despite not reporting total number of observations, they still used all eligible data within criteria)
Carter 2003	Yes, but the authors say the using the measures of ACSH is novel and should be treated with caution (see p.316)	Not applicable - using administrative data	NA - cross sectional	Yes	During the data period (1991-1993) the authors note there were organisational changes to care homes that may have affected "hospitalisation practices" (p.3), thus would not have been able to account for	Fair, due to possible changes in organisation of NHs that may have introduced some confounding for the outcome variable

					this in analysis. Used large amount of data and/or multiple linked datasets.	
Hutt 2011	Yes	Not applicable - using administrative data	NA - cross sectional	Yes	Used large amount of data and/or linked multiple datasets.	Good
Amador 2014	Yes	Not reported.	No data provided on whether there was loss to follow up.	Yes		Good
Deraas 2011	Yes	Not applicable - using administrative data	NA - cross sectional	Yes	There were some irregularities in the analysis presented	Poor, due to the irregularities in the data presented.
Grunier 2012	Yes	Not applicable - using administrative data	NA - retrospective cohort	Yes		Good
Sloane 2005	Yes	It is not reported whether data collection was masked, so assume no.	No detail is reported on this.	Yes		Fair, due to lack of information about sample and follow up.
Bardsley 2012	Yes	Not applicable - using administrative data	NA - cross sectional	HCU outcomes were standardised only for age and sex. No adjustment for deprivation,	Not all health and social care records were linked (not clear if this is due to not having NHS	Poor, due to limited adjustment for confounders, and insufficient information to

				health status, functional status.	number for one site with which to link). Does not include those who are fully self-funded.	make a judgement about the representativeness of the PCTs
Hollander 2007	Yes	Not reported.	Not reported.	No - descriptive analysis only		Poor, due to insufficient information/clarity regarding some issues, and presentation of only descriptive analysis.
Chappell 2004	Yes	No	NA - cross sectional	Only to a limited extent in that 2 way ANOVAs were used and so interactions between type and level of care were analysed, but otherwise, the analysis did not control for potential confounders.	Authors report that clients were a random sample, but this was only from a pre-selected pool identified by facility staff, so there was potential for bias and a non-representative sample.	Poor, due to lack of clarity about the sample, potential bias in sample selection, and analysis not controlling for potential confounders.
Wysocki 2014	Yes	Not applicable - using administrative data	NA - retrospective	Yes	Only the first hospitalisation was examined in the analysis, but this was the same across	Good

					both groups and so does not present a source of bias.	
Victor 2000	Yes	Not applicable - using patient note data	NA - cross sectional	Yes		Fair, due to lack of information about total number eligible and whether any patients were excluded.
Blackburn 2016	Yes	Not applicable - using administrative data	Yes	Yes		Fair, due to potential sample biases and only being able to match 20% of eligible sample.

Appendix B: Additional tables of study data for critical scoping review

Appendix Table B.1. Spread of study samples across measures of educational attainment and home ownership

	Spread of sample across categories of educational attainment (% in each category)	Spread of sample across categories of home ownership (% in each category)
OUTCOME GROUP: SOCIAL CARE UTILISATION		
Studies with samples from the UK		
McCann 2011[121]	DID NOT USE MEASURE	Renters: 28.0
Hancock 2002[124]	DID NOT USE MEASURE	Home owner: 49.3 Non-home owner: 50.7
Grundy 2007[123]	DID NOT USE MEASURE	Home owner: 68.4 Social tenant: 25.6 Private tenant: 6.0
van Groenou 2006[192]	Data not reported	Data not reported
Studies with US samples		
Lakdawalla 2003[184]	Data not reported	DID NOT USE MEASURE
Himes 2000[183]	DID NOT USE MEASURE	DID NOT USE MEASURE
Shea 2003[189]	Less than high school: 35.4 Some high school: 42.2 Some college: 22.4	DID NOT USE MEASURE
Studies with samples from Finland		
Nihtila 2007[186]	*Female/Male* Tertiary: 8.0/13.6 Intermediate: 13.6/12.3 Basic or less: 78.4/74.1	*Female/Male* Owner: 78.1/83.8 Renter: 18.0/12.7 Other or unknown: 3.8/3.5
Martikainen 2009[185]	DID NOT USE MEASURE	Data not provided
Studies with samples from Belgium		

Rodrigues 2018[187]	DID NOT USE MEASURE	DID NOT USE MEASURE
Van den Bosch 2013[191]	DID NOT USE MEASURE	DID NOT USE MEASURE
van Groenou 2006[192]	Data not reported	Data not reported
Studies with samples from Canada		
Tomiak 2000[190]	*Male/Female*, Years in Education Quartile 1: 24.1/22.3 Quartile 2: 26.2/27.4 Quartile 3: 23.9/24.2 Quartile 4: 25.8/26.1	*Male/Female* Home owner: 77.9/64.1
Studies with samples from Germany		
Rodrigues 2018[187]	DID NOT USE MEASURE	DID NOT USE MEASURE
Himes 2000[183]	DID NOT USE MEASURE	DID NOT USE MEASURE
Studies with samples from Sweden		
Shea 2003[189]	Less than high school: 68.2 Some high school: 14.3 Some college: 17.5	DID NOT USE MEASURE
Studies with samples from Italy or the Netherlands		
Rodrigues 2018[187]	DID NOT USE MEASURE	DID NOT USE MEASURE
van Groenou 2006[192]	Data not reported	Data not reported
Studies with samples from Austria		
Schmidt 2017[188]	DID NOT USE MEASURE	DID NOT USE MEASURE
Rodrigues 2018[187]	DID NOT USE MEASURE	DID NOT USE MEASURE
OUTCOME GROUP: HEALTHCARE UTILISATION		
Studies with samples from Canada		

Allen 2011[193]	*Rural/urban* Less than secondary school: 31.1/32.9 Secondary school graduation: 10.9/17.0 Some post-secondary school education: 10.1/7.3 Post secondary degree/diploma: 47.9/42.9	DID NOT USE MEASURE
Cohen 2013[198]	DID NOT USE MEASURE	DID NOT USE MEASURE
Studies with samples from the US		
Allin 2009[194]	Data not reported	DID NOT USE MEASURE
Auchincloss 2001[197]	No high school: 22.5 Some high school: 15.9 High school degree: 35.8 College: 25.8	DID NOT USE MEASURE
Freedman 2004[201]	*Plans A & B/HMO enrolees/FFS enrolees* High school degree: 38.2/32.0/35.0 No degree: 61.8/68.0/65.0	DID NOT USE MEASURE
Lindenaur 2013[205]	DID NOT USE MEASURE	Non-home owner: 37.7
Rathore 2006[207]	DID NOT USE MEASURE	DID NOT USE MEASURE
Roe-Prior 2007[208]	<High school: 42.0 High school diploma: 31.0 Post high school: 29.0	DID NOT USE MEASURE
Sheifer 2000[209]	DID NOT USE MEASURE	DID NOT USE MEASURE
Studies with samples from the UK		
Alwan 2007[195]	DID NOT USE MEASURE	DID NOT USE MEASURE
Studies with samples from Italy		
Allin 2009[194]	Data not reported	DID NOT USE MEASURE
Ancona 2007[196]	DID NOT USE MEASURE	NA DID NOT USE MEASURE

Studies with samples from Spain		
Fernandez-Mayorales 2000[199]	Higher studies: 5.0 Secondary: 49.5 Less than primary: 45.5	DID NOT USE MEASURE
Allin 2009[194]	Data not reported	DID NOT USE MEASURE
Studies with samples from Belgium		
Francois 2011[200]	No info: 3.9 No degree or primary: 34.7 Lower secondary: 24.4 Higher secondary: 21.7 Higher education: 15.3	DID NOT USE MEASURE
Hoeck 2013[203]	No info: 2.9 No degree or primary: 28.7 Lower secondary: 24.6 Higher secondary: 26.2 Higher education: 17.6	Home owner: 75.4
Allin 2009[194]	Data not reported	DID NOT USE MEASURE
Studies with samples from the Netherlands		
Wachelder 2017[211]	DID NOT USE MEASURE	DID NOT USE MEASURE
Allin 2009[194]	Data not reported	DID NOT USE MEASURE
Studies with samples from Australia		
Gill 2004[202]	DID NOT USE MEASURE	DID NOT USE MEASURE
Walker 2006[212]	DID NOT USE MEASURE	DID NOT USE MEASURE
Studies with samples from South Korea		
Kim 2011[223]	None: 8.57 1 - 11 years: 27.49 >12 years: 63.94	DID NOT USE MEASURE

Park 2014[206]	*Male/Female* Primary school: 47.4/84.9 Middle school: 17.0/8.7 High school: 22.0/5.1 College+: 14.0/1.3	DID NOT USE MEASURE
Studies with samples from Sweden		
Wastesson 2014[213]	Low: 56.5 Medium: 28.1 High: 15.4	DID NOT USE MEASURE
Allin 2009[194]	Data not reported	DID NOT USE MEASURE
Studies with samples from Norway		
Suominen-Taipale 2004[210]	Primary school: 49.0 Middle level: 25.0 University: 8.0	DID NOT USE MEASURE
Studies with samples from Finland		
Suominen-Taipale 2004[210]	Primary school: 57.0 Middle level: 30.0 University: 8.0	DID NOT USE MEASURE
OUTCOME GROUP: SELF-RATED HEALTH		
Studies with samples from the US		
Adjei 2017[214]	*Male/Female* Incomplete Sec. or less: 21.5/21.3 Secondary completed: 31.7/38.4 Tertiary Completed or above: 46.9/40.3	Home owner: 84.3
Ahn 2012[215]	<High school: 18.6 High school: 34.3 >High school: 47.1	DID NOT USE MEASURE

