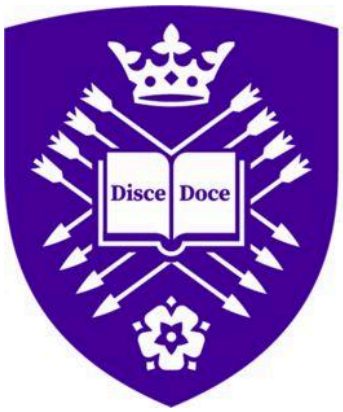

University of Sheffield

The Characteristics and Experiences of Unpaid Carers in the UK: trends and variations 2009-2023

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Thesis Summary

This thesis follows a non-traditional three-paper approach, consisting of six chapters: an introduction, a methodology chapter, three academic style papers and a conclusion. The introduction provides an overview of the topic and existing literature in the field, before outlining the research process. Chapters three to five present the main body of the research, analysis and discussion. Finally, chapter six concludes by presenting the key contributions and suggestions for future research.

The aim of this thesis is to explore the relationship between unpaid care and employment between the years 2009 and 2023, conducting cross-sectional and longitudinal analysis on data from the UK Household Longitudinal Study. Multi-level models (including with random slopes) are used to account for the hierarchical structure of the data, allowing for intersectional and longitudinal analysis.

The key findings include the negative relationship between care and employment and the presence (or absence) of variability in this relationship over time and between identity groups. This is a finding that persists over time and is most pronounced during and prior to mid-life (during prime working years). More research needs to be done to explore these differences.

Policy should continue to focus on supporting carers, through improved access to respite services, flexible working and financial support such as Carer's Allowance. Services should be co-produced with carers to identify what support will be most effective.

This study has contributed empirically, producing comparable findings to previous research, as well as novel findings on intersectional variations in the care-employment relationship using new data. It has also contributed methodologically, by presenting advanced research techniques that could be applied and developed further in the field of adult social care. Continued research is important. To ensure research can continue to a high standard, better data is needed to allow advanced statistical analysis to be conducted, particularly looking into intersectional inequalities in care.

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List of Abbreviations

MAIHDA = Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy
CA = Carer's Allowance
ONS = Office for National Statistics
ONS LS/LS = Office for National Statistics Longitudinal Study
UKHLS = UK Household Longitudinal Study

Chapter One: Introduction

Research overview and context

Rationale

The field of adult social care research is important as carers are an undervalued group (Carers UK, 2021; Holman and Walker, 2021), often experiencing social disadvantages. This is due to the lack of effective and accessible support (Public Health England, 2021; Serafini et al., 2023; The Health Foundation, 2024) and the emotional and physical demands that often come as part of the caring experience (Spann et al., 2020). Overall, the prevalence of unpaid care has increased over the last few decades, with a spike in caring seen during the COVID-19 pandemic (Onwumere et al., 2021). According to the Office for National Statistics (ONS) census data, although the overall number of unpaid carers rose between 2001 and 2011, it declined slightly between 2011 and 2021. Despite this, the proportion of carers providing the highest intensity care, which is 50 or more hours as per the census, has increased in 2021 (Office for National Statistics, 2013a; Office for National Statistics, 2023c), indicating there is a large group of individuals in the UK who may require support from policy initiatives and employers in managing their caring responsibilities without compromising their own physical and mental well-being.

It is also important to recognise that the experience of unpaid caring is not always a negative one, despite this research primarily focusing on the negative experiences of care. Providing unpaid care for a friend or family member can be very rewarding, and is deemed as very important by many (Walbaum et al., 2025). The point of this thesis is not to dismiss these positive experiences of providing unpaid caring, but to highlight some of the inequalities faced by carers so that carer centred policy recommendations can be made in the hope that more can be done to support and value carers. The positive experiences of providing unpaid care are therefore not explored within this thesis, but should not be overlooked.

Research Aims

The aim of this thesis is to shed light on the relationship between care and employment between the years 2009 and 2023, allowing us to identify what the relationship looks like over a time period characterised by economic and political uncertainty following on from the 2008

financial crash (Stuckler et al., 2017) and Brexit (Bank of England, 2019), and historic public health events such as the COVID pandemic (Alarilla, Grimm and Stafford, 2021). This will indicate whether policy change over this time period has had any positive effect on carers being able to better balance care with employment, and identify whether certain groups of people experience greater inequalities in employment due to providing care. This thesis also aims to uncover heterogeneities in paid employment, particularly intersectional inequalities between different groups of carers.

Thesis Overview

This thesis follows a non-traditional format, consisting of three academic style papers (chapters 3 to 5), bookended by an introduction and conclusion chapter (chapters 1 and 6). This introduction will first provide a background of the topic, introducing care as a concept before exploring what the issue is, and providing a review of the existing literature in the field. The theoretical and methodological frameworks used in the thesis will then be explained, followed by an overview of each chapter. Due to the non-traditional three-paper format of this thesis, there is some repetition between chapters, for example in describing data and defining key terms and concepts. This was necessary as chapter three, three and four are stand alone academic papers and there is therefore a degree of context that needs to be presented for each paper to be understood when not read in the context of the wider thesis.

Background

Conceptualising care

'Care' as a concept has been highly disputed in the literature (Daly and Lewis, 2000), with a variety of terms being used, and different meanings ascribed. The term 'unpaid care work' has been used over the term 'informal care', which is often used in the literature. This is due to the latter not explicitly capturing the fact that unpaid care work is still work, even though it is unpaid (Cruz et al., 2023). Some research also suggests that many carers feel the term 'informal' takes away from the role, and can be invalidating (Stall et al., 2019). It was deemed important to consider the language used in this thesis, leading to the choice of 'unpaid care work' being preferred.

Unpaid care work will be referred to simply as 'care' for the remainder of this thesis. Unpaid care is defined using the definition from Understanding Society (UK Household Longitudinal

Study), for consistency with the analysis since this dataset is used throughout. Unpaid care is defined as looking after or providing help for someone who is sick, elderly or disabled (U Essex, 2024). Within all analyses, care refers to care within and outside of the household.

Due to the quantitative nature of this thesis and the data source used, care is measured in the average hours of care provided per week (except in chapter five where care is considered as a binary variable) (U Essex, 2024). Whilst this allows us to capture one important aspect of care intensity, it also misses key details in other aspects of care intensity and experiences. For example, hours of care is an important measure as it is directly relevant to issues related to time availability, which are frequently cited to impact the relationship between care and employment (Pomeroy and Fiori, 2025; Henz, 2004; Jacobs et al., 2015; Sacco et al., 202; Raiber, Visser and Verbakel, 2022). However, it is recognised that carers are a heterogeneous group (Gallagher, 2020), and care experiences may be vastly different across individuals. For instance, the number of hours an individual cares for may not equate to the intensity of care provided in terms of the emotional and physical demands experienced (Public Health England, 2021; Spann et al., 2020). The type of care and relationship between the cared for individual and the carer may also play a role in the experience of caring (Zhang and Bennett, 2024). It is therefore important to study the qualitative and mixed-methods literature in the field, which may also share the voices and lived experiences (Pilcher and Cortazzi, 2024) of carers themselves, as this will help us gain a more well-rounded understanding of the relationship between care and labour market participation.

The framing of the term ‘care’ in the UKHLS may help pick up a larger number of carers than if it was to simply ask whether someone would define themselves as a carer or not. In the UK, it takes carers on average two years to recognise themselves as a carer (Carers UK, n.d., c). Often, care is perceived as something that is a natural part of the life-course, and of something that is expected of you if a loved one is in need. This may be particularly true for women, where gendered expectations shape a narrative of women being natural carers, and suggests that care is just an expected part of their role (Carr et al., 2018; Pomeroy and Fiori, 2025; Watkins and Overton, 2024). This may be partially connected to the unpaid nature of caring, making it more difficult to recognise the role as work. Similarly, there are also cultural differences in the term care itself and recognising oneself as a carer. In some cultures, providing care is an expected role (Banks, 2022; Carers UK, 2025b), and it is therefore more difficult to recognise yourself as a carer as a result. There are also language differences between cultures. In the UK terms such as

'unpaid care worker' and 'informal carer' are frequently used. However, in some languages, there is not a direct translation to these terms, as care is not recognised or viewed in the same way it is in the UK (Barnes et al., 2024). These disparities in an individual not recognising themselves as a carer can lead to issues with data underestimating the number of carers, particularly those of certain groups.

The UKHLS frames the question in regard to looking after or providing help to a loved one, and does not explicitly mention the term unpaid carer:

"Now thinking about everyone who you look after or provide help for, both those living with you and not living with you - in total, how many hours do you spend each week looking after or helping them?" (U Essex, 2024).

This may help to ensure as many people who provide care are included within the data, reducing disparities across minority groups. However, it is likely that some carers will be missed from analysis, again emphasising the need to study multiple pieces of research from a variety of sources.

There are multiple types of 'care literature', in which care is conceptualised and theorised in different ways. Whilst this thesis takes aspects from a wide range of literature spanning multiple fields and disciplines, the conceptualisation of care in this thesis falls mostly within the conceptualisation of '*care as a component of welfare state policy'.* Within this, care is situated within its relationship to the welfare state, in terms of how care is valued by what it provides to /what is provided to the welfare state. In her paper 'The concept of care: Insights, challenges and research avenues in COVID-19 times', Daly discusses the 'care diamond' , in which care intersects with the state, family, market and civil society, showing how care and policy can span over multiple dimensions (Daly, 2021).

This also relates to what decisions carers make as a result of providing care, for example, changing their employment, working patterns. This links to how carers interact with the welfare state, such as accessing benefits (like CA) and using other state provided services (Daly, 2021). This thesis draws on this by examining the impact care may have on employment, and how this intersects with policy and the welfare state (in terms of how policy and the welfare state does/does not support carers), and how this has changed over time in the context of a period of large social, political and economic change.

The care-employment relationship

Issues within adult social care have become increasingly prevalent across the UK media in recent years. Global public health events such as the COVID pandemic have contributed to this heightened visibility, highlighting some of the many cracks within the sector, many of which have persisted for many years pre-pandemic (Bottery, 2020). As a result of this, policy has aimed to address challenges within the paid and unpaid social care sector, but many policies have been inconsistent with their application, with many parts of the Care Act 2014 being scrapped or postponed (Burn et al., 2024).

This neglect of the adult social care sector, including a lack of funding into services, has put an increased emphasis on unpaid care: care being provided by family and friends (Carmichael et al., 2008; Heitmueller, 2007; HM Government, 2008). At the same time, unpaid carers remain a largely unsupported and undervalued group (Holman and Walker, 2021), despite the huge value they add to society (Petrillo, Zhang and Bennett, 2024). The financial support carers receive through Carer's Allowance (CA), a benefit provided to carers who care for at least 35 hours a week, is one of the poorest benefits, and is inaccessible to many carers. CA is one of the lowest paying benefits in the UK (Hamblin, Heyes and Allard, 2024) even after the increase following the introduction by Keir Starmer's Labour Government. To be eligible to receive CA, an individual must provide care for a minimum of 35 hours per week, and earn no more than £196 after tax and National Insurance (Age UK, 2024; UK Government, 2025). This thesis considers 'high intensity care' to be 20 hours or more per week, which is lower than the amount of care required to be provided to receive CA. Many carers therefore rely on combining care with paid employment, in order to financially support themselves, alongside pay for the additional costs that come along with caring, such as paying for equipment or additional support and travel (Schils, 2008; Watkins and Overton, 2024).

However, combining care and employment can be difficult, as both roles compete for an individual's time (Pomeroy and Fiori, 2025; Henz, 2004; Jacobs et al., 2015; Sacco et al., 202; Raiber, Visser and Verbakel, 2022). This can therefore lead to carers feeling stressed and burnt out (Austin and Heyes, 2020; Carers UK, 2019a; Hlebec, Monarres and Šadl, 2024; Verbakel and Boot, 2024), leading to longer term poor mental and physical well-being (Austin and Heyes, 2020; Carers UK, 2019a; Office for National Statistics, 2024b). Many carers have said that they feel unable to combine care with employment, particularly when caring at high intensities. As

a result, many carers leave the labour market or reduce their working hours (Carers UK, 2019a; Watkins and Overton, 2024; Van Houtven, Coe and Skira, 2013). This can lead to increased financial insecurity, especially when CA is insufficient at meeting carers' needs (Carers UK, 2022b; Fry et al., 2011; Hamblin, Heyes and Allard, 2024).

Why this topic matters

Competing for time (time availability)

Research into the relationship between care and employment is important to ensure policy is made with the best interest of carers in mind. Currently, carers face multiple dimensions of disadvantage, particularly related to employment.

Care and employment both compete for time (Pomeroy and Fiori, 2025; Henz, 2004; Jacobs et al., 2015; Sacco et al., 202; Raiber, Visser and Verbakel, 2022). Both roles can require a large time commitment, particularly if caring responsibilities are high intensity, putting pressure on a carer's ability to participate in paid employment (Brimblecombe et al., 2020; King and Pickard, 2013; Stanfors, Jacobs and Neilson, 2019; Young and Grundy, 2008). This can put pressure on carers and could create feelings of stress and burnout (Austin and Heyes, 2020; Carers UK, 2019a; Hlebec, Monarres and Šadl, 2024; Verbakel and Boot, 2024) which could impact an individual's ability to participate in both roles. Caring can also be emotionally and physically demanding, which can become an additional challenge. This is particularly relevant within the UK context where an ageing population (Pomeroy and Fiori, 2025; Royal Economic Society, n.d.; van de Ven, Bronka and Richiardi, 2024) is concurrent with a rising state pension age, meaning that more people are providing care at the same time as being of working age (Carmichael and Ercolani, 2016; Royal Economic Society, n.d.). This suggests that more people may be experiencing trade-offs between caring and paid employment, and later into the life-course.

Similarly, shifts away from a traditional nuclear family structure (Scott and Clery, 2013) has seen an increasing prevalence of women in paid employment (Yeandle and Joynes, 2012). Traditionally, care related roles within the family, including unpaid care are taken on by women, whilst men were the primary breadwinners (Carr et al., 2018; Watkins and Overton, 2024). Women are now more likely to participate in paid employment, but still also take on a disproportionate amount of the care responsibilities (Office for National Statistics, 2016;

Thompson, Jitendra and Woodruff, 2023; Xue and McMunn, 2021), meaning they are more likely to experience the strain of competing demands. This also occurs for men, but perhaps to a lesser extent. As gender roles are converging (Scott and Clery, 2013), more men are now expected to take on more of the domestic and care tasks alongside working, suggesting that both men and women may be affected by competing time constraints in a modern society.

Additional competing demands such as caring for dependent children may also play a role. Caring for an elderly parent whilst also caring for a dependent child is a common experience amongst many carers, and it occurs most frequently around mid-life (aged 40-60 years). Known as the 'sandwich generation' (Ansari-Thomas, 2024; Boyczuk and Fletcher, 2016; Pomeroy and Fiori, 2025), this group of carers may experience additional difficulties in being able to combine care with employment, due to the many roles all competing for time. Sandwich generation carers may be therefore more likely to reduce their hours in paid employment in order to fulfil their other commitments. Whilst gender roles and traditions are becoming less prevalent over time in a UK society (Scott and Clery, 2013), they still persist to a certain extent, particularly surrounding care responsibilities within the family (Carr et al., 2018; Pomeroy and Fiori, 2025; Watkins and Overton, 2024). Women are disproportionately likely to be sandwich carers, particularly within some cultures and ethnic groups where there is an emphasis on traditional family structures and beliefs about responsibilities of caring for elderly family members (Wells et al., 2025). That puts certain carers at a greater risk of reducing paid employment due to time constraints, which can have consequences on income and future employment opportunities (Petrillo et al., 2024; Pomeroy and Fiori; Watkins and Overton, 2024).

Financial costs

Reducing or leaving paid employment as a result of caring has the potential to negatively impact an individual's financial security. A reduction in hours in paid employment equates to a reduction in earnings. Research by Petrillo et al., (2024) finds that carers are at a financial disadvantage, with an overall average income loss of £162 per month. They also find this loss to be more pronounced for women than men. This research highlights some of the direct financial impacts carers can face, particularly when employment is affected by caring responsibilities, emphasising the need for continued study to ensure we know how to support carers from experiencing financial disadvantage.

Carers may also face indirect financial costs through a lack of employment opportunities which could limit their career progression (Pomeroy and Fiori, 2024). Evidence suggests that carers are less likely to accept promotions or take on additional (paid) responsibilities at work due to feeling unable to due to the additional pressure of providing care (Ansari-Thomas, 2024; Office for National Statistics, 2024b; Verbakel and Boot, 2024). Similarly, evidence finds that carers are more likely to face discrimination at work, for example, being less likely to be offered promotions (Watkins and Overton, 2024) or more likely to be considered 'unreliable' by employers. This may hinder their ability to progress in their career which could have a knock on effect for their income later in the life-course.

The additional costs of caring alone may add additional stress for carers as a group. Having to pay for equipment, formal support and services, as well as day-to-day expenses such as travel to and from appointments can become a financial burden for carers (Watkins and Overton, 2024), particularly those on a lower income. Financial support for carers such as Carer's Allowance (CA) is amongst the lowest benefits and has been frequently criticised for being inadequate and not supporting carer's needs (Hamblin, Heyes and Allard, 2024), as well as having an unintended disincentive effect on carers employment due to the harsh rules on earnings, despite the improvement as of April 2025 (Carers UK, 2025a). As a result, many carers rely on paid employment to support themselves, which could cause mental and physical strain if they are left with little time for their own leisure (Office for National Statistics, 2024b; Royal Economic Society, n.d.). In addition, carer's who are unable to work full time due to caring are not always sufficiently supported through the UK's welfare system due to the poor accessibility and low paying of CA, adding another layer of financial inequality that carers may experience.

This thesis considers 'high intensity care' to be 20 hours or more per week, which is lower than the amount of care required to be provided to receive CA. This thesis will therefore assess whether the eligibility criteria for receiving CA is currently satisfactory in being accessible to carers, or whether the criteria is too restrictive, and not accessible to many carers whose employment and subsequent income may be adversely affected by caring responsibilities.

Well-being

The financial costs of care may also be directly associated with health and well-being outcomes. As previously mentioned, many carers work fewer hours, or leave paid employment entirely due to their caring responsibilities (Carers UK, 2019a; Watkins and Overton, 2024), as

many find it unmanageable to combine the two due to time constraints (Pomeroy and Fiori, 2025; Henz, 2004; Jacobs et al., 2015; Sacco et al., 202; Raiber, Visser and Verbakel, 2022) and emotional/physical demands (Spann et al., 2020). This puts many carers at a financial disadvantage and a higher risk of experiencing financial strain which could have knock-on consequences for their well-being. Poor mental well-being can be associated with increased feelings of stress and anxiety, which can be linked to experiencing financial strain (Carers UK, 2019a; The Health Foundation, 2024). Poor mental well-being can also lead to poor physical health, whilst financial strain can also lead to poor physical health directly through having a lack of money to pay for things such as gym memberships and healthy foods (Williams et al., 2022).

The emotional and physical demands of providing care have also been associated with negative health and well-being outcomes. Providing care can be time consuming, leaving little time for a carer's own leisure time (Royal Economic Society, n.d.). This can lead to burnout and poor mental and physical health outcomes (Austin and Heyes, 2020; Carers UK, 2019a; Carers UK, 2025c; Office for National Statistics, 2024b; Redican et al., 2024). Similarly, if care is particularly emotionally demanding, this could increase feelings of stress and anxiety which again can negatively affect well-being overall. The emotional demands of care may also be highly linked to the relationship between the carer and cared for person. For example, caring for a loved one can be highly emotionally demanding due to the ongoing challenges and difficulties experienced as a result of care, particularly if the care is long-term (Keating et al., 2019). This highlights the many ways in which well-being can be impacted directly and indirectly through experiences of providing care.

Existing literature

A wide body of literature has addressed the relationship between care and employment in the UK. This introduction provides a more concise overview of this literature, with a more extensive review presented within chapters three to five. The general consensus from the literature is one that is perhaps expected. Overall, the majority of studies indicate that care is negatively associated with paid employment (Brimblecombe et al., 2020; Carers UK, 2019a; Carmichael and Charles, 2003; Drinkwater, 2015; Henz, 2004; King and Pickard, 2013; Stanfors, Jacobs and Neilson, 2019; Watkins and Overton, 2024; Young and Grundy, 2008). Care intensity is found to be important across most studies, with caring at higher intensities being more

associated with reduced labour market participation than caring at lower intensities (Brimblecombe et al., 2020; King and Pickard, 2013; Stanfors, Jacobs and Neilson, 2019; Young and Grundy, 2008). This is again unsurprising, as research frequently highlights the competing nature of care and paid employment in terms of time availability (Pomeroy and Fiori, 2025; Henz, 2004; Jacobs et al., 2015; Sacco et al., 202; Raiber, Visser and Verbakel, 2022), as previously mentioned.

However, less research has been conducted in recent years using panel data, meaning there is scope to explore how the literature relates to current findings on the relationship between care and employment. Similarly, to my knowledge, no research has been conducted on the relationship between care and employment using a MAIHDA approach, or even a multi-level approach more generally. This justifies the importance of this thesis in filling a gap in the literature both empirically and methodologically.

Demographic (intersectional differences)

The literature has also highlighted a range of socio-demographic factors that may relate to both care and employment - these have therefore been considered across this thesis analysis and provided the justification for the intersectional approach taken.

The notion that care is gendered is perhaps the most common throughout the literature. In the UK, despite converging gender norms and expectations (Scott and Clery, 2013), women are often still viewed as 'natural caregivers' (Carr et al., 2018; Pomeroy and Fiori, 2025; Watkins and Overton, 2024), and consequently carry out most of the domestic labour including unpaid care (Office for National Statistics, 2016; Thompson, Jitendra and Woodruff, 2023; Xue and McMunn, 2021). Simultaneously, these expectations also mean that women work fewer hours in paid employment than men, and there is still a gender pay gap in the UK where women disproportionately work lower paying jobs (UK Women's Budget Group, 2021). This is likely to impact the relationship between care and employment, hence the stratification of the data by sex in chapter four, and the inclusion of sex as a strata level variable in chapters three and five.

Another key socio-demographic variable is ethnicity. Firstly, ethnicity is deemed as an important factor to include when taking an intersectional approach (Hankivsky et al., 2014; Holman and Walker, 2021), with ethnicity and gender being the two key characteristics considered by Crenshaw (Crenshaw, 1991) when she first coined the term 'intersectionality'. In

the context of adult social care research, the inclusion of ethnicity also makes sense as differences in care provision were found across the literature. For example, there may be cultural differences that may be associated with ethnicity that mean an individual is more or less likely to provide care; in some cultures, care is seen as obligatory and an expected part of the life-course (Banks, 2022; Carers UK, 2025b), which often intersects with gender with this expectation being emphasised on women (Carr et al., 2018; Pomeroy and Fiori, 2025; Watkins and Overton, 2024). Similarly, traditional gender expectations and family structures are more prominent in certain cultures, which may impact choices to participate in employment, particularly whilst caring (Carers UK, 2023). Ethnicity is therefore used as a strata defining variable in chapters three and five, and as a control variable in chapter four.

Socio-economic status is also associated with care and employment outcomes. Those of high socio-economic status are more likely to have greater financial assets and therefore may be able to pay for additional formal support making it easier for them to combine care with employment due to having more time available (Carers UK, 2019b; Watkins and Overton, 2024). Having additional assets to pay for formal care may also influence their choice to care. Similarly, the opportunity cost of giving up employment or reducing their working hours may be greater than those of lower socio-economic status due to being more likely to be in higher paying roles (Carmichael and Charles, 2003; Carmichael, Charles and Hulme, 2010; Miller and Sedai, 2022; Rebaudo, Calahorrano and Hausmann, 2024). These factors indicate how socio-economic status can interact with decision making across the life-course that may affect both care and employment, hence education (used as a proxy for socio-economic status) is used as a strata defining variable in chapters three and five, and as a control variable in chapter four.