Enroth 2013[219]	*Male/Female:* High educated: 20.0/11.0 Middle educated: 30.0/17.0 Low educated: 47.0/68.0 Education unknown: 3.0/4.0	DID NOT USE MEASURE
Grau 2001[222]	<High school: 24.0 High school: 41.0 Post-high school: 34.0	DID NOT USE MEASURE
Angel 2003[217]	DID NOT USE MEASURE	DID NOT USE MEASURE
Li 2008[226]	No data reported	DID NOT USE MEASURE
Robert 2009[235]	No data reported specifically for 65+ sample	DID NOT USE MEASURE
Robert 2002[234]	Only average number of years in education provided: 10.8 average (SD: 2.59)	DID NOT USE MEASURE
von dem Kneesbeck 2003[241]	0-9 years: 9.4 10-12 years: 44.9 13+ years: 45.7	Home owner: 82.5
Evans 2008[220]	DID NOT USE MEASURE	DID NOT USE MEASURE
Studies with samples from the UK		
Bambra 2010[218]	No data reported	DID NOT USE MEASURE
Adjei 2017[214]	*Male/Female* Incomplete sec. or less: 63.3/76.5 Secondary completed: 18.5/13.5 Tertiary completed or above: 18.3/10.0	Home owner: 72.6
Alwan 2007[195]	No data reported	DID NOT USE MEASURE
Studies with samples from Japan		
Aida 2011[216]	<6 years: 3.5 6-9 years: 50.5 10-12 years: 33.7 13+ years: 12.3	DID NOT USE MEASURE

Otaki 2017[230]	DID NOT USE MEASURE	DID NOT USE MEASURE
Studies with samples from Italy		
Pirani 2012[232]	No data reported	DID NOT USE MEASURE
Piumatti 2017[233]	DID NOT USE MEASURE	DID NOT USE MEASURE
Bambra 2010[218]	No data reported	DID NOT USE MEASURE
Adjei 2017[214]	*Male/Female* Incomplete sec. or less: 67.5/80.1 Secondary completed: 27.7/17.9 Tertiary completed or above: 4.8/2.1	Home owner: 83.1
Studies with samples from Spain		
Bambra 2010[218]	No data reported	DID NOT USE MEASURE
Adjei 2017[214]	*Male/Female* Incomplete sec. or less: 69.3/77.7 Secondary completed: 23.2/18.5 Tertiary completed or above: 8.5/3.9	Home owner: 90.1
Giron 2012[221]	Illiterate or no education: 37.1 Primary and secondary 1st cycle: 49.7 Second cycle secondary and post-secondary: 7.2 university: 6.1	DID NOT USE MEASURE
Lasheras 2001[225]	No data reported	DID NOT USE MEASURE
Orfila 2000[229]	65-74 High school or university: 26.5 Primary school: 61.9 Unable to read or write: 11.7 72-79* High school or university: 20.9 Primary school: 72.9 Unable to read or write: 6.2	DID NOT USE MEASURE

	80+* High school or university: 13.6 Primary school: 79.7 Unable to read or write: 6.8	
Rueda 2012[237]	*Male/Female* BASQUE Primary +: 40.2/22.4 Primary: 49.0/61.5 <Primary: 10.8/16.1 NAVARRA Primary +: 17.5/10.9 Primary: 59.5/64.5 <Primary: 23.0/24.6 ANDALUSIA Primary +: 16.9/8.4 Primary: 35.5/29.4 <Primary: 47.6/62.2 MURCIA Primary +: 17.3/4.5 Primary: 34.6/29.9 <Primary: 48.1/65.6	DID NOT USE MEASURE
Rueda 2008[236]	*Male/Female* Without formal education: 6.5/9.9 Primary education or less: 31.5/34.5 Secondary education: 43.2/44.5 Higher than secondary education: 17.9/9.8	DID NOT USE MEASURE
Studies with samples from South Korea		

Kim 2011[223]	No data presented specifically for 60+ subsample	DID NOT USE MEASURE
Park 2009[231]	DID NOT USE MEASURE	DID NOT USE MEASURE
Park 2014[206]	*Male/Female* primary school: 47.4/84.9 Middle school: 17.0/8.7 High school: 22.0/5.1 College+: 14.0/1.3	DID NOT USE MEASURE
Studies with samples from Poland		
Knurowski 2005[224]	Basic or lower: 32.4 secondary: 45.6 University: 22.0	Home owners: 66.0
Studies with samples from Australia		
Mather 2014[227]	65-79 No school certificate: 14.8 School cert: 25.5 Higher school cert: 22.9 Cert or diploma: 18.9 University+: 18.0 80+ No school certificate: 18.3 School cert: 25.8 Higher school cert: 23.9 Cert or diploma: 16.9 University+: 15.1	DID NOT USE MEASURE
Studies with samples from Finland		
Nummela 2007[228]	Data not reported for 60+ subsample.	DID NOT USE MEASURE
Bambra 2010[218]	No data reported	DID NOT USE MEASURE

Sulander 2012[239]	*Male/Female* Secondary: 58.8/46.0 Middle: 18.8/29.8 Elementary: 22.4/24.3	DID NOT USE MEASURE
Studies with samples from Sweden		
Bambra 2010[218]	No data reported	DID NOT USE MEASURE
Sherman 2012[238]	Elementary: 49.0 Upper sec: 29.0 University: 20.0 Missing: 2.0	DID NOT USE MEASURE
Studies with samples from Germany		
von dem Kneesbeck 2003[241]	0-9 years: 54.3 10-12 years: 27.5 13+ years: 18.2	Home owner: 54.0
Adjei 2017[214]	*Male/Female* Incomplete Sec. or less: 10.7/28.9 Secondary completed: 41.8/53.6 Tertiary Completed or above: 47.5/17.5	Home owner: 58.9
Bambra 2010[218]	No data reported	DID NOT USE MEASURE
Studies with samples from Greece		
Tigani 2012[240]	Illiterate: 42.8 Unfinished primary: 30.8 Primary: 14.0 Unfinished secondary: 3.3 Secondary: 4.5 Unfinished tertiary: 0.5 Tertiary: 3.5	DID NOT USE MEASURE
Studies with samples from Denmark, Norway, Ireland, Austria, Belgium, France, Luxembourg, Netherlands, Switzerland, Portugal		

Bambra 2010[218]	No data reported	DID NOT USE MEASURE

*Not separate samples, follow up.

Appendix C: Bivariate analyses tables (financial resources)

Appendix Tables C.1-C.12: Bivariate associations between each indicator used in financial resources score

Appendix Table C.1. Odds of living in least deprived area by housing tenure[a]

HOUSING TENURE	OR	Lower CI	Upper CI
Social renters	Referent		
Private renters	1.61	0.88	2.94
Home owners	5.58	4.17	7.46

[a]Ordinal regression

Appendix Table C.2. Odds of living in least deprived area by income classification[a]

INCOME CLASSIFICATION	OR	Lower CI	Upper CI
State pension only (+/- benefits)	Referent		
SP + Other pension	1.36	0.84	2.18
SP + Other pension +/- Savings & Investments	2.66	1.80	3.94

[a]Ordinal regression

Appendix Table C.3. Odds of living in least deprived area by occupational classification[a]

OCCUPATIONAL CLASSIFICATION	OR	Lower CI	Upper CI
Manual/routine	Referent		
Intermediate	1.37	0.94	2.01
Managerial/professional	3.60	2.68	4.85

[a]Ordinal regression

Appendix Table C.4. Odds of owning a home by area deprivation[a]

HOUSING TENURE	OR	Lower CI	Upper CI
High deprivation	Referent		
Medium deprivation	2.60	1.86	3.63
Low deprivation	9.87	6.61	14.74

[a]Ordinal regression

Appendix Table C.5. Odds of owning a home by income classification[a]

INCOME CLASSIFICATION	OR	Lower CI	Upper CI
State pension only (+/- benefits)	Referent		
SP + Other pension	2.51	1.50	4.19
SP + Other pension +/- Savings & Investments	5.72	3.69	8.88

[a]Ordinal regression

Appendix Table C.6. Odds of owning a home by occupational classification[a]

OCCUPATIONAL CLASSIFICATION	OR	Lower CI	Upper CI
Manual/routine	Referent		
Intermediate	1.76	1.16	2.68
Managerial/professional	5.16	3.58	7.42

[a]Ordinal regression

Appendix Table C.7. Odds of having managerial/professional occupation by area deprivation[a]

HOUSING TENURE	OR	Lower CI	Upper CI
High deprivation	Referent		
Medium deprivation	1.52	1.07	2.14
Low deprivation	4.06	2.89	5.70

[a]Ordinal regression

Appendix Table C.8. Odds of having managerial/professional occupation by income classification[a]

INCOME CLASSIFICATION	OR	Lower CI	Upper CI
State pension only (+/- benefits)	Referent		
SP + Other pension	2.37	1.35	4.16
SP + Other pension +/- Savings & Investments	3.21	1.99	5.17

[a]Ordinal regression

Appendix Table C.9. Odds of having managerial/professional occupation by housing tenure[a]

OCCUPATIONAL CLASSIFICATION	OR	Lower CI	Upper CI
Social renters	Referent		
Private renters	2.06	1.08	3.94
Home owners	4.18	3.05	5.74

[a]Ordinal regression

Appendix Table C.10. Odds of highest income classification by area deprivation[a]

HOUSING TENURE	OR	Lower CI	Upper CI
High deprivation	Referent		
Medium deprivation	1.63	1.15	2.31
Low deprivation	3.04	2.07	4.46

[a]Ordinal regression

Appendix Table C.11. Odds of highest income classification by occupational classification[a]

INCOME CLASSIFICATION	OR	Lower CI	Upper CI
Manual/routine	Referent		
Intermediate	1.34	0.85	2.12
Managerial/professional	2.30	1.60	3.30

[a]Ordinal regression

Appendix Table C.12. Odds of highest income classification by housing tenure[a]