Age and generation cohorts are also relevant to care and employment. Care episodes may be more likely to occur at different stages for the life-course (Keating et al., 2019). For example, sandwich caring is more likely to occur in mid-life, when caring for an elderly parent at the same time as dependent children (Ansari-Thomas, 2024; Pomeroy and Fiori, 2025). Men are also more likely to care later in the life-course to a spouse (Office for National Statistics, 2023c). Generational differences in values and traditions may also impact the care-employment relationship. Older generations such as Boomers may put a greater emphasis on familial caregiving. This may also intersect with sex and also ethnicity, as generational gender and cultural expectations may differ across generations (Shorrocks, 2018; Wang and Coulter, 2019).

Age is therefore controlled for in chapters three to five and generation is used as a strata defining variable in chapter three and five.

In chapter four only, household composition is also controlled for. Household composition may be associated with care and employment outcomes for a few reasons. Firstly, more people in a household such as a married/cohabiting partner may mean there are additional people to take on care responsibilities which may reduce the amount of care one individual will provide. Similarly, there may be others in the household with income that may mean one individual might be more able to reduce their own working hours to provide care, as there is still another source of income into the household. Household composition also accounts for dependent children, which is important as having additional people to care for such as children may make it more difficult to engage in unpaid care, and particularly difficult to engage in paid employment particularly for sandwich carers (Ansari-Thomas, 2024; Pomeroy and Fiori, 2025) due to a lack of time availability (Boyczuk and Fletcher, 2016). However, the decision was made not to control for additional variables such as household composition in chapter three and four to avoid overcontrolling within the MAIHDA framework (Bennett et al., 2025).

Theoretical and methodological framework

Intersectionality and multiplicative effects

A large proportion of this thesis is inspired by an intersectionality framework, which is followed in chapter three and four. Intersectionality was a term first introduced by critical race theorist and advocate Kimberlé Crenshaw in 1989 (Crenshaw, 1991). Intersectionality refers to the multiplicative nature of sociodemographic characteristics, where the experience of multiple characteristics simultaneously is greater than the experience of multiple characteristics individually (Hankivsky et al., 2014; Holman and Walker, 2021). To demonstrate this, Crenshaw used the example of the combined impact of being Black and a woman. Crenshaw emphasises that the marginalisation experienced as being a black woman is greater than the marginalisation experienced by being Black and being a woman when those two characteristics are considered separately (Crenshaw, 1991). In other words, the experiences are multiplicative rather than additive.

The intersectional nature of socio-demographic characteristics is important to consider when conducting social research. Following an intersectionality framework allows researchers to account for the fact that experiences may differ based on a combination of factors, and that the

relationship between these is often more complex than simply a layering effect (Hankivsky et al., 2014; Holman and Walker, 2021).

Multiplicative and additive are terms related to intersectionality that are frequently used within the quantitative literature. When using these terms throughout the thesis, multiplicative refers to the interaction of socio-demographic characteristics, whereas additive refers to the layering of sociodemographic characteristics (Evans et al., 2024b). For example: sex * ethnicity * generation * socioeconomic status versus sex + ethnicity + generation + socioeconomic status.

An inter-categorical approach is taken in which the assumption is made that people in pre-identified social categories experience aspects of social discrimination, hence the justification for using set categories within the analysis (McCall, 2005). Whilst it remains important to recognise that categories are often not fixed, this approach allows for useful analysis to be conducted to highlight wider social inequalities and aspects of discrimination in the care-employment relationship, which may not otherwise be possible.

Intersectionality and social justice

Another important aspect of intersectionality relates to ideas of social justice and discrimination. Intersectionality can be an important analytical tool in uncovering and understanding inequalities, allowing for positive change to be made to improve society and reduce inequalities. This is important in terms of social justice as understanding the complexity of these issues and how they are shaped and reinforced through power structures and societies can help gain a wider understanding of how we can overcome social injustice experienced on the basis of someone's identity (Hill Collins and Bilge, 2020).

This thesis draws on these ideas by aiming to account for the fact that there may be inequalities in the experience of labour market participation that are related to an individual's identity and background. Accounting for intersectionality is important from the perspective of adult social care research as identifying possible disparities in carers' employment will be important in being able to make informed recommendations to help target support to those who may need it the most. It is however, important to remember that some aspects of the inequalities found through intersectional modelling may not be social justice issues, as MAIHDA models (introduced below) are agnostic to the causes of the social inequalities they

uncover. In this thesis the results are considered alongside existing literature to be able to identify the extent to which the inequalities identified can be considered as 'unjust'.

Taking a longitudinal approach

Chapter 3 takes a longitudinal approach to research in order to explore changes over time. This chapter considers how the overall relationship between care and employment has changed in the context of changing policy and economic uncertainty. Changes such as the introduction of carer focused policy may take a while for the effects to be visible, for which a cross-sectional study would not be able to account for. Similarly, whilst there may be immediate effects from policy change, economic uncertainty following events such as the financial crash (Stuckler et al., 2017), Brexit (Bank of England, 2019) and the COVID pandemic (Alarilla, Grimm and Stafford, 2021), these would be difficult to pick up on a cross-sectional study, and the long lasting effects of these events would not be clear.

However, it is recognised that the effects of policy and large scale events are not necessarily measurable. There is a large interplay of changing factors over time that may impact care and also employment patterns, and the individual outcomes of each individual event are not clear. Similarly, the UK Government has not reported on the impacts of individual policy on carers, hence it is not possible to accurately attribute changes over time to specific policy measures.

Nonetheless, taking a longitudinal approach allows the social context to be accounted for. This means inferences can be made as to why certain trends might appear. More importantly, this will allow us to better understand how improvements can be made from a policy perspective in order to better support carers going forward.

Life-course & intersectional life-course

An intersectional life-course approach is used in chapter five to expand on the previous two chapters. The addition of a life-course approach is particularly useful to address how experiences play out over the life-course across different socio-demographic groups (Alonso-Perez et al., 2024). Life-course theory emerged in the 1960s and rose in popularity throughout the 1970s (Heinz et al., 2009), emphasising the importance of panel data in conducting meaningful research that considers the interplay between multiple contextual, individual and demographic factors in shaping experiences and trajectories over the life-course (Elder and Giele, 2009).

Life-course theory is particularly relevant in the field of adult social care. Caring episodes can vary in length and intensity, and may be more or less likely to occur at different stages in the life-course (Keating et al., 2019). For example, caring might be more likely in mid-life due to caring for elderly parents (Brown, Dodgeon and Goodman, n.d.), or later in the life-course due to caring for a spouse (which is particularly true for men) (Office for National Statistics, 2023c).

An intersectional life-course approach combines intersectionality theory with a life-course framework. Intersectionality is intrinsically connected to the life-course as experiences and choices made throughout the life-course may be shaped by the intersection of multiple social identity characteristics. Systems of advantage and disadvantage may be experienced differently depending on multiple factors. Discrimination and inequalities can be multiplicative - the example Crenshaw gives to describe the multiplicative relationship between being Black and being a Woman (Crenshaw, 1991) highlights how social identities can intersect to increase the advantages or disadvantages experienced. In this example, a Black Woman may face multiple aspects of discrimination simultaneously, and this matters in shaping their experiences. It is these experiences that can affect life-course pathways. For example, experiencing multiple dimensions of inequality simultaneously may have negative consequences for pathways (Keating et al., 2019; Holman and Walker, 2021) such as employment over the life-course, could influence where someone lives and the level of deprivation they experience.

This is directly relevant to care as socio-demographic characteristics may intersect to shape trajectories of care provision. For example, women may be more likely to provide care due to traditional roles and expectations around gender (Carr et al., 2018; Office for National Statistics, 2016; Pomeroy and Fiori, 2025; Watkins and Overton, 2024; Thompson, Jitendra and Woodruff, 2023; Xue and McMunn, 2021). Similarly, some ethnic groups may be more likely to provide care due to traditional cultural expectations that put a greater emphasis on providing family care, particularly for older relatives (Banks, 2022; Carers UK, 2025b; Wells et al., 2025). Considering this intersectionality, women from particular ethnic groups may be much more likely to provide care throughout the life-course due to the combined impact of gender specific norms and culturally specific norms (Banks, 2022).

Employment outcomes may also be impacted as a result. Using the same example, females from certain ethnic groups may be less likely to remain in employment if care needs arise in

comparison to men from specific cultures where there is a heavier focus on males fulfilling a breadwinner role (Wang and Coulter, 2019). It may also be the case that other social identity characteristics interact with one another. For example, there may be generational differences in holding traditional values. Similarly, socio-economic status could be associated with the amount of autonomy an individual has over decisions to provide care and participate in employment (Floridi, Carrino and Glaser, 2021), but could differ depending on other socio-demographic characteristics an individual has. chapter five attempts to account for these intersecting characteristics and their relationship with care.

Multilevel modelling and MAIHDA

Introducing the multi-level model

The multilevel model is a form of regression model that takes a hierarchical structure in which there are two or more levels. Traditional multilevel models are useful in modelling hierarchical data, such as longitudinal or geographical data (Goldstein, 2010). This structure allows for differences across time and space to be accounted for. For example, observations over time can be nested in individuals to account for change over time, and individuals can be nested in spatial units such as the Local Authority in which they live to account for differences across areas.

Introducing MAIHDA

Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy (MAIHDA) models were introduced by Evans et al. (2018) in the field of epidemiology to account for the impact of the intersectional nature of social identities on health outcomes. Instead of treating socio-demographic characteristics as individual 'risk factors', MAIHDA allows for these factors to intersect with one another in multi-way interactions (Merlo, 2018). The introduction of MAIHDA was a notable contribution to the field of quantitative research, as it allows for an intersectionality framework to be implemented into quantitative analysis in a novel way.

In a MAIHDA model, intersectional social identities (referred to as 'intersectional strata') are the higher level, in which individuals are nested in their intersecting social identities (for example, gender*ethnicity*socio-economic status*age). Conceptually, this assumes that the experience of belonging to multiple social identities simultaneously may have an effect on individuals' experiences and life outcomes, due to the combined social (dis)advantages that are reinforced by social structures and institutions (Crenshaw, 1991; Hankivsky et al., 2014;

Holman and Walker, 2021). As a result, social strata can be defined as a hierarchical level to account for the differences in outcomes between and within intersectional strata (Evans et al., 2018, 2024).

MAIHDA models have an advantage over single level models with multi-way interactions for a number of reasons. Firstly, interpretability. Multi-way interaction terms can become difficult to interpret particularly when more than two variables are included in the interaction. MAIHDA often also performs better than models with interactions (Evans et al., 2024a) as interactions may be more likely to result in overfitting. MAIHDA may also be easier to interpret than a model with many interaction terms. Secondly, using a multilevel structure allows for the variability between and within strata groups to be analysed, which can help paint a clearer picture of the distribution of inequalities across the strata (Merlo, 2018). Thirdly, the MAIHDA model is more effective on small sample sizes due to model shrinkage (Bell, Holman and Jones, 2019; Evans et al., 2024b), which shrinks strata estimates towards the mean when sample sizes are smaller, meaning unreliable predictions are less likely to occur. This highlights the important contribution of MAIHDA in applying an intersectional framework within quantitative research, and in being able to separate additive and multiplicative effects.

MAIHDA is becoming increasingly popular, and used across disciplines (Bell at el., 2024), however it is relatively unexplored within the field of adult social care. To my knowledge, at the time of writing there are only two papers that employ MAIHDA models in this field. Pomeroy and Fiori's (2025) study is the only study using MAIHDA in a UK context, exploring how competing demands (such as having dependent children, being able to share household responsibilities, caring inside the household, paid employment) and their intersection with gender and income, is associated with the provision of non-coresidential unpaid parental care. In other words, is the prevalence of having competing demands intersect with sociodemographic factors associated with the likelihood of providing non-coresidential unpaid parental care? They found that the effects of sociodemographic characteristics and competing demands were primarily additive, rather than multiplicative, indicating that the effects are layered, suggesting there is limited evidence to suggest that these characteristics intersect.

Alonso-Perez et al. (2024) also employ MAIHDA models, but within a European context. They use waves 1 to 9 of the Survey of Health, Ageing and Retirement in Europe (SHARE) to investigate the average age of the onset of caring within Europe, and whether this varies across

intersectional strata (consisting of sex, migration background, education and occupation. They find that although there are multiplicative effects, the majority of the difference in onset of caring can be explained by the layering of socio-demographic characteristics (additive effects).

The finding that effects are predominantly additive rather than multiplicative is a fairly common finding within MAIHDA analysis (Evans et al., 2024a), and is also consistent with findings from my own work within this thesis. It is not uncommon for intersectional relationships between socio-demographic characteristics to explain a small amount of variation in outcomes, given the complexity of social processes and the influence of individual life experiences. Even small differences can be important in MAIHDA analysis and should not be overlooked. Differences that appear to be small in terms of effect size can still have important implications for individuals in a given strata in practice.

This thesis also offers methodological innovations in the extensions of the standard MAIHDA approach. For example, by incorporating random slopes, which allows the strength of relationships to vary across higher level groups. In chapter three the random slopes for care allow the relationship between care and employment to differ across intersectional groups. In chapter five, the random slopes for age allow the relationship between care and employment across strata and individuals to vary for age (Bell et al., 2024). The standard MAIHDA approach is further extended by including care as a strata level variable, which has to my knowledge not been done before.

Data and methods by chapter

Data overview

Initially, the Office for National Statistics Census Longitudinal Study was intended to be used throughout the thesis. This was due to the large sample size being ideal for MAIHDA modelling and the opportunity for longitudinal analysis. Due to delays in the 2021 data being available, up to date and longitudinal analysis would not have been possible, leading to the decision to use an alternative dataset. Whilst this meant that a compromise on sample size had to be made, the alternative dataset (UK Household Longitudinal Study, also known as Understanding Society) provided its own benefits.

The UKHLS dataset has been used throughout the thesis. This decision was made for three reasons: firstly, because the dataset was the largest available dataset that is nationally

representative (U Essex, 2024) with recent data points. This means that analysis was able to be conducted in recent years, allowing us to identify more recent trends and make more relevant policy suggestions. Secondly, the annual data points across 14 waves in the UKHLS allowed for longitudinal analysis, a strength over the Census which has ten year gaps between waves. Thirdly, for consistency. Using the same dataset throughout allowed each chapter to naturally build on one another in order to progress and develop our understanding. This allowed for a coherent thesis consisting of three methodologically advanced applications.

Across chapters three to five the outcome variable is employment, measured in the average hours participated in paid employment per week. This variable was created by combining the 'jbhrs' (no. of hours normally worked per week) variable with 'jbstat' (current labour force status) variable (U Essex, 2024), resulting in a continuous variable ranging from 0 hours to 98 hours. This variable was chosen to account for people who are unemployed, working part-time, full-time or somewhere in between. Care is the key independent variable across all chapters, and has been described in chapter one (page 6).

Chapter three

Taking an intersectional approach, the aim of chapter three is to provide an overview of the relationship between care and employment in recent times, and understand whether different intersectional strata experience this relationship differently. In other words, to identify whether there is intersectional variation in the relationship between care intensity and job hours. To investigate this, chapter one introduces a cross-sectional exploration of the relationship between care intensity and labour market participation in 2022/23, using data from wave 14 of the Understanding Society dataset (U Essex, 2024). MAIHDA models, including with random slopes, were employed to answer the following research questions:

RQ 1 What is the relationship between being a carer (both low and high intensity caring, compared to non carers) and labour market participation (job hours)?

RQ 2 How does the relationship between care intensity on labour market participation (job hours) vary across intersectional strata?

RQ 3 To what extent is the variation in the care-employment relationship (identified in RQ2) explained by two-way, care-by-demographic-variable, interactions?

MAIHDA models were used to explore the relationship between care intensity (measured in the average hours of care provided by week) and employment (measured in the average hours of paid employment participated in per week) across strata. In these models, individuals were nested in their intersectional strata, consisting of sex, ethnicity, generation and educational attainment.

The MAIHDA model was extended in chapter three to include random slopes for care intensity at the strata level. The inclusion of random slopes allows for the relationship between care and employment to vary between strata. In other words, the effect of care on employment differs for each strata (Evans et al., 2023). This was deemed important as caring at high intensities compared to low intensities may have a different relationship with employment depending on the combination of an individual's socio-demographic characteristics.

Chapter three acts as a starting point for chapters four and five to build on. The initial model approach in chapter one follows a cross-sectional, two-level hierarchical structure, in which individuals were nested in their intersectional strata. This chapter sets the scene for the rest of the thesis, by outlining what the overall relationship is currently, and beginning to explore intersectional effects. This multi-level approach was then extended into a longitudinal two-level structure using panel data in chapter four and longitudinal three-level structure in chapter five. This allowed for a current snapshot of the relationship between care and employment to be presented, before adding the additional complexity of a longitudinal approach.

Chapter four

Taking a longitudinal approach, chapter four introduces an exploration of the relationship between care intensity (measured in the average hours of care provided per week) and employment (measured in the average hours per week participated in paid employment) between 2009 and 2022/23. This chapter focuses specifically on the policy landscape in the UK over the past few decades, to identify how the relationship between care and employment has changed in-line with policy change over this period. Two-level longitudinal multilevel models are employed to address the following research questions:

RQ1 What is the relationship between unpaid care and hours of paid employment for men and women?

RQ2 Has the relationship between unpaid care and hours of paid employment changed over the period 2009-2022/23?

Chapter four expands on chapter three by using a longitudinal approach rather than cross-sectional. This allows us to assess the stability of the relationship between care and labour market participation over time. Using a similar methodological approach as in chapter three, chapter four uses a two-level hierarchical model structure, but focuses on repeated observations over time nested in individuals rather than intersectional strata.

The extension of using a longitudinal approach allows for trends over time to be visualised. This is important as it allows the social context over the changing time period to be addressed alongside the results. Whilst unable to make causal claims about specific policy or events on the results, it provides important context to formulate a wider discussion around the support for carers over the last few decades. It also enables more effective policy suggestions to be made with the needs of carers in mind. This situates chapter four as a stand alone important piece of work whilst also painting a wider picture when considered alongside chapters three and five.

Chapter five

Chapter five takes an intersectional life-course approach to explore the overall relationship between care and employment, and identify whether there are variations in employment trajectories over the life-course between intersectional strata. Longitudinal MAIHDA models (Bell et al., 2024) are employed to waves 1-14 (2009-2022/3) of the Understanding Society dataset (U Essex, 2024) to answer the following research questions:

RQ1a What is the overall relationship between unpaid care and job hours?

RQ1b When allowing care to intersect with socio-demographic variables, how do job hours vary between these intersectional strata groups?

RQ1c Can the intersectional variance be explained by controlling for socio-demographic variables and two-way interaction terms?

RQ2a What do trajectories of employment look like over the life-course between different levels of care provision?

RQ2b Is there intersectional variability in these life-course trajectories of employment?

Two-level multilevel models, in which multiple observations over time are nested in the individual to which they belong to, are employed to address the relationship between care and employment, and whether this changes over time. This allowed for the predicted average job hours per week to be plotted at each time point, for each level of care intensity.

Chapter five builds on chapters three and four by combining methodologies to produce an advanced analysis of the relationship between care and employment over the life-course, across different intersectional groups. The three-level hierarchical model combines an intersectional approach, similar to the one taken in chapter three, and a longitudinal approach, similar to the one taken in chapter four. Methodologically, this is the first study to adapt longitudinal MAIHDA (already a state-of-the-art approach) to incorporate a key variable of interest (in this case, being a carer). This extension allowed for a more advanced analysis, in which changes in the care-employment relationship over the life-course across different socio-demographic groups could be visualised. Combined, these three chapters provide a well-rounded overview of the relationship between care and employment, as well as highlight inequalities within this across different groups of people.

Chapter six

Chapter six consists of an overall conclusion to the thesis. Within this chapter the key contributions of the thesis will be presented, including both the empirical and methodological contributions as well as the use of new data. Some suggestions will then be provided, including those for future research and those for improving data and analysis going forward.

Chapter Two: Methodology

Introduction

This methodology chapter will provide an overview of the methodological decisions that have been made across chapters three to six. As each chapter sits as a stand alone piece of research, this overview aims to situate the methodological decisions in the context of the wider thesis, and how they may be different or similar across each chapter and why. This chapter will first discuss the concepts of unpaid care and employment and how each concept was operationalised, as well as exploring alternative approaches that could have been taken. It will then discuss the decision to conduct analysis at an individual level rather than at a household level, before going on to explore issues related to causality, and how these play out in the thesis. Age-period-cohort effects will then be considered in how they relate to each individual chapter differently and why. A brief overview of the estimation strategies and software used is provided before the chapter concludes with a discussion of data limitations and potential biases.

Operationalising Unpaid Care

The care-employment relationship

The care and employment relationship is complex. There are many ways in which care may impact employment, and this is explored in more depth throughout the thesis. As a broad summary, care may impact employment in the following ways:

Care can be time consuming and therefore leave less time available for participating in paid employment (Henz, 2004; Jacobs et al., 2015; Raiber, Visser and Verbakel, 2022; Sacco et al., 2023). As a result, carers often report reducing their working hours of leaving employment entirely as a result (Carers UK, 2019a; Van Houtven, Coe and Skira, 2013). Similarly, people may end up being forced to take early retirement, or the reverse, carry on working past retirement age due to needing the income from employment to support the caring role or to replace loss of pension that has occurred through reduced employment over the life-course. This is particularly common amongst older carers providing spousal care (Costa-Font and Vilaplana-Prieto, 2023). This highlights some of the ways in which caring might negatively impact employment directly through limiting the amount of hours a carer has to participate in

paid employment, which can have knock-on consequences for carers income and subsequent financial security (Brimblecombe et al., 2020; Petrillo et al., 2024), hence the importance of continued research into this topic.

Employment may also impact care. For example, if an individual is in a secure job that is well paid and would not fit well around care responsibilities should they arise, an individual may feel they are less able to provide care. In this scenario, an individual may be financially secure, and able to pay for care, such as paying for carers and other additional help, whereas other carers who have a lower income may be less able to afford these additional costs (Carers UK, 2019b; Watkins and Overton, 2024). This highlights how the decision to care, or not to, may be linked to a number of factors, many of which will be impacted by employment.

Other complexities may also come into play. The strict eligibility criteria of CA may mean people work fewer hours. Carers must earn no more than £196 per week in order to qualify for CA (UK Government, 2025). As a result, carers may be more likely to work part time hours to ensure they earn below the threshold required to receive the benefit. This means many carers will be limited in the amount of paid work they can participate in, and on what they are able to earn. As CA is a low paying benefit (Hamblin, Heyes and Allard, 2024), this will put many carers at financial risk, as it is argued that CA is limited in its ability to support carers and cover some of the extra costs that come alongside caring responsibilities (Watkins and Overton, 2024). This thesis will address CA and suggestions for improvements in the context of the findings from this research.

Measuring unpaid care

Care is operationalised as hours per week throughout the thesis. Operationalising care intensity in this way has some weaknesses. It does not account for the other aspects of care that may impact an individual's experiences. Hours of care does not necessarily directly translate to intensity in terms of the physical and emotional aspects of care. For example, research finds that the type of care provided, as well as the relationship between the carer and cared-for individual, may impact the experience of providing care (Carmichael et al., 2008; Dixley, Boughey and Herrington, 2019; Keating et al., 2019). As these experiences are heterogenous (Gallagher, 2020), it is difficult to quantify the physical and emotional intensity of caring. Despite this, the number of hours spent doing care is undoubtedly highly correlated to care intensity in other domains; other things being equal, spending more hours caring will be

more “intense” than spending fewer hours caring. Where the interest is in the precise processes that define and produce intensity, this is best done through in-depth qualitative studies that are able to listen to the lived experiences of carers. The emotional and physical intensity of care is often overlooked in social surveys, and in the future, it may also be important for social surveys to increase and improve their questioning on care, in order for large scale quantitative analysis to be conducted into understanding care in different contexts.

Given the constraints of the data, however, it was necessary to measure care intensity in some way, for a quantitative analysis to be conducted, allowing the important and externally valid findings of this thesis. Second, hours of care is used throughout existing quantitative literature (see: Cartagena-Farias, and Brimblecombe, 2023; King and Pickard, 2013, Petrillo et al., 2024; Young and Grundy, 2008), most likely due to the fact that care is most commonly measured in this way in large social surveys, including Understanding Society (U Essex, 2024). This means that the findings in this thesis were more easily able to be compared to those from existing studies, which allows for a wider understanding of the relationship between care and employment to be had in the context of how this thesis is similar or dissimilar to other studies in the same field.