OCCUPATIONAL CLASSIFICATION	OR	Lower CI	Upper CI
Social renters	Referent		
Private renters	0.89	0.50	1.54
Home owners	3.80	2.75	5.25

[a]Ordinal regression

Appendix D: Bivariate analyses tables (social care and healthcare use)

Appendix table D.1. Associations between social care and NHS direct contact, bivariate and adjusted for measures of need[a]

Social care variable[b]		NHS Direct contact					
		Bivariate[c]			Adjusted for need[c]		
		OR[d]	Lower CI	Upper CI	OR[d]	Lower CI	Upper CI
Warden		NA			NA		
Any home care		1.52	0.40	5.80	0.76	0.14	4.24
Social services home care		1.43	0.30	6.71	0.49	0.05	4.73
Voluntary agency home care		NA			NA		
Private home care		2.78	0.59	13.18	2.62	0.52	13.10
Social services day sitter		NA			NA		
Voluntary agency day sitter		NA			NA		
Private day sitter		NA			NA		
Social services night attendant		NA			NA		
Voluntary agency night attendant		NA			NA		
Private night attendant		NA			NA		
Social services meals provision		NA			NA		
Voluntary agency meals provision		NA			NA		
Private meals provision		NA			NA		
Day centre		NA			NA		
Luncheon club		1.35	0.17	10.77	1.45	0.18	11.81
Social worker		2.47	0.31	19.90	2.48	0.28	21.88
Residency	Own home	Ref			Ref		
	Sheltered accommodation	1.28	0.27	6.02	1.31	0.27	6.42
	Care home	NA			NA		

[a]Adjusted for: disease count, dependency, presence of a long-standing illness, self-rated health; [b]referent: no contact with service; [c]NA Indicates association could not be modelled; [d]logistic regression

Appendix table D.2. Associations between social care and use of emergency ambulance, bivariate and adjusted for measures of need[a]

Social care variable[b]		Use of emergency ambulance					
		Bivariate[c]			Adjusted for need[c]		
		OR[d]	Lower CI	Upper CI	OR[d]	Lower CI	Upper CI
Warden		NA			NA		
Any home care		1.04	0.45	2.44	0.57	0.21	1.56
Social services home care		0.85	0.29	2.47	0.33	0.09	1.24
Voluntary agency home care		NA			NA		
Private home care		1.18	0.35	3.97	1.03	0.30	3.58
Social services day sitter		NA			NA		
Voluntary agency day sitter		NA			NA		
Private day sitter		NA			NA		
Social services night attendant		NA			NA		
Voluntary agency night attendant		NA			NA		
Private night attendant		NA			NA		
Social services meals provision		0.81	0.11	6.16	0.62	0.08	4.90
Voluntary agency meals provision		3.10	0.37	25.93	2.53	0.29	22.25
Private meals provision		NA			NA		
Day centre		0.60	0.08	4.53	NA		
Luncheon club		1.05	0.31	3.50	0.79	0.18	3.45
Social worker		3.72	1.36	10.18	1.87	0.51	6.85
Residency	Own home	Ref			Ref		
	Sheltered accommodation	0.96	0.36	2.53	0.67	0.23	1.98
	Care home	1.78	0.77	4.18	0.19	0.02	1.67

[a]Adjusted for: disease count, dependency, presence of a long-standing illness, self-rated health; [b]referent: no contact with service; [c]NA Indicates association could not be modelled; [d]logistic regression

Appendix table D.3. Associations between social care and A&E attendance, bivariate and adjusted for measures of need[a]

Social care variable[b]		A&E attendance					
		Bivariate[c]			Adjusted for need[c]		
		OR[d]	Lower CI	Upper CI	OR[d]	Lower CI	Upper CI
Warden		0.66	0.07	6.33	0.70	0.07	7.23
Any home care		1.62	0.85	3.08	1.27	0.60	2.71
Social services home care		1.45	0.68	3.07	0.98	0.39	2.47
Voluntary agency home care		NA			NA		
Private home care		2.09	0.90	4.88	1.93	0.80	4.63
Social services day sitter		NA			NA		
Voluntary agency day sitter		NA			NA		
Private day sitter		NA			NA		
Social services night attendant		NA			NA		
Voluntary agency night attendant		NA			NA		
Private night attendant		NA			NA		
Social services meals provision		0.53	0.07	4.01	0.43	0.06	3.33
Voluntary agency meals provision		NA			NA		
Private meals provision		1.69	0.38	7.52	1.57	0.34	7.23
Day centre		1.4	0.41	4.73	1.24	0.35	4.41
Luncheon club		0.47	0.11	1.96	0.50	0.12	2.14
Social worker		1.92	0.65	5.66	0.72	0.16	3.21
Residency	Own home	Ref			Ref		
	Sheltered accommodation	0.78	0.33	1.88	0.77	0.31	1.90
	Care home	1.39	0.63	3.05	0.79	0.22	2.83

[a]Adjusted for: disease count, dependency, presence of a long-standing illness, self-rated health; [b]referent: no contact with service; [c]NA Indicates association could not be modelled; [d]logistic regression

Appendix table D.4. Associations between social care use and number of A&E attendances, bivariate and adjusted for measures of need[a]

Social care variable[b]		Number of A&E attendances (categorical)					
		Bivariate[c]			Adjusted for need[c]		
		OR[d]	Lower CI	Upper CI	OR[d]	Lower CI	Upper CI
Warden		0.66	0.07	6.33	0.70	0.07	7.23
Any home care		1.49	0.77	2.88	1.19	0.55	2.58
Social services home care		1.28	0.58	2.81	0.87	0.33	2.27
Voluntary agency home care		NA			NA		
Private home care		2.12	0.91	4.95	1.97	0.82	4.74
Social services day sitter		NA			NA		
Voluntary agency day sitter		NA			NA		
Private day sitter		NA			NA		
Social services night attendant		NA			NA		
Voluntary agency night attendant		NA			NA		
Private night attendant		NA			NA		
Social services meals provision		0.54	0.07	4.09	0.45	0.06	3.50
Voluntary agency meals provision		NA			NA		
Private meals provision		0.84	0.11	6.45	0.79	0.10	6.23
Day centre		1.41	0.42	4.78	1.27	0.36	4.51
Luncheon club		0.47	0.11	1.99	0.51	0.12	2.19
Social worker		2.08	0.70	6.15	0.77	0.17	3.45
Residency	Own home	Ref			Ref		
	Sheltered accommodation	0.80	0.33	1.92	0.80	0.32	1.97
	Care home	1.45	0.66	3.19	0.92	0.25	3.35

[a]Adjusted for: disease count, dependency, presence of a long-standing illness, self-rated health; [b]referent: no contact with service; [c]NA Indicates association could not be modelled; [d]ordinal regression

Appendix table D.5. Associations between social care use and inpatient attendance, bivariate and adjusted for measures of need[a]

Social care variable[b]		Inpatient admission					
		Bivariate[c]			Adjusted for need[c]		
		OR[d]	Lower CI	Upper CI	OR[d]	Lower CI	Upper CI
Warden		2.73	0.58	12.91	3.55	0.68	18.66
Any home care		3.52	2.39	5.20	2.56	1.58	4.15
Social services home care		3.31	2.13	5.14	2.13	1.19	3.79
Voluntary agency home care		5.53	0.92	33.39	6.87	0.99	47.72
Private home care		3.33	1.92	5.77	2.86	1.55	5.28
Social services day sitter		3.67	0.51	26.26	6.56	0.48	89.44
Voluntary agency day sitter		2.44	0.40	14.75	2.25	0.32	15.81
Private day sitter		NA			NA	0.48	89.44
Social services night attendant		7.35	0.66	81.62	NA		
Voluntary agency night attendant		NA			NA		
Private night attendant		NA			NA		
Social services meals provision		4.18	1.93	9.09	4.26	1.78	10.20
Voluntary agency meals provision		2.21	0.52	9.33	1.95	0.38	10.01
Private meals provision		2.17	0.84	5.61	2.30	0.81	6.53
Day centre		1.19	0.52	2.69	0.79	0.31	2.00
Luncheon club		1.25	0.68	2.30	1.08	0.53	2.22
Social worker		2.90	1.41	5.94	2.54	1.11	5.81
Residency	Own home	Ref			Ref		
	Sheltered accommodation	1.25	0.78	2.00	1.07	0.63	1.82
	Care home	1.33	0.80	2.21	0.89	0.39	2.02

[a]Adjusted for: disease count, dependency, presence of a long-standing illness, self-rated health; [b]referent: no contact with service; [c]NA Indicates association could not be modelled; [d]logistic regression

Appendix table D.6. Associations between social care use and number of inpatient admissions, bivariate and adjusted for measures of need[a]

Social care variable[b]		Number of inpatient admissions					
		Bivariate[c]			Adjusted for need[c]		
		OR[d]	Lower CI	Upper CI	OR[d]	Lower CI	Upper CI
Warden		2.73	0.58	12.86	3.68	0.70	19.29
Any home care		3.59	2.45	5.28	2.69	1.68	4.31
Social services home care		3.41	2.21	5.28	2.44	1.39	4.27
Voluntary agency home care		7.41	1.34	40.92	7.19	1.20	42.95
Private home care		3.38	1.99	5.77	2.65	1.48	4.75
Social services day sitter		4.04	0.61	26.67	4.43	0.45	43.99
Voluntary agency day sitter		2.69	0.46	15.80	1.96	0.30	12.81
Private day sitter		20.22	1.65	247.37	16.01	0.88	290.35
Social services night attendant		7.37	0.91	59.40	16.01	0.88	290.35
Voluntary agency night attendant		20.19	1.65	247.01	16.01	0.88	290.10
Private night attendant		35.03	3.41	359.34	16.01	0.88	290.35
Social services meals provision		4.02	1.94	8.32	3.63	1.66	7.94
Voluntary agency meals provision		2.70	0.64	11.51	2.17	0.43	11.11
Private meals provision		2.29	0.90	5.82	2.38	0.87	6.57
Day centre		1.29	0.57	2.92	0.82	0.33	2.06
Luncheon club		1.17	0.64	2.13	0.93	0.46	1.88
Social worker		3.11	1.54	6.27	2.66	1.21	5.82
Residency	Own home	Ref			Ref		
	Sheltered accommodation	1.20	0.75	1.92	1.05	0.62	1.77
	Care home	1.20	0.72	2.00	0.78	0.34	1.76

[a]Adjusted for: disease count, dependency, presence of a long-standing illness, self-rated health; [b]referent: no contact with service; [c] NA Indicates association could not be modelled; [d]ordinal regression

Appendix table D.7. Associations between social care use and length of hospital stay (nights), bivariate and adjusted for need[a]

Social care variable[b]		Length of hospital stay (nights)					
		Bivariate			Adjusted for need		
		IRR[c]	Lower CI	Upper CI	IRR[c]	Lower CI	Upper CI
Warden		3.71	0.55	24.93	4.58	0.72	29.02
Any home care		5.43	2.79	10.57	3.90	1.78	8.54
Social services home care		5.71	2.60	12.53	4.23	1.63	10.97
Voluntary agency home care		5.00	0.16	158.95	10.11	0.39	261.60
Private home care		2.61	0.91	7.46	2.85	0.98	8.27
Social services day sitter		5.09	0.11	243.91	15.90	0.24	1032.31
Voluntary agency day sitter		4.06	0.13	130.24	9.40	0.36	246.66
Private day sitter		10.20	0.04	2383.99	24.07	0.15	3877.05
Social services night attendant		6.79	0.08	588.11	24.07	0.15	3877.05
Voluntary agency night attendant		10.19	0.04	2370.62	24.07	0.15	3862.04
Private night attendant		8.48	0.10	730.01	24.07	0.15	3877.05
Social services meals provision		3.47	0.77	15.64	3.25	0.69	15.44
Voluntary agency meals provision		3.12	0.20	48.71	7.11	0.44	113.98
Private meals provision		5.51	0.93	32.53	8.60	1.42	52.28
Day centre		2.00	0.48	8.37	2.33	0.55	9.99
Luncheon club		0.62	0.21	1.93	0.51	0.17	1.57
Social worker		2.30	0.55	9.61	2.88	0.69	11.97
Residency	Own home	Ref			Ref		
	Sheltered accommodation	1.26	0.57	2.81	1.02	0.46	2.28
	Care home	3.56	1.46	8.66	0.31	0.07	1.42

[a]Adjusted for: disease count, dependency, presence of a long-standing illness, self-rated health; [b]referent: no contact with service; [c]negative binomial regression

Appendix table D.8. Associations between social care use and day patient attendance, bivariate and adjusted for measures of need[a]

Social care variable[b]		Day patient attendance					
		Bivariate[c]			Adjusted for need[c]		
		OR[d]	Lower CI	Upper CI	OR[d]	Lower CI	Upper CI
Warden		0.57	0.11	3.04	0.62	0.11	3.53
Any home care		1.30	0.77	2.17	1.19	0.64	2.22
Social services home care		1.07	0.57	2.00	0.90	0.41	1.96
Voluntary agency home care		NA			NA		
Private home care		1.97	1.00	3.88	1.93	0.93	3.99
Social services day sitter		NA			NA		
Voluntary agency day sitter		1.78	0.20	16.10	1.93	0.20	18.41
Private day sitter		NA			NA		
Social services night attendant		NA			NA		
Voluntary agency night attendant		NA			NA		
Private night attendant		NA			NA		
Social services meals provision		0.56	0.13	2.39	0.55	0.12	2.43
Voluntary agency meals provision		NA			NA		
Private meals provision		1.34	0.38	4.69	1.49	0.41	5.40
Day centre		1.08	0.37	3.16	1.27	0.42	3.90
Luncheon club		1.46	0.69	3.08	1.66	0.73	3.74
Social worker		1.38	0.52	3.66	1.89	0.67	5.32
Residency	Own home	Ref			Ref		
	Sheltered accommodation	0.67	0.34	1.34	0.69	0.33	1.44
	Care home	0.32	0.11	0.90	NA		

[a]Adjusted for: disease count, dependency, presence of a long-standing illness, self-rated health; [b]referent: no contact with service; [c]NA Indicates association could not be modelled; [d]logistic regression

Appendix table D.9. Associations between social care use and outpatient department attendance, bivariate and adjusted for measures of need[a]

Social care variable[b]		Outpatient department attendance					
		Bivariate[c]			Adjusted for need[c]		
		OR[d]	Lower CI	Upper CI	OR[d]	Lower CI	Upper CI
Warden		2.93	0.62	13.87	4.28	0.75	24.41
Any home care		1.37	0.94	1.98	1.10	0.70	1.73
Social services home care		1.41	0.91	2.17	1.12	0.65	1.94
Voluntary agency home care		0.5	0.06	4.50	0.43	0.04	4.16
Private home care		1.35	0.78	2.35	1.21	0.66	2.22
Social services day sitter		4.05	0.37	44.86	3.46	0.28	42.61
Voluntary agency day sitter		1.34	0.22	8.10	1.17	0.18	7.65
Private day sitter		2.02	0.13	32.37	1.52	0.08	29.03
Social services night attendant		2.02	0.13	32.37	1.52	0.08	29.03
Voluntary agency night attendant		2.01	0.13	32.30	1.52	0.08	29.02
Private night attendant		4.05	0.37	44.86	1.52	0.08	29.03
Social services meals provision		1.19	0.54	2.64	1.11	0.47	2.63
Voluntary agency meals provision		0.67	0.13	3.33	0.58	0.11	3.21
Private meals provision		1.48	0.59	3.72	1.57	0.58	4.28
Day centre		1.23	0.60	2.54	1.10	0.49	2.47
Luncheon club		0.88	0.49	1.58	0.98	0.51	1.87
Social worker		1.62	0.80	3.29	1.52	0.69	3.33
Residency	Own home	Ref			Ref		
	Sheltered accommodation	0.77	0.49	1.20	0.74	0.46	1.21
	Care home	0.45	0.25	0.79	0.65	0.29	1.46

[a]Adjusted for: disease count, dependency, presence of a long-standing illness, self-rated health; [b]referent: no contact with service; [c] NA Indicates association could not be modelled; [d]logistic regression

Appendix table D.10. Associations between social care use and number of outpatient department visits, bivariate and adjusted for measures of need[a]

Social care variable[b]		Number of outpatient department visits					
		Bivariate			Adjusted for need		
		IRR[c]	Lower CI	Upper CI	IRR[c]	Lower CI	Upper CI
Warden		2.82	0.68	11.73	2.72	0.72	10.25
Any home care		1.32	0.92	1.88	1.16	0.76	1.77
Social services home care		1.31	0.87	1.99	0.99	0.59	1.66
Voluntary agency home care		0.30	0.03	3.38	0.23	0.02	2.67
Private home care		1.30	0.77	2.20	1.44	0.84	2.47
Social services day sitter		1.00	0.10	10.06	0.90	0.09	8.79
Voluntary agency day sitter		0.6	0.08	4.40	0.58	0.08	4.26
Private day sitter		0.75	0.04	14.91	0.47	0.02	8.99
Social services night attendant		0.75	0.04	14.91	0.47	0.02	8.99
Voluntary agency night attendant		0.75	0.04	14.87	0.47	0.02	8.98
Private night attendant		1.00	0.10	10.06	0.47	0.02	8.99
Social services meals provision		1.41	0.67	2.96	1.62	0.75	3.50
Voluntary agency meals provision		0.56	0.11	2.79	0.64	0.12	3.32
Private meals provision		1.44	0.60	3.46	2.17	0.89	5.31
Day centre		0.81	0.38	1.72	0.81	0.37	1.75
Luncheon club		0.84	0.47	1.49	1.00	0.56	1.80
Social worker		1.68	0.86	3.30	1.81	0.91	3.60
Residency	Own home	Ref			Ref		
	Sheltered accommodation	0.70	0.55	0.89	0.61	0.38	0.96
	Care home	0.99	0.71	1.38	0.62	0.28	1.33

[a]Adjusted for: disease count, dependency, presence of a long-standing illness, self-rated health; [b]referent: no contact with service; [c]negative binomial regression

Appendix table D.11. Associations between social care use and GP contact, bivariate and adjusted for measures of need[a]

Social care variable[b]		GP Contact					
		Bivariate[c]			Adjusted for need[c]		
		OR[d]	Lower CI	Upper CI	OR[d]	Lower CI	Upper CI
Warden		9.66	2.25	41.47	16.04	2.50	102.84
Any home care		1.09	0.51	2.29	0.91	0.36	2.30
Social services home care		1.36	0.53	3.53	1.54	0.41	5.74
Voluntary agency home care		NA			NA		
Private home care		0.91	0.31	2.62	0.68	0.23	2.06
Social services day sitter		NA			NA		
Voluntary agency day sitter		NA			NA		
Private day sitter		NA			NA		
Social services night attendant		NA			NA		
Voluntary agency night attendant		NA			NA		
Private night attendant		NA			NA		
Social services meals provision		NA			NA		
Voluntary agency meals provision		NA			NA		
Private meals provision		NA			NA		
Day centre		2.19	0.29	16.34	NA		
Luncheon club		0.69	0.26	1.80	0.51	0.19	1.38
Social worker		2.20	0.29	16.43	1.65	0.21	12.93
Residency	Own home	Ref			Ref		
	Sheltered accommodation	0.64	0.31	1.32	0.50	0.23	1.08
	Care home	1.03	0.40	2.70	1.37	0.25	7.40

[a]Adjusted for: disease count, dependency, presence of a long-standing illness, self-rated health; [b]referent: no contact with service; [c] NA Indicates association could not be modelled; [d]logistic regression