The measure of unpaid care throughout this thesis comes from the ‘AIDHRS’ variable in the Understanding Society dataset (U Essex, 2024), which is defined as the average number of hours of care provided per week, both inside and outside of the household. The question asked to responders is: “Now thinking about everyone who you look after or provide help for, both those living with you and not living with you - in total, how many hours do you spend each week looking after or helping them?”. This question is part of a wider question stem that requires at least one of the following questions to have been responded ‘yes’ to:

> Do you provide some regular service or help for any sick, disabled or elderly person not living with you? (AIDXHH)
>
> Is there anyone living with you who is sick, disabled or elderly whom you look after or give special help to (for example, a sick, disabled or elderly relative, husband, wife or friend etc)? (AIDHH).

If answering no to both, a responder will be coded as providing 0 hours of care per week. If answering yes to either question, a respondent will then be asked the AIDHRS question, in

which they are able to give a number of hours that they provide care each week, and includes care within and outside of the household. The decision was made to use AIDHRS, rather than focusing on care within or outside the household, as this would maximise the sample size of carers, which was important in being able to conduct the type of analysis conducted across the thesis. It is recognised, however, that there may be key differences between carers providing care within versus outside the household versus both, and future research may benefit from looking into these differences to produce some more nuanced findings. It was decided that this was outside of the scope of this analysis due to time and sample size constraints.

This definition of care also excludes childcare, and focuses only on unpaid care that is provided due to someone having a disability, being in poor health or elderly. This definition, however, may include childcare responsibilities that are in addition to standard childcare, for example in instances where a child may have a disability. There does remain some vagueness in the questioning, which has the potential to lead to some level of measurement error and, as a result, attenuation bias. The line at which 'regular' childcare becomes something different is often blurred, and may be interpreted differently by different responders. For example, caring for a child with Autism may be included as care in this survey amongst some responders but not others. What counts as unpaid care is also recognised differently across different people, and not everyone will recognise themselves as a carer, especially as it takes on average two years for an individual to recognise themselves as a carer (Carers UK, n.d., c). This may intersect with other cultural factors, as in some cultures, care is often normalised as a family obligation, rather than being seen as unpaid care (Banks, 2022; Carers UK, 2025b). This is highlighted by the fact that there is no direct translation between the term unpaid care in English and in other languages. It may be possible that some groups' levels of caring are undercaptured in the dataset.

The 'vagueness' of the questions asked in the survey may also be a way to try and capture some of these groups. The question does not explicitly mention 'care', which may mean the survey is able to collect care data on individuals who may not recognise themselves as a carer, or attach care as a label to the roles and responsibilities they take on. As mentioned, some individuals view care more as an obligatory part of the life-course when it arises, rather than it being 'unpaid care'. By describing what care can entail, without using explicit labelling, can therefore ensure certain groups are not excluded from the data due to these differences in views on whether they are or are not an unpaid carer.

Despite this, some carers may not be captured. This however, is for the most part, unavoidable. Even with measures in place such as survey weighting, the true distribution of care is unknown. Increasing the recognition and visibility of carers in the UK, as well as improved education and support, would hopefully be able to mitigate some of these issues over time. Ultimately, although this is important to recognise, the results of this thesis, whilst likely not perfect (as is all research) are still important and allow us to get closer to understanding some of the issues carers in the UK face when considered alongside other bodies of research.

Categorising 'care intensity'

It is recognised that this thesis uses wide categories of hours of care to describe care intensity. In the interest of maintaining large enough sample sizes for regression analysis, it was not deemed appropriate to use smaller categories of care intensity, such as breaking down high intensity care into multiple categories above 20 hours. As shown in figure 2.1, some of the categories in the understanding society care variable account for a small proportion of the data, particularly those who provide over 20 hours or more, which would make it difficult to explore high intensity care in much detail.

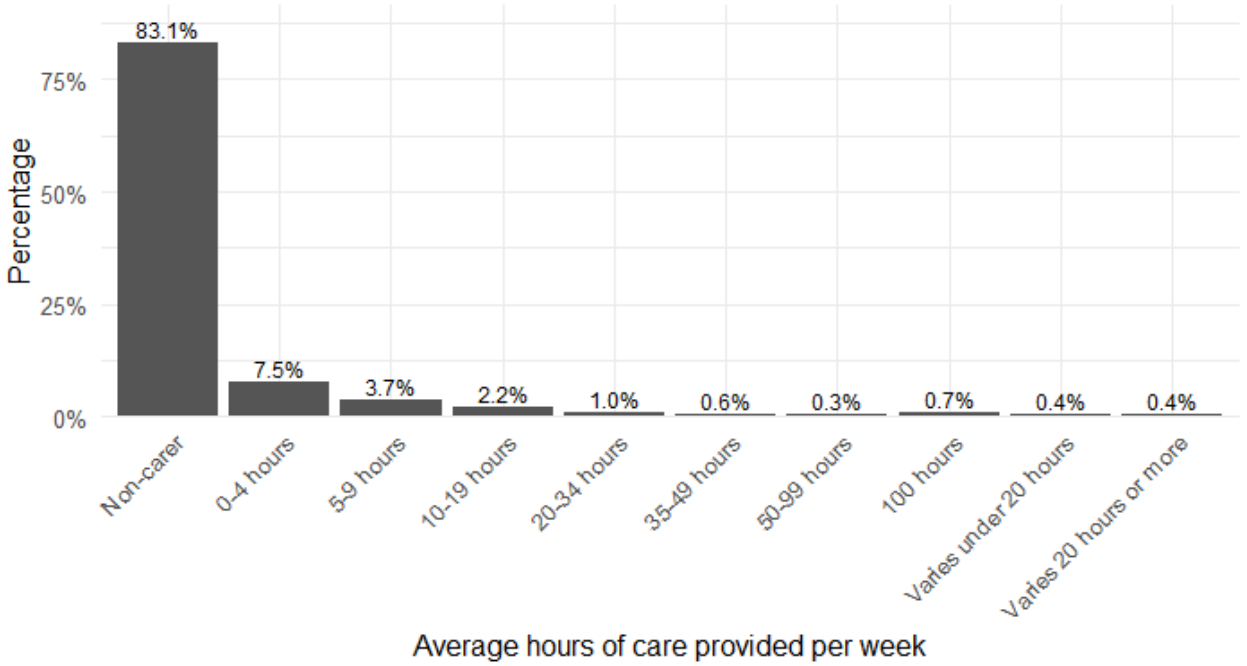

Figure 2.1 The distribution of care provided amongst people who are classed as "Employed", in the Understanding Society dataset waves 1 to 14 (source: U Essex, 2024).

In terms of making policy recommendations, it may have been ideal to break down high intensity care, as CA is only given to carers who care for at least 35 hours per week (UK

Government, 2025). It would be interesting to see how high intensity care specifically impacts employment, as this is most directly relevant to CA. However, this was not possible due to small counts if using smaller categories, as evidenced in figure 2.1. This research ultimately is still important as it highlights that care is negatively associated with employment at much lower intensities than you would have to be caring for to receive carer's allowance, which is particularly interesting from a policy perspective. The large sample size of the census may allow for better analysis of the highest intensity care groups, specifically on 35 or more hours as this is the group that would be eligible for receiving CA. Unfortunately it was not possible to use the census 2021 not being available for analysis at the time of writing, but it is recommended that future research conducts analysis on the census in order to explore this in greater detail.

The categories of care used in this thesis are also fairly consistent with existing literature. For example, King and Pickard (2013) categorise care into under 20 hours and 20 hours plus, and Young and Grundy (2008) also explore care as over 20 hours or more. This means that the findings throughout this thesis are more easily comparable to existing literature in the field, further justifying the categories used throughout the research.

Operationalising Employment

Employment is operationalised as average hours worked per week in paid employment, using the ‘jbhrs’ variable (how many hours, excluding overtime and meal breaks, are you expected to work in a normal week?) and ‘jbstat’ variable (Current labour force status). Jbstat is categorised into a binary variable ‘employed’ (in part-time or full-time employment) and ‘not employed’ (unemployed, retired, or looking after family/home) (U Essex, 2024). People in the ‘not employed’ category were assigned a value of 0 job hours, as shown in figure 2.2.

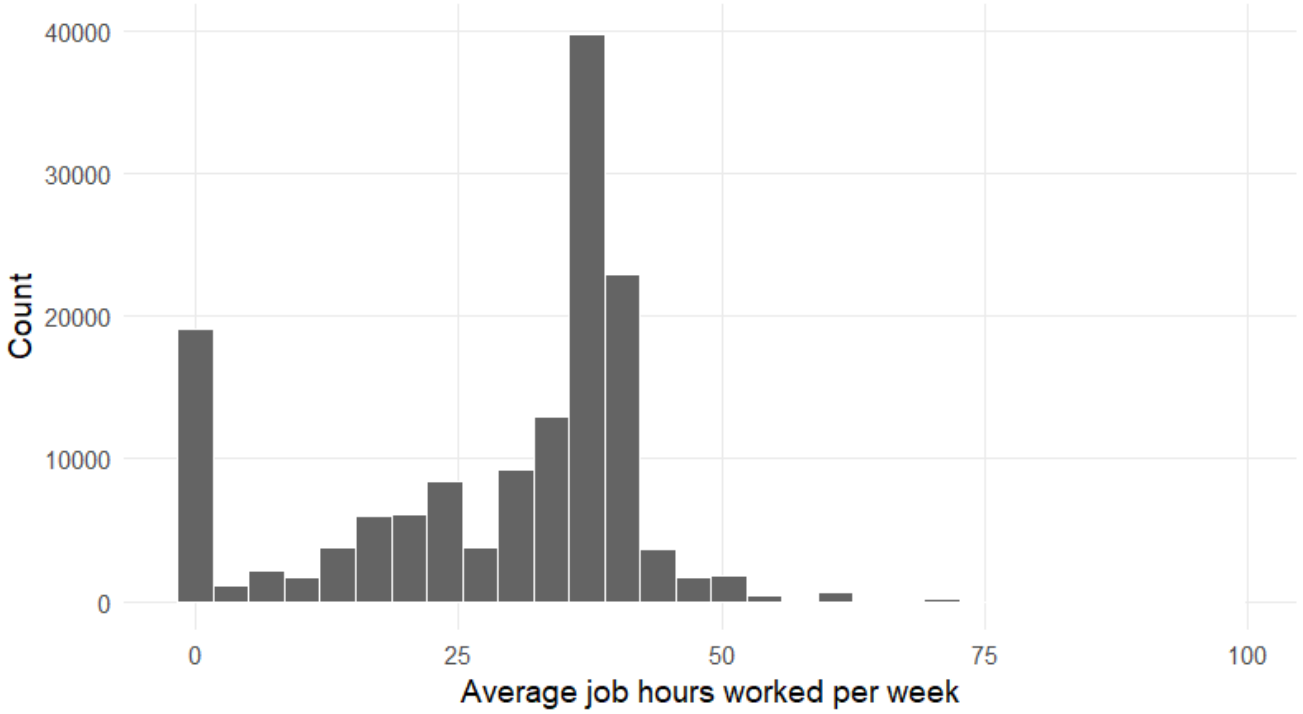

Figure 2.2 A histogram of the average job hours worked per week, created using the Understanding Society dataset waves 1 to 14 (U Essex, 2024).

Operationalising employment as hours per week was deemed an appropriate measure as it relates to the concept of 'time availability' that is referred to throughout the thesis (Henz, 2004; Jacobs et al., 2015; Raiber, Visser and Verbakel, 2022). Care and employment can both compete for time, which is the key focus of the thesis, hence the decision to use hours of employment, rather than employment type.