Appendix table D.12. Associations between social care use and number of GP contacts, bivariate and adjusted for measures of need[a]

Social care variable[b]		Number of GP contacts					
		Bivariate			Adjusted for need		
		IRR[c]	Lower CI	Upper CI	IRR[c]	Lower CI	Upper CI
Warden		1.76	1.12	2.77	1.68	1.06	2.67
Any home care		1.35	1.18	1.55	1.26	1.08	1.47
Social services home care		1.30	1.10	1.52	1.14	0.94	1.39
Voluntary agency home care		1.92	1.00	3.69	2.06	1.11	3.82
Private home care		1.44	1.18	1.77	1.33	1.08	1.64
Social services day sitter		2.62	1.28	5.34	3.22	1.48	6.99
Voluntary agency day sitter		1.47	0.75	2.88	1.56	0.82	2.96
Private day sitter		2.31	0.83	6.40	2.53	0.97	6.61
Social services night attendant		2.11	0.91	4.88	2.53	0.97	6.61
Voluntary agency night attendant		2.31	0.83	6.41	2.53	0.97	6.61
Private night attendant		2.22	0.96	5.13	2.53	0.97	6.61
Social services meals provision		1.24	0.92	1.67	1.28	0.94	1.72
Voluntary agency meals provision		1.82	1.08	3.07	1.43	0.83	2.46
Private meals provision		1.45	1.02	2.05	1.35	0.95	1.92
Day centre		1.24	0.95	1.63	1.19	0.90	1.58
Luncheon club		1.01	0.82	1.25	0.95	0.76	1.19
Social worker		1.20	0.92	1.58	1.25	0.94	1.66
Residency	Own home	Ref			Ref		
	Sheltered accommodation	1.09	0.93	1.27	0.99	0.84	1.16
	Care home	1.10	0.92	1.31	0.99	0.75	1.30

[a]Adjusted for: disease count, dependency, presence of a long-standing illness, self-rated health; [b]referent: no contact with service; [c]negative binomial regression

Appendix table D.13. Associations between social care use and practice nurse contact, bivariate and adjusted for measures of need[a]

Social care variable[b]		Practice Nurse Contact					
		Bivariate[c]			Adjusted for need[c]		
		OR[d]	Lower CI	Upper CI	OR[d]	Lower CI	Upper CI
Warden		9.66	2.25	41.47	1.67	0.50	5.54
Any home care		0.33	0.22	0.50	0.41	0.25	0.68
Social services home care		0.44	0.27	0.70	0.59	0.32	1.09
Voluntary agency home care		0.88	0.10	7.91	0.96	0.10	9.18
Private home care		0.27	0.15	0.47	0.34	0.18	0.64
Social services day sitter		0.66	0.07	6.35	0.63	0.05	7.90
Voluntary agency day sitter		0.33	0.05	1.97	0.37	0.06	2.34
Private day sitter		NA			NA		
Social services night attendant		NA			NA		
Voluntary agency night attendant		NA			NA		
Private night attendant		0.44	0.04	4.85	NA		
Social services meals provision		0.76	0.30	1.92	0.78	0.29	2.10
Voluntary agency meals provision		NA			NA		
Private meals provision		0.36	0.14	0.94	0.39	0.14	1.10
Day centre		0.45	0.22	0.93	0.46	0.20	1.04
Luncheon club		2.33	1.04	5.22	1.71	0.73	4.00
Social worker		0.24	0.12	0.48	0.31	0.14	0.69
Residency	Own home	Ref			Ref		
	Sheltered accommodation	0.46	0.29	0.72	0.45	0.27	0.73
	Care home	0.08	0.05	0.13	0.22	0.10	0.49

[a]Adjusted for: disease count, dependency, presence of a long-standing illness, self-rated health; [b]referent: no contact with service; [c]NA Indicates association could not be modelled; [d]logistic regression

Appendix table D.14. Associations between social care use and number of practice nurse contacts, bivariate and adjusted for measures of need[a]

Social care variable[b]		Number of practice nurse contacts					
		Bivariate			Adjusted for need		
		IRR[c]	Lower CI	Upper CI	IRR[c]	Lower CI	Upper CI
Warden		1.30	0.68	2.49	1.40	0.70	2.83
Any home care		0.59	0.49	0.71	0.62	0.50	0.76
Social services home care		0.63	0.51	0.78	0.68	0.52	0.87
Voluntary agency home care		0.73	0.29	1.82	0.68	0.28	1.67
Private home care		0.55	0.41	0.73	0.60	0.44	0.80
Social services day sitter		0.66	0.23	1.89	0.65	0.20	2.11
Voluntary agency day sitter		0.46	0.17	1.28	0.45	0.16	1.21
Private day sitter		1.00	0.25	3.91	0.90	0.24	3.40
Social services night attendant		0.88	0.28	2.77	0.90	0.24	3.40
Voluntary agency night attendant		1.00	0.25	3.92	0.90	0.24	3.40
Private night attendant		0.66	0.20	2.20	0.90	0.24	3.40
Social services meals provision		0.99	0.68	1.45	1.04	0.70	1.54
Voluntary agency meals provision		1.76	0.93	3.31	1.70	0.88	3.27
Private meals provision		0.61	0.37	0.99	0.46	0.26	0.78
Day centre		0.68	0.46	1.02	0.62	0.40	0.95
Luncheon club		1.27	0.96	1.69	1.19	0.89	1.60
Social worker		0.59	0.39	0.89	0.73	0.48	1.09
Residency	Own home	Ref			Ref		
	Sheltered accommodation	0.90	0.74	1.11	0.87	0.70	1.08
	Care home	0.22	0.16	0.31	0.35	0.23	0.54

[a]Adjusted for: disease count, dependency, presence of a long-standing illness, self-rated health; [b]referent: no contact with service; [c]negative binomial regression

Appendix E: Bivariate analyses tables (covariates)

Appendix Table E.1. Bivariate associations between covariates and warden contact

COVARIATES	Warden contact[a]		
	OR[b,c]	Lower CI	Upper CI
Female	1.04	0.33	3.30
Marital status			
Single, separated or divorced	2.61	1.19	5.72
Married/re-married	Ref		
Widowed	2.24	1.25	4.02
Years in education	0.82	0.70	0.97
Has a longstanding illness/disability	2.14	0.59	7.73
Dependency			
Independent	Ref		
Long interval	2.56	0.82	7.98
Short interval	5.71	0.64	50.65
Critical interval	NA		
Disease count	0.97	0.72	1.32
Self-rated health			
Excellent	Ref		
Very Good	0.66	0.32	1.37
Good	1.40	0.72	2.70
Fair	2.49	1.25	4.96
Poor	2.19	0.76	6.32
How often feel lonely			
Always/often	2.94	1.56	5.52
Sometimes	1.62	0.99	2.63
Never	Ref		

[a]In four weeks previous for those in sheltered accommodation only; [b]Logistic regressions; [c]NA indicates association could not be modelled

Appendix Table E.2. Bivariate associations between covariates and social services home care

COVARIATES	Social services home care[a]		
	OR[b]	Lower CI	Upper CI
Female	1.36	0.88	2.11
Marital status			
Single, separated or divorced	3.12	1.44	6.74
Married/re-married	Ref		
Widowed	2.67	1.52	4.71
Lives alone	2.37	1.39	4.04
Years in education	0.92	0.81	1.05
Has a longstanding illness/disability	2.42	1.22	4.76
Dependency			
Independent	Ref		
Long interval	11.65	4.57	29.68
Short interval	64.8	23.77	176.68
Critical interval	142.56	35.95	565.28
Disease count	1.48	1.30	1.68
Self-rated health			
Excellent	Ref		
Very Good	0.85	0.34	2.16
Good	1.71	0.74	3.99
Fair	3.19	1.34	7.58
Poor	2.82	0.81	9.87
How often feel lonely			
Always/often	2.34	1.22	4.49
Sometimes	1.76	1.12	2.76
Never	Ref		

[a]In four weeks previous; [b]Logistic regressions

Appendix Table E.3. Bivariate associations between covariates and voluntary agency home care

COVARIATES	Voluntary agency home care[a]		
	OR[b,c]	Lower CI	Upper CI
Female	0.98	0.16	5.91
Marital status			
Single, separated or divorced	NA		
Married/re-married	Ref		
Widowed	0.35	0.06	2.13
Lives alone	0.49	0.08	2.96
Years in education	1.03	0.65	1.62
Has a longstanding illness/disability	NA		
Dependency			
Independent	Ref		
Long interval	3.15	0.33	30.48
Short interval	4.97	0.31	80.46
Critical interval	NA		
Disease count	1.17	0.74	1.84
Self-rated health			
Excellent	Ref		
Very Good	NA		
Good	NA		
Fair	0.37	0.06	2.27
Poor	NA		
How often feel lonely			
Always/often	2.02	0.21	19.73
Sometimes	0.56	0.06	5.35
Never	Ref		

[a]In four weeks previous; [b]Logistic regressions; [c]NA indicates association could not be modelled

Appendix Table E.4. Bivariate associations between covariates and private home care

COVARIATES	Private home care[a]		
	OR[b]	Lower CI	Upper CI
Female	1.79	0.98	3.24
Marital status			
Single, separated or divorced	1.27	0.47	3.39
Married/re-married	Ref		
Widowed	1.35	0.72	2.51
Lives alone	1.27	0.67	2.41
Years in education	1.14	1.01	1.28
Has a longstanding illness/disability	2.17	0.92	5.16
Dependency			
Independent	Ref		
Long interval	3.52	1.80	6.88
Short interval	2.56	0.92	7.07
Critical interval	3.77	0.77	18.50
Disease count	1.15	0.99	1.33
Self-rated health			
Excellent	Ref		
Very Good	0.61	0.22	1.74
Good	1.12	0.44	2.85
Fair	1.47	0.55	3.96
Poor	2.53	0.65	9.85
How often feel lonely			
Always/often	1.85	0.76	4.46
Sometimes	1.98	1.12	3.51
Never	Ref		

[a]In four weeks previous; [b]Logistic regressions;

Appendix Table E.5. Bivariate associations between covariates and social services day sitter

COVARIATES	Social services day sitter[a]		
	OR[b,c]	Lower CI	Upper CI
Female	0.65	0.09	4.65
Marital status			
Single, separated or divorced	NA		
Married/re-married	Ref		
Widowed	0.18	0.02	1.70
Lives alone	NA		
Years in education	0.85	0.40	1.77
Has a longstanding illness/disability	NA		
Dependency			
Independent	Ref		
Long interval	0.04	0.01	0.34
Short interval	NA		
Critical interval	NA		
Disease count	1.43	0.82	2.50
Self-rated health			
Excellent	Ref		
Very Good	0.38	0.02	6.07
Good	NA		
Fair	1.14	0.10	12.78
Poor	NA		
How often feel lonely			
Always/often	3.05	0.27	34.09
Sometimes	0.83	0.08	9.24
Never	Ref		

[a]In four weeks previous; [b]Logistic regressions; [c]NA indicates association could not be modelled

Appendix Table E.6. Bivariate associations between covariates and voluntary agency day sitter

COVARIATES	Voluntary agency day sitter[a]		
	OR[b,c]	Lower CI	Upper CI
Female	0.16	0.02	1.45
Marital status			
Single, separated or divorced	NA		
Married/re-married	Ref		
Widowed	0.35	0.06	2.13
Lives alone	0.49	0.08	2.97
Years in education	0.79	0.38	1.64
Has a longstanding illness/disability	NA		
Dependency			
Independent	Ref		
Long interval	2.10	0.19	23.23
Short interval	9.94	0.89	111.22
Critical interval	NA		
Disease count	1.23	0.79	1.93
Self-rated health			
Excellent	Ref		
Very Good	0.75	0.07	8.42
Good	0.29	0.02	4.65
Fair	0.57	0.03	9.18
Poor	NA		
How often feel lonely			
Always/often	6.19	0.86	44.66
Sometimes	0.83	0.08	9.24
Never	Ref		

[a]In four weeks previous; [b]Logistic regressions; [c]NA indicates association could not be modelled

Appendix Table E.7. Bivariate associations between covariates and private day sitter

COVARIATES	Private day sitter[a]		
	OR[b,c]	Lower CI	Upper CI
Female	0.65	0.04	10.47
Marital status			
Single, separated or divorced	NA		
Married/re-married	Ref		
Widowed	NA		
Lives alone	NA		
Years in education	0.54	0.12	2.44
Has a longstanding illness/disability	NA		
Dependency			
Independent	Ref		
Long interval	NA		
Short interval	NA		
Critical interval	NA		
Disease count	1.43	0.72	2.82
Self-rated health			
Excellent	Ref		
Very Good	NA		
Good	NA		
Fair	0.57	0.03	9.18
Poor	NA		
How often feel lonely			
Always	6.11	0.38	98.88
Sometimes	NA		
Never	Ref		

[a]In four weeks previous; [b]Logistic regressions; [c]NA indicates association could not be modelled

Appendix Table E.8. Bivariate associations between covariates and social services night attendant

COVARIATES	Social services night attendant[a]		
	OR[b,c]	Lower CI	Upper CI
Female	1.31	0.12	14.48
Marital status			
Single, separated or divorced	NA		
Married/re-married	Ref		
Widowed	0.27	0.02	2.94
Lives alone	NA		
Years in education	0.54	0.15	1.85
Has a longstanding illness/disability	NA		
Dependency			
Independent	Ref		
Long interval	0.10	0.01	1.12
Short interval	NA		
Critical interval	NA		
Disease count	1.43	0.72	2.82
Self-rated health			
Excellent	Ref		
Very Good	NA		
Good	NA		
Fair	1.14	0.10	12.78
Poor	NA		
How often feel lonely			
Always/often	6.11	0.38	98.88
Sometimes	1.67	0.10	26.84
Never	Ref		

[a]In four weeks previous; [b]Logistic regressions; [c]NA indicates association could not be modelled

Appendix Table E.9. Bivariate associations between covariates and voluntary agency night attendant

COVARIATES	Voluntary agency night attendant[a]		
	OR[b,c]	Lower CI	Upper CI
Female	0.65	0.04	10.49
Marital status			
Single, separated or divorced	NA		
Married/re-married	Ref		
Widowed	NA		
Lives alone	NA		
Years in education	0.54	0.12	2.43
Has a longstanding illness/disability	NA		
Dependency			
Independent	Ref		
Long interval	NA		
Short interval	NA		
Critical interval	NA		
Disease count	1.43	0.72	2.82
Self-rated health			
Excellent	Ref		
Very Good	NA		
Good	NA		
Fair	0.57	0.03	9.18
Poor	NA		
How often feel lonely			
Always/often	6.10	0.38	98.65
Sometimes	NA		
Never	Ref		

[a]In four weeks previous; [b]Logistic regressions; [c]NA indicates association could not be modelled

Appendix Table E.10. Bivariate associations between covariates and private night attendant

COVARIATES	Private night attendant[a]		
	OR[b,c]	Lower CI	Upper CI
Female	1.31	0.12	14.48
Marital status			
Single, separated or divorced	NA		
Married/re-married	Ref		
Widowed	0.27	0.02	2.94
Lives alone	0.37	0.03	4.10
Years in education	0.54	0.15	1.85
Has a longstanding illness/disability	NA		
Dependency			
Independent	Ref		
Long interval	NA		
Short interval	NA		
Critical interval	NA		
Disease count	1.43	0.72	2.82
Self-rated health			
Excellent	Ref		
Very Good	NA		
Good	NA		
Fair	0.28	0.02	3.13
Poor	NA		
How often feel lonely			
Always/often	6.11	0.38	98.88
Sometimes	1.67	0.10	26.84
Never	Ref		

[a]In four weeks previous; [b]Logistic regressions; [c]NA indicates association could not be modelled

Appendix Table E.11. Bivariate associations between covariates and social services meals provision

COVARIATES	Social services meals provision[a]		
	OR[b,c]	Lower CI	Upper CI
Female	0.60	0.28	1.29
Marital status			
Single, separated or divorced	3.30	1.03	10.56
Married/re-married	Ref		
Widowed	1.35	0.52	3.52
Lives alone	1.76	0.67	4.63
Years in education	0.93	0.73	1.18
Has a longstanding illness/disability	1.06	0.39	2.84
Dependency			
Independent	Ref		
Long interval	2.79	0.98	7.92
Short interval	7.56	2.32	24.61
Critical interval	9.26	1.65	51.95
Disease count	1.30	1.06	1.59
Self-rated health			
Excellent	Ref		
Very Good	0.25	0.04	1.50
Good	1.47	0.42	5.22
Fair	1.14	0.28	4.70
Poor	NA		
How often feel lonely			
Always/often	3.50	1.25	93.79
Sometimes	1.53	0.64	3.67
Never	Ref		

[a]In four weeks previous; [b]Logistic regressions; [c]NA indicates association could not be modelled

Appendix Table E.12. Bivariate associations between covariates and voluntary agency meals provision

COVARIATES	Voluntary agency meals provision[a]		
	OR[b,c]	Lower CI	Upper CI
Female	0.65	0.16	2.62
Marital status			
Single, separated or divorced	NA		
Married/re-married	Ref		
Widowed	1.61	0.32	8.04
Lives alone	1.49	0.27	8.20
Years in education	0.78	0.43	1.41
Has a longstanding illness/disability	NA		
Dependency			
Independent	Ref		
Long interval	1.52	0.18	12.58
Short interval	NA		
Critical interval	NA		
Disease count	1.29	0.89	1.88
Self-rated health			
Excellent	Ref		
Very Good	NA		
Good	0.14	0.01	1.58
Fair	1.14	0.20	6.38
Poor	1.74	0.15	20.05
How often feel lonely			
Always/often	1.52	0.17	13.78
Sometimes	1.25	0.28	5.65
Never	Ref		

[a]In four weeks previous; [b]Logistic regressions; [c]NA indicates association could not be modelled

Appendix Table E.13. Bivariate associations between covariates and private meals provision

COVARIATES	Private meals provision[a]		
	OR[b,c]	Lower CI	Upper CI
Female	3.57	1.03	12.37
Marital status			
Single, separated or divorced	1.57	0.28	8.77
Married/re-married	Ref		
Widowed	1.76	0.57	5.45
Lives alone	2.52	0.69	9.24
Years in education	0.77	0.52	1.14
Has a longstanding illness/disability	1.28	0.37	4.47
Dependency			
Independent	Ref		
Long interval	1.69	0.55	5.22
Short interval	4.05	1.06	15.50
Critical interval	NA		
Disease count	1.22	0.95	1.57
Self-rated health			
Excellent	Ref		
Very Good	2.7	0.33	22.29
Good	1.75	0.21	14.79
Fair	2.91	0.33	25.38
Poor	NA		
How often feel lonely			
Always/often	1.21	0.26	5.66
Sometimes	1.17	0.44	3.12
Never	Ref		

[a]In four weeks previous; [b]Logistic regressions; [c]NA indicates association could not be modelled

Appendix Table E.14. Bivariate associations between covariates and luncheon club attendance