Although not within the scope of this research, operationalising employment as an employment type would also be interesting. Whilst this is partly encapsulated in the socioeconomic status variable (hiqual) that is used throughout this thesis, as this is somewhat associated with job type, it would be interesting to understand how care is associated with job type. For example, it is discussed in the thesis that those who are of a higher economic status and may have a higher paying job such as a managerial role, may be less likely to reduce their employment as a result of care due to the increase in foregone earnings (Carmichael, Charles and Hulme, 2010). Similarly, these individuals may also be less likely to take on intense care responsibilities if they are the primary earner in the household, and there are others in the household that are also able to take on care responsibilities. This highlights some of the other

avenues of research that could be explored in future studies, as the care-employment relationship can be complex.

As a further step, research could also look into how flexible working patterns and being self-employed are associated with caregiving. This may also intersect with job type. Some types of jobs may allow flexible working more than others, such as managerial roles, or office based roles. For example, computer based work or office work in general may offer more flexibility such as being able to host meetings virtually, allowing for home working. It may also be more feasible for individuals who work in an office to provide care during the working day such as visiting a cared-for person on their lunch break. This may be less so for individuals who work in the service sector or do manual work, as they may be less able to leave their workplace during the work day to carry out care.

This thesis unfortunately does not explore these aspects, as the project did not have the time or resources to explore all avenues of interest. However, there are related variables in the data that could be applied to the analysis, and this may be of interest for future research. The impact of COVID feels particularly relevant here, as the shift towards flexible working (Carers UK, 2020b; UK Parliament, 2014b; UK Government, n.d., a) has had lasting impacts on society and the workplace. Exploring this over the next few years would therefore be particularly interesting. At the time of writing, data up to 2023 was available, which is not a particularly long time after the end of the COVID lock down. As a result it was decided that not enough time had passed to be able to focus the analysis around COVID, hence these questions are not featured in this thesis, but it would be interesting to see future research look into this further

Implications of re-coding hours of employment

Coding people not in work as working 0 hours per week comes with some issues. For example, there is a large peak of individuals coded as working 0 hours per week, as shown in figure 2.2. This is not necessarily compatible with a linear regression model that assumes the outcome variable is normally distributed, which is not the case in figure x.

There are various modelling techniques that can be used in these scenarios, For example, hurdle models (Feng, 2021). However, sometimes adding additional complexity such as through using a hurdle model, in combination with other complex techniques (such as multilevel models, including with random slopes), may be unnecessary if not adding anything

to the story that is being told. Estimation issues may also come into play when using complex models, which were already a concern in this research, meaning it would not necessarily have been possible to implement these kinds of complexities. Often, using simpler modelling techniques is more effective when there is already a large amount of complexity in the models, hence the decision to somewhat overlook the normal distribution assumption. This is particularly the case for more exploratory analysis such as that presented here.

Using complex models, such as hurdle models, has the potential to act as a barrier for future research to reproduce or build on this work. If researchers need to understand and implement models that have additional complexities, it may make it more difficult. This research aims to be a starting point for further research to build upon, hence using simpler, more reproducible models was preferable.

Implications of selecting the sample population

In the analysis, people who were long term sick or disabled were removed from the sample. This may also remove a large proportion of carers, as many carers often have a disability themselves (Public Health England, 2021). However, this choice was made as often this demographic are unable to work, and it may often be the case that this is likely as a result of the disability, rather than being a result of providing care. It may be interesting however to look into this in more detail in future research, as disabled carers are an under researched group in the wider literature. However, here, we focus on the employment decisions of non-disabled non-long-term-sick people.

Those over 60 years old were also removed; there is also a large demographic over 60 who provide care, particularly men and women who provide spousal care (Office for National Statistics, 2023c). This again is likely removing a demographic of people who may be interesting to research, but was deemed the best, imperfect solution in ensuring the results were not capturing people who were not in work because they had hit state pension age, rather than as a result of providing care. However, this may miss people who remain in employment past state pension age as a result of needing the additional income to afford the additional costs that come with caring (Watkins and Overton, 2024). It may also miss people between 60 and state pension age who are retiring early to allow more time to provide care. It may be worth more research focusing on this age group to see how care may impact people entering later life. Qualitative research around this would be particularly interesting to uncover some of

the individual experiences amongst this demographic, as there are likely to be a lot of differences within this age group.

Households versus individuals

This thesis uses individual level data; however, it is also important to consider the fact that care and employment decisions are often household decisions. For example, paid and unpaid labour are often distributed between members of the household; if one member of the household is the primary breadwinner, it may be more likely that another member of the household is able to take on care responsibilities if they arise. Household composition may also impact the likelihood of providing care within the home, and may also impact the number of people in the home that require care. For example, in multigenerational households there may be a higher likelihood of there being dependent children as well as elderly parents who require care simultaneously, known as sandwich care (Ansari-Thomas, 2024; Boyczuk and Fletcher, 2016; Pomeroy and Fiori, 2025), which may impact care and employment decisions. In the UK, households are getting more diverse, stepping away from traditional nuclear family structures (Vanner and Patel, 2024), and there are various dynamics that will be relevant in the care-employment relationship.

However, care is also an individual phenomenon. Within a household, women are more likely to be carers than men (Office for National Statistics, 2016; Thompson, Jitendra and Woodruff, 2023; Xue and McMunn, 2021), and this gendered aspect of care would often be obscured when looked at a household level. Observing care and employment dynamics within households enables a greater understanding of how these dynamics arise. For example, understanding who takes on the caring responsibilities within the household may be interesting from a policy perspective, as it may indicate what kinds of people may need greater support. It may also be interesting to consider the extent to which this care division within households varies across different types of households.

Although household level information would be interesting, it would also add additional complexities that are outside the scope of this analysis. The research questions this thesis was interested in addressing are appropriately answered using individual level data. As the research conducted in this thesis is mostly exploratory, looking at differences over time and across different groups of people, looking into more nuanced relationships between households may have overcomplicated the analysis and taken away from the research

questions at hand. It may therefore be more useful to analyse household level data as a separate study, as this would allow for a more in-depth analysis of these household dynamics to be explored.

Looking at the relationship at an individual level additionally allowed for comparisons to be made with existing literature, which has focused on individual-level analysis. A lot of the analysis techniques used in this thesis have not been used before in this field, meaning the comparability of the findings was important in ensuring the techniques provided results that were expected.

Chapter four does control for household composition to account for the impact household decisions may have on the care-employment relationship. The decision was made to not control for household composition in chapters three and five, as the primary focus of these chapters was the MAIHDA approach, in which controlling for non-strata-defining variables would make it difficult to understand the intersectional inequalities being explored (see page 67). It would be interesting, however, for future research to explore the impact of household decisions on the care-employment relationship in greater depth, as this is an under-researched topic.

Addressing causality

There are also questions around causality in the care-employment relationship. It may be the case that those who care may work fewer hours even if they do not have caring responsibilities. There may be confounders that impact care and employment independently, such as work preferences or family expectations that may mean an individual is more likely to choose to work part-time hours. This may be associated with working fewer hours, and subsequently caring for more hours, which highlights the fact that the care-employment relationship may not be causal. From this analysis, it is not possible to determine to what extent these 'other' causes may be impacting the results. This means there is potential bias within some of the findings that is impossible to measure with the data available. This further highlights some of the complexities that may be interesting to be looked into further in more specific studies that can go into this in greater detail.

This thesis is primarily focused on the inequalities in the relationship between care and employment, rather than identifying a causal relationship that assumes a specific direction in

the relationship. Exploring these inequalities is an important, policy relevant finding, regardless of what drives the inequalities (as mentioned above). Although it is not the key focus of the thesis, it is touched upon that the care-employment relationship is often complex, and may be bi-directional. For example, individuals who are already working fewer hours unrelated to providing care, may be more able to take on care responsibilities as they arise, due to having more time available to do so. This links to the idea of time availability that is discussed throughout this thesis (Pomeroy and Fiori, 2025; Henz, 2004; Jacobs et al., 2015; Sacco et al., 202; Raiber, Visser and Verbakel, 2022). This topic of reverse causation is discussed in existing literature. Heitmueller (2007) highlights this in their study 'The chicken or the egg? Endogeneity in labour market participation of informal carers in England' which discussed the complexities in the care-employment relationship, where care can affect employment, employment can affect care, as well as both being impacted by other confounders. This would be an interesting topic to explore further in future research, given the lack of scope available to do so within this thesis.

This does however, mean that the findings in this thesis cannot be interpreted as being causal; we cannot say with certainty that care negatively impacts employment as a result of the analysis conducted in this thesis. Not being able to establish a causal relationship between care and employment does not take away from the importance of the research, but it is important to recognise when interpreting findings.

One way causality could be addressed is by using fixed-effects rather than random-effects models. Fixed-effects models control for time constant effects (for example, characteristics of an individual that remain stable over time, such as ethnicity), leaving only the 'within-person' effects; things that change over time such as hours of employment or hour of care provided per week. This means that the effects observed are explained by changes over time within an individual. A Random Effects Within Between (REWB) approach could also be taken, which allows within and between individual effects to be estimated simultaneously (Bell, Fairbrother and Jones, 2019). These approaches allow for a more causal interpretation of the relationship between hours of employment and care, although it is important to note that this does not necessarily guarantee causality, since there might be time-varying confounders that remain uncontrolled for. However, this approach would mean that between person variability could not be analysed. This would therefore not capture the carers whose employment patterns may

not have changed over time, and whose caring patterns do not change, which would mean that a group of carers who may still require support would not be visible in the research.

Chapter four aimed to act as an exploratory piece of research, identifying the relationship between care and employment in order to understand how this has changed over time in a period of large social, political and economic change. In doing so, it aimed to explore whether and to what extent carers were less likely to be employed in comparison to non-carers. In chapter four identifying a causal relationship is not therefore the key aim of the research, as it is more interested in looking at the overall relationship (causal or not). That overall relationship, and the inequalities implied by it, exist regardless of what mechanism produced that inequality. Indeed, controlling for additional factors (as a fixed effects model does) would potentially hide those raw inequalities that are arguably most relevant from a policy perspective.

For example, if a carer is more likely to provide care as a result of the fact they are either not in employment, or work part time, and therefore have more time available to provide the care, that does not mean that they could not benefit from financial support, through CA for example. Carers who are working fewer hours than non carers, or who are out of the labour market entirely, are still at a higher risk of financial insecurity and resulting negative consequences of this (Carers UK, 2019a; The Health Foundation, 2024) than those who do not provide care and work full time, regardless of whether care directly caused a reduction in hours worked. This is for multiple reasons, including, but not limited to the lack of earnings through paid employment combined with the possible additional costs carers face (Watkins and Overton, 2024).

It was therefore deemed more appropriate to use a random-effects model over a fixed-effects model as it allowed for this kind of exploratory analysis that is important in understanding how carers may benefit from certain policies and support. It may, however, be an interesting avenue for future research to take a more causal approach, using fixed-effects multi-level models to explore the causal relationship between care and employment, or better, experiments or quasi-experiments to test the effect of different care decisions and policies on employment choices.

Age, period, cohort effects

There are different effects related to time that can shape experiences, specifically age, period and cohort effects. Age effects relate to changes that happen as a result of ageing, for example, people (generally) are likely to get better off financially as they age, and they are more likely to experience poor health later in life (Bell, 2020). This is related to caring as firstly, people may be more likely to know someone who requires care in mid-life to later-life, as they get to the age where they may have elderly parents (Boyczuk and Fletcher, 2016), or live with a spouse who is in poor health (Bauer and Sousa-Poza, 2015; Vlachantoni, 2010). Similarly, someone's age may play a part in the decision to provide care or not, as age is associated with employment (where people in mid-life tend to work the most hours and for the highest wage) which can impact whether someone has the time available or the ability to forego earnings if they are currently in a well paid job that is limited in its flexibility. It may also impact how financially secure an individual is which could impact whether they are able to pay for additional support to help them with caring responsibilities, as caring is often associated with additional costs (Watkins and Overton, 2024).

Period effects relate to changes year-on-year (Bell, 2020; Bell et al., 2024). For example, the COVID pandemic may have changed experiences, and large-scale social changes such as a change in government or policy changes may impact things. One care-related example includes the increase in demand for unpaid care during the pandemic due to the increase in people needing care alongside the high demand on healthcare services such as the NHS (Onwumere et al., 2021). This is explored in chapter four, which takes a focus on year-on-year changes in the care-employment relationship in the context of social, political and economic change.