COVARIATES	Luncheon club[a]		
	OR[b,c]	Lower CI	Upper CI
Female	2.24	1.19	4.23
Marital status			
Single, separated or divorced	2.56	0.96	6.85
Married/re-married	Ref		
Widowed	2.45	1.17	5.13
Lives alone	2.60	1.26	5.36
Years in education	1.01	0.87	1.16
Has a longstanding illness/disability	1.21	0.60	2.44
Dependency			
Independent	Ref		
Long interval	2.69	1.42	5.12
Short interval	1.01	0.32	3.14
Critical interval	1.59	0.51	5.02
Disease count	1.04	0.88	1.22
Self-rated health			
Excellent	Ref		
Very Good	1.68	0.47	6.01
Good	2.66	0.79	8.98
Fair	2.16	0.59	7.96
Poor	3.19	0.60	16.79
How often feel lonely			
Always/often	2.12	1.02	4.42
Sometimes	0.83	0.44	1.54
Never	Ref		

[a]In four weeks previous; [b]Logistic regressions;

Appendix Table E.15. Bivariate associations between covariates and day centre attendance

COVARIATES	Day centre[a]		
	OR[b]	Lower CI	Upper CI
Female	2.37	1.02	5.52
Marital status			
Single, separated or divorced	2.24	0.59	8.52
Married/re-married	Ref		
Widowed	2.54	0.96	6.73
Lives alone	1.12	0.50	2.54
Years in education	0.73	0.54	1.01
Has a longstanding illness/disability	1.12	0.46	2.77
Dependency			
Independent	Ref		
Long interval	7.55	1.70	33.49
Short interval	19.64	4.22	91.35
Critical interval	11.58	2.07	64.70
Disease count	1.21	0.99	1.47
Self-rated health			
Excellent	Ref		
Very Good	0.7	0.13	3.89
Good	2.16	0.48	9.62
Fair	2.64	0.56	12.52
Poor	4.85	0.77	30.59
How often feel lonely			
Always/often	3.18	1.23	8.23
Sometimes	1.66	0.76	3.63
Never	Ref		

[a]In four weeks previous; [b]Logistic regressions

Appendix Table E.16. Bivariate associations between covariates and social worker contact

COVARIATES	Social worker[a]		
	OR[b]	Lower CI	Upper CI
Female	0.57	0.28	1.14
Marital status			
Single, separated or divorced	0.48	0.10	2.23
Married/re-married	Ref		
Widowed	0.92	0.43	1.95
Lives alone	0.60	0.24	1.47
Years in education	0.91	0.72	1.14
Has a longstanding illness/disability	2.53	0.76	8.40
Dependency			
Independent	Ref		
Long interval	2.33	0.80	6.78
Short interval	5.37	1.66	17.34
Critical interval	9.84	3.10	31.22
Disease count	1.20	0.99	1.45
Self-rated health			
Excellent	Ref		
Very Good	1.04	0.27	3.93
Good	0.81	0.22	3.09
Fair	1.50	0.39	5.81
Poor	2.00	0.32	12.61
How often feel lonely			
Always/often	1.52	0.49	4.70
Sometimes	1.43	0.67	3.06
Never	Ref		

[a]In four weeks previous; [b]Logistic regressions;

Appendix Table E.17. Bivariate associations between covariates and residency

COVARIATES	Residency					
	Sheltered accommodation			Care home		
	RRR[a,b]	Lower CI	Upper CI	RRR[a.b]	Lower CI	Upper CI
Female	1.69	1.09	2.61	2.12	1.27	3.51
Marital status						
Single, separated or divorced	3.58	1.73	7.38	4.03	1.92	8.46
Married/re-married	Ref			Ref		
Widowed	2.55	1.49	4.37	1.94	1.08	3.48
Lives alone[c]						
Years in education	0.83	0.72	0.96	1.01	0.89	1.14
Longstanding illness/ disability	1.51	0.86	2.65	0.72	0.42	1.24
Dependency						
Independent	Ref			Ref		
Long interval	2.25	1.40	3.60	5.81	0.67	50.09
Short interval	3.33	1.71	6.48	158.82	21.11	1194.74
Critical interval	2.31	0.62	8.56	1061.54	135.64	8307.93
Disease count	1.07	0.95	1.20	1.24	1.08	1.43
Self-rated health						
Excellent	Ref			Ref		
Very Good	1.25	0.58	2.66	2.53	0.85	7.51
Good	1.08	0.51	2.27	1.82	0.61	5.41
Fair	1.63	0.75	3.57	1.06	0.30	3.74
Poor	1.89	0.58	6.21	4.74	1.16	19.38
How often feel lonely						
Always/often	2.40	1.29	4.46	2.30	1.10	4.82
Sometimes	1.68	1.08	2.60	1.47	0.86	2.51
Never	Ref			Ref		

[a]Multinomial regressions, base outcome=own home; [b]NA indicates association could not be modelled; [c]No association with living alone as not applicable to those in a care home

Appendix Table E.18. Bivariate associations between covariates and NHS Direct contact

COVARIATES	NHS Direct Contact[a]		
	OR[b,c]	Lower CI	Upper CI
Female	1.66	0.44	6.29
Marital status			
Single, separated or divorced	2.82	0.39	20.32
Married/re-married	Ref		
Widowed	1.80	0.37	8.75
Lives alone	0.92	0.25	3.48
Years in education	0.82	0.52	1.31
Has a longstanding illness/disability	2.48	0.32	19.55
Dependency			
Independent	Ref		
Long interval	2.08	0.52	8.40
Short interval	2.37	0.39	14.39
Critical interval	NA		
Disease count	1.09	0.78	1.52
Self-rated health			
Excellent	Ref		
Very Good	0.62	0.09	4.45
Good	1.76	0.36	8.58
Fair	NA		
Poor	NA		
How often feel lonely			
Always/often	2.27	0.43	11.90
Sometimes	1.30	0.35	4.87
Never	Ref		

[a]In three months previous; [b]Logistic regressions; [c]NA indicates association could not be modelled

Appendix Table E.19. Bivariate associations between covariates and emergency ambulance use

COVARIATES	Emergency ambulance[a]		
	OR[b]	Lower CI	Upper CI
Female	1.00	0.53	1.89
Marital status			
Single, separated or divorced	0.16	0.02	1.24
Married/re-married	Ref		
Widowed	0.79	0.41	1.50
Lives alone	0.64	0.31	1.33
Years in education	0.71	0.53	0.95
Has a longstanding illness/disability	1.43	0.59	3.45
Dependency			
Independent	Ref		
Long interval	1.88	0.82	4.32
Short interval	5.19	2.12	12.73
Critical interval	1.82	0.48	6.94
Disease count	1.07	0.89	1.29
Self-rated health			
Excellent	Ref		
Very Good	1.61	0.34	7.60
Good	2.14	0.48	9.56
Fair	3.93	0.87	17.84
Poor	1.50	0.13	17.18
How often feel lonely			
Always/often	0.43	0.10	1.86
Sometimes	0.83	0.42	1.65
Never	Ref		

[a]In three months previous; [b]Logistic regressions;

Appendix Table E.20. Bivariate associations between covariates and A&E attendance

COVARIATES	A&E Attendance[a]		
	OR[b]	Lower CI	Upper CI
Female	1.01	0.58	1.74
Marital status			
Single, separated or divorced	0.35	0.10	1.21
Married/re-married	Ref		
Widowed	0.75	0.42	1.31
Lives alone	0.73	0.39	1.34
Years in education	1.02	0.89	1.17
Has a longstanding illness/disability	1.50	0.70	3.25
Dependency			
Independent	Ref		
Long interval	1.36	0.71	2.61
Short interval	2.93	1.37	6.27
Critical interval	1.30	0.42	3.99
Disease count	1.21	1.01	1.41
Self-rated health			
Excellent	Ref		
Very Good	3.15	0.71	13.91
Good	2.91	0.67	12.69
Fair	4.67	1.04	20.92
Poor	3.11	0.42	23.16
How often feel lonely			
Always/often	0.54	0.16	1.81
Sometimes	1.27	0.72	2.23
Never	Ref		

[a]In three months previous; [b]Logistic regressions;

Appendix Table E.21. Bivariate associations between covariates and inpatient admission

COVARIATES	Inpatient admission[a]		
	OR[b]	Lower CI	Upper CI
Female	0.90	0.64	1.25
Marital status			
Single, separated or divorced	0.91	0.51	1.61
Married/re-married	Ref		
Widowed	0.91	0.63	1.30
Lives alone	1.21	0.82	1.78
Years in education	1.04	0.95	1.13
Has a longstanding illness/disability	1.77	1.12	2.81
Dependency			
Independent	Ref		
Long interval	2.09	1.41	3.09
Short interval	1.74	0.99	3.06
Critical interval	3.41	1.87	6.19
Disease count	1.38	1.24	1.52
Self-rated health			
Excellent	Ref		
Very Good	1.28	0.64	2.57
Good	1.67	0.86	3.27
Fair	2.87	1.43	5.78
Poor	7.59	2.93	19.68
How often feel lonely			
Always/often	2.16	1.30	3.61
Sometimes	1.31	0.91	1.87
Never	Ref		

[a]In year previous; [b] Logistic regressions;

Appendix Table E.22. Bivariate associations between covariates and outpatient attendance

COVARIATES	Outpatient attendance[a]		
	OR[b]	Lower CI	Upper CI
Female	0.69	0.51	0.92
Marital status			
Single, separated or divorced	0.59	0.35	1.01
Married/re-married	Ref		
Widowed	0.77	0.56	1.06
Lives alone	0.81	0.59	1.13
Years in education	1.02	0.95	1.10
Has a longstanding illness/disability	1.75	1.18	2.60
Dependency			
Independent	Ref		
Long interval	1.24	0.89	1.72
Short interval	1.03	0.62	1.69
Critical interval	0.91	0.49	1.67
Disease count	1.28	1.17	1.40
Self-rated health			
Excellent	Ref		
Very Good	1.18	0.67	2.06
Good	1.39	0.81	2.39
Fair	2.19	1.22	3.92
Poor	1.31	0.52	3.30
How often feel lonely			
Always/often	1.32	0.81	2.15
Sometimes	0.96	0.70	1.32
Never	Ref		

[a]In three months previous; [b] Logistic regressions;