Cohort (generation) effects relate to the fact that being a part of a specific generation may shape experiences due to differing social contexts and shared experiences between different generations (Bell, 2020). For example, generation Z will have grown up around technology such as computers and mobile phones that may have shaped their childhood in a different way to previous generations. Similarly, norms and expectations have also changed over time, and older generations may have been brought up with parents who have more traditional values, towards gender roles and religion for example, which could have shaped their life-course trajectories differently to younger generations (Halpern and Perry-Jenkins, 2016). In relation to

care, certain older generations may hold greater expectations on women to take on care roles in comparison to men, whereas the increase in women entering the work force (Carmichael and Charles, 2003; Yeandle and Joynes, 2012) and reduced gender expectations over time (Scott and Clery, 2013) may mean that women from younger generations face less pressure to provide care and potentially see it more as a choice than an obligation (although this may intersect with other things such as culture).

There are debates around whether and how age, period and cohort effects can be observed simultaneously in quantitative analysis. In cross-sectional studies, such as paper 1, period is constant, and age and cohort are exactly collinear with each other (Bell, 2020, Bell et al., 2024). In longitudinal studies, it is possible to consider age alongside generation effects, or age alongside period effects, as has been done in chapters three and four, however, including all three in regression models will introduce collinearity issues (Bell, 2020). In including two of the three, an assumption is made that there will be no effect of the third. In the analysis in this thesis, this is not deemed as a major concern, as much of the effects of the excluded effect(s) will be absorbed by the included effect(s). Theoretical and practical decisions were made about which effect to include in each chapter, and these are outlined below:

The thesis uses a combination of age and generation in different ways across chapters three to five. In chapter three, generation cohort (defined by birth year) is used as a strata defining variable. In chapter four, age as a continuous variable is controlled for. In chapter five, generation cohort is included as a strata defining variable. Age as a continuous variable is also included in the model, as age-demographic variable interactions and as age random slopes.

In chapter three, a cross-sectional study, age and generation are exactly collinear (Bell, 2020; Bell et al., 2024). This means that only age or generation can be included in the model. In this chapter, the decision was made to include generation cohorts, although generation cohorts in the context of this research will estimate inequalities that are mostly driven by age related effects, since theoretically we would expect age effects to dominate cohort effects when considering employment variation and care decisions. However, this cannot be empirically distinguished in this cross-sectional study.

The choice to label these age effects as generation, rather than age groups, was made for two key reasons. Firstly, semantic reasons. Labelling by generation allows us to use terms that fit the age groups meaningfully for the time period being discussed. For example, when we refer

to ‘generation X’, we are referring to people who were aged 44-59 in 2023. Generation cohorts stay stable over time and hence makes it easier to refer to generations where the research becomes longitudinal.

Secondly, for conceptual consistency over the thesis. As age and generation effects are considered in chapter five, which is possible due to the longitudinal nature of the research, generation cohort was used as a strata defining variable for similar reasons as above. Age and age interactions were included in the fixed part of the model in addition to this as it made it possible to account for the fact that changes over time may be related to age (age effects); this would not have been possible in chapter three due to the cross-sectional nature of the study. Including generation cohort in the strata groups, rather than age, in both studies, allows for consistency in strata definition across the thesis.

Chapter four was most interested in period differences; changes year on year based on events occurring at specific time points, and as more of an exploratory analysis, and so was less concerned by what variables drive the changes over time than in mapping the year-by-year changes. Given this chapter is the only one of the three to not take a MAIHDA approach, it made less sense to include the generation cohort, and controls for age given the centrality of age to care trajectories and decisions.

Chapter five extended chapters three and four and took a longitudinal MAIHDA approach, and was more interested in individual trajectories, age and generation cohort effects. Unlike chapter three, the longitudinal nature of the analysis meant that issues of exact collinearity between age and generation cohort were no longer a concern. This meant age could also be included in the model, as it has been in the form of fixed effects, interactions and random slopes. Following Bell et al. (2024), this approach allows for the conceptualisation of “cohort careers” (Fosse and Winship 2023), thereby not assuming no period effects, but understanding the estimates of the age and cohort differences as including period effects within their definition.

Estimation and software

Throughout this thesis, frequentist estimation has been used. To conduct the regression analysis in R Studio using R version 4.1.1 (R Core Team, 2021), the lmer function within the

lme4 package has been used. This uses Maximum Likelihood Estimation (MLE) (Bates et al., 205).

This approach was used as this doctoral programme was conducted alongside a Masters programme in which advanced quantitative skills were learnt in order to support the doctoral research. Within this masters (and previously) my learning and knowledge has focused on frequentist approaches, which is where my skills are the strongest. After conducting the analysis for chapters three and five, it became clear that the complexity of the models may have meant that a small number of the models were struggling to converge (see pages 69 and 231). As a result of this, it could be argued that using Bayesian techniques may have been able to overcome some of these issues relating to model convergence and the formation of confidence intervals. This is because Bayesian models help with model convergence in some instances (Bates et al., 2015).

However, the models presented in the thesis were assessed to have converged, and given that the primary aim of this research was to estimate associations within a multilevel framework rather than to incorporate prior information or make probabilistic statements about parameters, adopting a Bayesian approach was not considered necessary. Existing methodological research suggests that frequentist and Bayesian multilevel models often produce substantively similar results in applied settings when weakly informative priors are used, especially when there are a large number of higher level units as is the case here (Stegmueller 2013). As such, introducing additional methodological complexity was unlikely to materially alter the substantive conclusions of the thesis.

Data biases

Missing data

In chapter three which is cross sectional and uses wave 14 of Understanding Society, the target population is individuals aged 16-64. There is approximately 1.62% overall missingness in the job hours variable within people aged 16-64, and only 0.88% missingness in the care (aidhrs) variable. Once filtered to the target population of individuals which includes only those who are either in employment (employees, not self-employed), retired, looking after the family or home, or unemployed, missingness in the care variable is reduced slightly to 0.74%. The missingness in the strata variables is also fairly low (<3.5%).

In chapters which take a longitudinal approach and use all 14 waves of data (three and four), the target population is individuals aged 16–60. Within this target population, there is only 0.82% missingness in the job hours variable. Since this level of missingness is very small, it was not deemed a major concern. Missingness in the care variable was slightly higher, at 7.14% among individuals aged 16–60. However, once the data was filtered to the relevant employment target population, missingness in the care variable reduced slightly to 6.44%.

To minimise missingness in time-invariant variables (such as birth year, sex, and ethnicity), values from waves without missingness were used to fill waves where these values were missing. Cases where values conflicted across waves were removed from the data, representing a very small proportion of observations. Overall, once filtered to the target population, missingness across all other variables was very small (<2%).

List-wise deletion is used to handle the remaining missing data throughout this thesis. This approach removes an entire observation (row) from the analysis if it contains missing data on any of the variables included in the model. For example, individuals with no valid response for care intensity (aidhrs) are excluded from the analyses. List-wise deletion produces unbiased estimates only under the assumption that data are Missing Completely at Random (MCAR), meaning that the missingness is unrelated to both observed and unobserved variables (Kang, 2013). Examples of MCAR include technical failures, such as a computer crash, or respondents unintentionally failing to submit their responses.

However, in large-scale survey data such as Understanding Society, missingness is often related to respondents' circumstances or characteristics, making Missing at Random (MAR) or Missing Not at Random (MNAR) more plausible than Missing Completely at Random (MCAR). For example, respondents may be less likely to report their average weekly job hours depending on observed characteristics such as age or employment status; for instance, younger respondents or those in more precarious employment may be more likely to skip this question. As this missingness can be explained by other variables observed in the data, it would be consistent with Missing at Random (MAR).

In contrast, missingness would be Missing Not at Random (MNAR) if respondents are less likely to answer the job hours question because of the value itself. For instance, individuals working extremely long hours may choose not to report their job hours due to fatigue or stress, meaning the missingness depends directly on the unobserved value. Similarly, high-intensity

carers may be less likely to complete later survey questions because their caring responsibilities limit the time available to finish the survey. As this non-response is directly related to the level of care provided, which is unobserved when missing, this pattern of missingness is more consistent with MNAR than MAR.

As a result, list-wise deletion may introduce bias into the data. If certain groups are less likely to respond to particular questions, they may become under-represented in the analytical sample when entire observations are dropped. This may limit the ability of the analysis to fully capture the care–employment relationship, which could have implications for the resulting interpretations and recommendations. An alternative approach would have been to use multiple imputation to replace missing values with plausible responses predicted from the observed data (Kang, 2013). However, to do this without introducing additional bias, the assumption that data are Missing at Random (MAR) would need to hold (Hughes et al., 2019), as imputation relies on observed variables to predict missing values. As it is likely that some of the missingness in this analysis is Missing Not at Random (MNAR), multiple imputation would not fully resolve potential bias and would introduce additional complexity. Given the relatively low levels of missingness overall, a decision was made to proceed with list-wise deletion. Whilst not a perfect solution, no models are truly perfect, and these models and results remain useful.

Sample weights

There is likely bias in the data by certain demographics being less likely to respond to the survey. This can introduce bias where certain groups are under-represented in the data, and subsequently have smaller proportions in the data in comparison to the actual population of the UK. Survey weights can be used to help mitigate some of these biases, as they can scale up the data to be more representative of the population (Moore, 2025).

This thesis does not use survey weights for a number of reasons. Firstly, the aim of the thesis was not to try and provide exact population estimates. The aim of the thesis was to act more as a descriptive study, investigating structural patterns in the data, rather than aiming to explore differences at a population level. The Understanding Society dataset is also fairly nationally representative as it is (U Essex, 2024), which means it is less prone to bias compared to other surveys.

Secondly, in using MAIHDA, the strata groups are defined by important variables (such as ethnicity, generation, sex and socio-economic status). Biases in the data would arise based on the non-representativeness within strata, which are likely to be driven by other, unmeasured variables. In this case, weights would not likely be able to fix these biases. It may be that future research could adapt this research framework to include the use of survey weights to see to what extent this changes any of the findings.

Overall, it is possible that the results of this research may have been slightly improved by using survey weights and multiple imputation. Ultimately, it would likely not make much of a substantive difference to the findings and subsequent conclusions made, as the sample is fairly representative and the missingness is overall relatively small.

Conclusion

This chapter has provided an overview of the decision making processes taken in formulating the methods for each chapter individually, while also bringing them together as part of a wider thesis. The methods used have been carefully considered and justified in relation to the research questions the thesis aims to address. However, there are alternative options that could have been explored, and may be interesting to explore through further research. It is worth noting that no research and no statistical model is perfect, and this thesis is no exception. It is likely that there are some biases that remain in the data, as well as some nuances that have been unable to be uncovered. Despite this, the substantive key findings and conclusions from this research remain important and useful, particularly in being able to uncover inequalities in the care-employment relationship that can be used to inform decisions around how to best support carers.

Chapter Three: Labour market participation and Unpaid Care Work in the UK: An Intersectional Analysis of the Understanding Society Dataset

Abstract

Context: The number of unpaid carers has risen in recent years, with a growing proportion providing high-intensity care. Balancing caregiving with employment can create significant challenges, such as financial strain, poor mental and physical well-being and reduced labour market participation. This study explores how caring intensity and socio-demographic characteristics combine to shape labour market outcomes, taking an intersectional approach. The ways in which the caring-employment relationship varies by socio-demographic characteristics is yet to be explored.

Aims: We address the following research questions: **RQ 1** What is the relationship between being a carer (both low and high intensity caring, compared to non carers) and labour market participation (job hours)? **RQ 2** How does the relationship between care intensity on labour market participation (job hours) vary across intersectional strata? **RQ 3** To what extent is the variation in the care-employment relationship (identified in RQ2) explained by two-way, care-by-demographic-variable, interactions?

Methods: Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy (MAIHDA) Regression models with random slopes are used to analyse wave 14 (2022-2023) of the Understanding Society dataset.