Appendix Table E.23. Bivariate associations between covariates and day patient attendance

COVARIATES	Day patient attendance[a]		
	OR[b]	Lower CI	Upper CI
Female	0.83	0.54	1.28
Marital status			
Single, separated or divorced	1.04	0.51	2.11
Married/re-married	Ref		
Widowed	0.85	0.53	1.35
Lives alone	1.05	0.66	1.67
Years in education	1.05	0.94	1.16
Has a longstanding illness/disability	1.15	0.66	2.01
Dependency			
Independent	Ref		
Long interval	1.22	0.77	1.95
Short interval	0.63	0.27	1.46
Critical interval	0.69	0.26	1.83
Disease count	1.10	0.97	1.24
Self-rated health			
Excellent	Ref		
Very Good	0.87	0.37	2.06
Good	1.51	0.68	3.35
Fair	1.33	0.55	3.20
Poor	3.90	1.30	11.67
How often feel lonely			
Always/often	0.96	0.67	1.69
Sometimes	1.06	0.67	1.69
Never	Ref		

[a]In year previous; [b] Logistic regressions;

Appendix Table E.24. Bivariate associations between covariates and GP contact

COVARIATES	GP Contact[a]		
	OR[b,c]	Lower CI	Upper CI
Female	1.07	0.61	1.90
Marital status			
Single, separated or divorced	0.40	0.17	0.93
Married/re-married	Ref		
Widowed	0.87	0.45	1.71
Lives alone	0.68	0.34	1.36
Years in education	1.06	0.90	1.25
Has a longstanding illness/disability	1.65	0.89	3.09
Dependency			
Independent	Ref		
Long interval	0.96	0.52	1.80
Short interval	1.54	0.51	4.59
Critical interval	0.98	0.32	2.96
Disease count	1.35	1.13	1.63
Self-rated health			
Excellent	Ref		
Very Good	1.15	0.49	2.71
Good	2.01	0.82	4.91
Fair	2.51	0.84	7.50
Poor	2.87	0.34	24.00
How often feel lonely			
Always/often	NA		
Sometimes	0.79	0.45	1.40
Never	Ref		

[a]In year previous; [b] Logistic regressions; [c] NA indicates association could not be modelled

Appendix Table E.25. Bivariate associations between covariates and practice nurse contact

COVARIATES	Practice Nurse Contact[a]		
	OR[b]	Lower CI	Upper CI
Female	0.57	0.41	0.81
Marital status			
Single, separated or divorced	0.53	0.30	0.91
Married/re-married	Ref		
Widowed	0.65	0.44	0.95
Lives alone	0.85	0.55	1.30
Years in education	1.04	0.95	1.14
Has a longstanding illness/disability	1.11	0.75	1.66
Dependency			
Independent	Ref		
Long interval	0.49	0.32	0.75
Short interval	0.21	0.13	0.36
Critical interval	0.09	0.05	0.16
Disease count	1.02	0.92	1.12
Self-rated health			
Excellent	Ref		
Very Good	0.65	0.34	1.24
Good	0.69	0.37	1.30
Fair	0.66	0.33	1.30
Poor	0.43	0.16	1.14
How often feel lonely			
Always/often	0.70	0.41	1.20
Sometimes	0.78	0.55	1.11
Never	Ref		

[a]In year previous; [b] Logistic regressions;

Appendix Table E.26. Bivariate associations between covariates and number of A&E attendances

COVARIATES	Number of A&E attendances[a]		
	OR[b]	Lower CI	Upper CI
Female	0.98	0.56	1.70
Marital status			
Single, separated or divorced	0.36	0.10	1.23
Married/re-married	Ref		
Widowed	0.73	0.41	1.28
Lives alone	0.70	0.38	1.30
Years in education	1.03	0.90	1.18
Has a longstanding illness/disability	1.46	0.68	3.15
Dependency			
Independent	Ref		
Long interval	1.36	0.71	2.60
Short interval	2.77	1.27	6.03
Critical interval	1.29	0.42	3.97
Disease count	1.21	1.04	1.41
Self-rated health			
Excellent	Ref		
Very Good	2.93	0.66	13.00
Good	2.89	0.66	12.62
Fair	4.57	1.02	20.50
Poor	3.06	0.411	22.77
How often feel lonely			
Always/often	0.56	0.17	1.87
Sometimes	1.32	0.75	2.33
Never	Ref		

[a]In three months previous; [b]Ordinal regressions;

Appendix Table E.27. Bivariate associations between covariates and number of inpatient admissions

COVARIATES	Number of inpatient admissions[a]		
	OR[b]	Lower CI	Upper CI
Female	0.90	0.65	1.26
Marital status			
Single, separated or divorced	0.91	0.52	1.62
Married/re-married	Ref		
Widowed	0.89	0.62	1.28
Lives alone	1.22	0.83	1.80
Years in education	1.04	0.96	1.13
Has a longstanding illness/disability	1.78	1.12	2.81
Dependency			
Independent	Ref		
Long interval	2.12	1.44	3.14
Short interval	1.67	0.94	2.94
Critical interval	3.11	1.72	5.61
Disease count	1.37	1.24	1.51
Self-rated health			
Excellent	Ref		
Very Good	1.27	0.63	2.54
Good	1.65	0.85	3.21
Fair	3.00	1.50	6.03
Poor	5.97	2.40	14.82
How often feel lonely			
Always/often	2.05	1.24	3.41
Sometimes	1.33	0.93	1.90
Never	Ref		

[a]In year previous; [b]Ordinal regressions;

Appendix Table E.28. Bivariate associations between covariates and length of stay

COVARIATES	Length of stay[a]		
	IRR[b]	Lower CI	Upper CI
Female	1.15	0.65	2.02
Marital status			
Single, separated or divorced	0.86	0.33	2.26
Married/re-married	Ref		
Widowed	0.89	0.48	1.64
Lives alone	1.66	0.89	3.11
Years in education	0.94	0.79	1.12
Has a longstanding illness/disability	1.15	0.58	2.27
Dependency			
Independent	Ref		
Long interval	2.64	1.48	4.83
Short interval	6.27	2.63	14.94
Critical interval	12.27	4.35	34.58
Disease count	1.44	1.22	1.71
Self-rated health			
Excellent	Ref		
Very Good	1.96	0.74	5.18
Good	2.03	0.79	5.23
Fair	3.17	1.11	9.02
Poor	9.49	1.83	49.30
How often feel lonely			
Always/often	1.36	0.53	3.50
Sometimes	0.88	0.48	1.59
Never	Ref		

[a]In year previous; [b]Negative binomial regressions;

Appendix Table E.29. Bivariate associations between covariates and number of outpatient attendances

COVARIATES	Number of outpatient attendances[a]		
	IRR[b]	Lower CI	Upper CI
Female	0.94	0.70	1.25
Marital status			
Single, separated or divorced	0.60	0.36	1.02
Married/re-married	Ref		
Widowed	0.92	0.68	1.26
Lives alone	1.04	0.76	1.43
Years in education	1.05	0.97	1.13
Has a longstanding illness/disability	1.71	1.17	2.50
Dependency			
Independent	Ref		
Long interval	1.00	0.73	1.38
Short interval	1.05	0.66	1.68
Critical interval	0.87	0.49	1.56
Disease count	1.23	1.13	1.34
Self-rated health			
Excellent	Ref		
Very Good	1.26	0.73	2.18
Good	1.76	1.04	2.97
Fair	1.89	1.07	3.35
Poor	2.46	1.07	5.66
How often feel lonely			
Always/often	1.64	1.03	1.88
Sometimes	1.39	1.03	1.88
Never	Ref		

[a]In three months previous; [b]Negative binomial regressions;

Appendix Table E.30. Bivariate associations between covariates and number of GP contacts

COVARIATES	Number of GP contacts[a]		
	IRR[b]	Lower CI	Upper CI
Female	1.07	0.96	1.19
Marital status			
Single, separated or divorced	0.86	0.71	1.04
Married/re-married	Ref		
Widowed	0.94	0.84	1.06
Lives alone	0.96	0.85	1.08
Years in education	1.01	0.98	1.04
Has a longstanding illness/disability	1.15	1.00	1.32
Dependency			
Independent	Ref		
Long interval	1.13	1.00	1.28
Short interval	1.07	0.89	1.28
Critical interval	1.38	1.12	1.70
Disease count	1.10	1.07	1.14
Self-rated health			
Excellent	Ref		
Very Good	1.27	1.04	1.55
Good	1.42	1.17	1.73
Fair	1.51	1.23	1.87
Poor	1.89	1.36	2.61
How often feel lonely			
Always/often	1.29	1.08	1.55
Sometimes	1.03	0.92	1.16
Never	Ref		

[a]In year previous; [b]Negative binomial regressions;

Appendix Table E.31. Bivariate associations between covariates and number of practice nurse contacts

COVARIATES	Number of practice nurse contacts[a]		
	IRR[b]	Lower CI	Upper CI
Female	0.80	0.69	0.92
Marital status			
Single, separated or divorced	0.67	0.51	0.87
Married/re-married	Ref		
Widowed	0.90	0.76	1.05
Lives alone	0.93	0.80	1.08
Years in education	0.99	0.95	1.03
Has a longstanding illness/disability	1.22	1.01	1.46
Dependency			
Independent	Ref		
Long interval	0.91	0.78	1.06
Short interval	0.50	0.39	0.64
Critical interval	0.30	0.21	0.42
Disease count	1.05	1.01	1.10
Self-rated health			
Excellent	Ref		
Very Good	0.96	0.74	1.24
Good	0.97	0.75	1.25
Fair	1.02	0.78	1.35
Poor	0.94	0.61	1.48
How often feel lonely			
Always/often	0.77	0.60	1.00
Sometimes	0.94	0.81	1.10
Never	Ref		

[a]In year previous; [b]Negative binomial regressions;

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