Key findings: Caring is linked to reduced levels of labour market participation, even after accounting for socio-demographic variables. This association was most pronounced for people providing higher intensity care (20 hours or more). There is variation in the relationship between care intensity and labour market participation; most of this variation is explained by the two-way, care-by-demographic-variable interactions: There is a larger gap in job hours between male non-carers and male high intensity carers compared to females, although females work overall fewer hours. High intensity carers from younger generations (X and Y) work considerably fewer hours on average in comparison to non-carers of the same generations. High intensity carers with secondary school or other education work similar hours to lower intensity carers or non-carers who have no qualifications, and many fewer hours than non-carers with the same qualifications. There are fewer clear differences between ethnic groups.

Limitations: To maintain large enough sample sizes, detail is lost in the re-categorising of care intensity into fewer categories, and the measurement of care intensity does not include detail about the individual experience of providing care.

Conclusion: More support for carers should be put in place, such as respite care and improved access to Carer's Allowance, this will particularly help support carers of lower socio-economic status. Support should also focus on carers of younger generations who are entering employment or in their prime working years to enable them to combine care and work where possible, to mitigate negative impacts later into their life-course.

Introduction

As the demand for unpaid care rises, an increasing number of people feel the strain of combining care responsibilities alongside paid employment (Carers UK, 2019a). The caring landscape has evolved over time, and the number of carers providing high-intensity unpaid care is on the rise. According to the latest Census results from the Office for National Statistics (2023), there has been a significant increase in the intensity of care provided, making carers an important group to research from a policy perspective (Bauer and Sousa-Poza, 2015). With more people providing care, and at higher intensities, an increasing number of carers are struggling to combine work and care. Many are reducing working hours or leaving work entirely (Van Houtven, Coe and Skira, 2013), and could experience negative impacts on their financial and mental well-being as a result (Carers UK, 2019a). It is therefore important to explore the relationship between caring and labour market participation.

This research follows an intersectionality framework. This approach considers how individuals' multiple, intersecting identities, such as gender, ethnicity, age/generation, and socioeconomic status, may influence their experiences (Bell, Holman, and Jones, 2019; Crenshaw, 1991). This framework has been increasingly recognised across disciplines (Cho, Crenshaw and McCall, 2013), noting that people are not affected by a single aspect of their identity but by the complex, cumulative impact of multiple overlapping identities. By using this theoretical framework through a quantitative lens, this research builds on existing literature by developing statistical models to examine the relationship between caring and labour market participation and how this varies across socio-demographic characteristics. The following research questions are addressed:

> **RQ 1** What is the relationship between being a carer (both low and high intensity caring, compared to non carers) and labour market participation (job hours)?
>
> **RQ 2** How does the relationship between care intensity on labour market participation (job hours) vary across intersectional strata?
>
> **RQ 3** To what extent is the variation in the care-employment relationship (identified in RQ2) explained by two-way, care-by-demographic-variable, interactions?

This paper is structured as follows: We first review the existing literature on the relationship between caring and labour market participation, paying particular attention to how broader

societal shifts have shaped the caring landscape. We then introduce intersectionality as the theoretical framework used in this research. The process of analysis is then outlined, in which we discuss the uses of advanced multilevel models, specifically an extension of MAIHDA (Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy), to assess the extent to which the relationship between care and labour market participation is influenced by intersecting socio-demographic characteristics. Finally, the results and significance of these are presented, which help to inform our final conclusions and suggestions for future research.

The results of the analysis revealed that carers are on average, significantly less likely to participate in the labour market than non-carers, a finding consistent with previous research (Brimblecombe et al., 2020; Carers UK, 2019a). Carers providing both 1-19 hours and 20 or more hours of care per week were less likely to participate in the labour market, even after controlling for socio-demographic characteristics, compared to non-carers. The analysis also demonstrates that the impact of caring on employment is not uniform across all carers; this variability was the most pronounced for higher intensity carers (20 or more hours). Multiplicative effects are present in the analysis, although the interaction between care and socio-demographic factors explains much of this variation and the models were unable to identify any significant differences between strata once interaction terms were added. The interactions revealed some interesting results. Whilst the effect of high intensity caring appears to be less for women in comparison to non-carers, women work overall fewer job hours and therefore high intensity female carers work on average the fewest hours. The findings from the interaction between care and ethnicity suggest that while high-intensity caregiving is consistently linked to reduced job hours across all ethnic groups, the effects of 1-19 hours of caring vary. Providing 20 or more hours of care per week is associated with a reduction in working hours across all ethnic groups. Overall, high intensity care is associated with working fewer job hours across all generations. The gap in job hours between high intensity carers and non-carers is largest for generation X and Y, suggesting that the effect of high intensity caring may be the greatest on people in their prime working years. Finally, care and education. People with degree-level education consistently work the highest number of hours, while those with no qualifications work the fewest, regardless of their caring responsibilities. However, for people with secondary or other qualifications, those providing 20 or more hours of care have much lower predicted job hours compared to non-carers, suggesting a stronger negative impact of caregiving in these groups. To summarise, the

relationship between care and employment varies by gender, ethnicity, generation and highest educational qualification, with no evidence of higher order interactions.

This research makes an important contribution to the literature on caring and labour market participation by applying a quantitative intersectional approach, which to my knowledge has not yet been applied to the field of adult social care in the UK. We also make a methodological contribution, in that using random slopes in combination with MAIHDA has only been done a handful of times before (see: Bell et al., 2024; Evans et al., 2023), and never outside of health disciplines. The findings highlight the need for policy to recognise the diverse experiences of carers, rather than treating them as a homogenous group. As a result, we argue for further research employing MAIHDA models to continue advancing knowledge in this underexplored area. Future studies should conduct similar analysis using other large, representative datasets, such as the Census (Office for National Statistics, n.d. a) and the English Longitudinal Study of Ageing (NatCen Social Research, University College London, Institute for Fiscal Studies, 2023), to further validate these findings and inform policy decisions.

Literature Review

Background

Unpaid care in this paper is defined as 'looking after or giving help to someone who is sick, disabled or elderly, such as a friend, relative or partner' (U Essex, 2024), and is referred to simply as 'care/carer/carers' throughout this paper. Between 2001 and 2011, the number of unpaid carers in England and Wales grew by 600,000, reaching approximately 5.8 million. This increase was observed in all regions except London (Office for National Statistics, 2013a). The intensity of care being provided also increased, with those providing 50 or more hours per week rising from 2.3% to 2.7% in England and from 3.4% to 3.7% in Wales. The most recent census data (from 2021) shows a slight decrease in the overall number of carers, but an increase in the proportion of people providing higher intensity care. Specifically, the percentage of those providing 20-49 hours of care weekly increased to 1.9%, while those providing 50 or more hours rose to 2.8% (Office for National Statistics, 2023c). These trends highlight the growing need for policies to support carers, particularly those providing high-intensity care, who may experience negative consequences from balancing multiple roles such as stress and burnout (Austin and Heyes, 2020; Carers UK, 2019a).

As the number of carers providing high intensity care continues to rise, so does the number of individuals juggling caring with employment, which can have negative repercussions on their labour market participation. The 2011 Census reported that 3 million people (1 in 9 of working age) were balancing employment with caring responsibilities. Carrying out multiple roles can lead to increased stress, and many carers report that it negatively affects their employment, often forcing them to reduce their working hours or leave paid employment entirely (Carers UK, 2019a; Van Houtven, Coe and Skira, 2013). For example, the Health Foundation estimates that as many as 4 in 10 carers do not work as much as they would if they were not providing care (Peytrignet, Grimm and Tallack, 2023). The relationship between caring and labour market participation is therefore important to study, as it directly impacts carers' financial security and mental well-being. For example, reduced working hours can lead to lower earnings (Brimblecombe et al., 2020), and limited career advancement opportunities, such as promotions. In turn, this can increase anxiety and financial dependence on benefits like Carer's Allowance, that are often described as being inadequate in meeting carers needs (Arber and Ginn, 1995; NHS England, 2017; Carers UK, 2022b) due to strict eligibility criteria and low payments.

Multiple factors contribute to the changes in care provision over time. An ageing population, where people have longer life expectancies but often at the same time as having poor health or disabilities, has increased the demand for care (Heitmueller and Inglis, 2007). Simultaneously, reductions in public services, including those provided by the NHS and local authorities, have increased the reliance on unpaid care (Heitmueller, 2007). Additionally, shifts in gender roles have played a role, as more women enter the workforce and more men engage in caring activities traditionally associated with women (Carmichael and Charles, 2003; Yeandle and Joynes, 2012). However, despite these changes, gender norms persist, resulting in a gendered division of caring, with women still more likely to provide unpaid care than men at all ages except post-retirement (Bauer and Sousa-Poza, 2015).

Theoretical framework

This research follows an intersectionality framework. Kimberlé Crenshaw first coined the term 'intersectionality' in 1989, using the example of race and sex, in which the combined experience of being both Black and a woman is greater than the sum of the experience of being Black or a woman individually. For example, belonging to multiple social groups, such as being

both Black and female, may produce different experiences compared to considering each characteristic in isolation (Crenshaw, 1991). Originating in Black feminism, intersectionality is becoming increasingly used across multiple disciplines (Cho, Crenshaw and McCall, 2013), and is beginning to be used within the field of quantitative methods. Traditional multivariable regression models consider the effect of different identities and characteristics on the outcome, however, they do not consider how these identities and characteristics may combine together to produce different effects. In order to account for intersectionality in quantitative data analysis, multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA) models have been developed, in which individuals are nested in their intersectional social strata (Evans et al., 2018).

The intersectional MAIHDA approach has increasingly been adopted across disciplines such as epidemiology, social sciences, and education, where it has proved useful in uncovering intersectional inequalities in large datasets (Bell et al., 2024). Recently, this approach has also been employed in adult social care research from a European context (Alonso-Perez, 2024). It has proved a useful tool in beginning to identify intersectional inequalities in large datasets, which has not yet been able to be explored. This approach is therefore a significant advance in the field of quantitative research, which is historically limited in its ability to explore complex intersectional relationships in this way. In doing so, it provides a method that can analyse aspects of intersectional inequalities that were previously accessible primarily through qualitative and mixed methods research.

This is a useful framework in adult social care research, as there could be inequalities in the relationship between care and employment. Being out of the labour market comes with a financial cost due to lack of earnings (Brimblecombe et al., 2020; Cartagena-Farias and Brimblecombe, 2023; Petrillo et al., 2024). Evidence also consistently shows that many carers face considerable financial challenges, which may have been exacerbated by the COVID-19 pandemic (Carers UK, 2020a). Reduced participation in the labour market among carers may add to these financial struggles. This can exacerbate the existing financial challenges faced by many carers, but particularly for certain groups, such as those of a low socioeconomic status. In contrast, inequalities may also arise in the case of certain groups, particularly those of higher socioeconomic status, having more choice. For example, the decision to retire early, or to dedicate more time to full-time caring can be easier for those with greater financial

resources. This highlights a significant aspect of inequality: when people have greater financial stability, they may have more freedom to make choices (Carers Trust, 2024). In contrast, those who struggle financially often face tough compromises that can limit their choices.

Additionally, those who are more dependent on income through paid employment in order to support them with their caring responsibilities may face additional stress. For example, the costs of caregiving can force carers to work longer hours, adding to the stress of managing multiple responsibilities. This dual burden of combining multiple roles (caring with paid employment) can reduce time available for carers' own leisure time. This could lead to negative mental and physical health outcomes (Austin and Heyes, 2020; Carers UK, 2019a). This highlights how social and structural inequalities intersect to shape carers' experiences in unequal ways.

These issues are related to the wider social and structural inequalities faced in the UK. The welfare provision for carers falls short in being able to support their financial needs, as Carer's Allowance (CA) is criticised for being too little, and too inaccessible (Carers UK, 2022a, b; Fry et al., 2011). As of April 2025, eligibility for CA requires providing at least 35 hours of care per week and earning no more than £196 per week after tax, National Insurance, and expenses. This requires carers to be caring at a much higher intensity than this research considers to be high intensity caregiving, emphasising how the strict criteria may mean many carers who could benefit from the benefit, are not eligible to receive it. Even for those who meet these stringent criteria, the allowance is only £83.30 per week (UK Government, 2025). This lack of support is likely to affect carers who receive Carer's Allowance but still have limited financial means the most. Even in receipt of the benefit, many may find it difficult to make ends meet. Without enough financial help, some may feel they have no choice but to take on extra work, increasing the risk of stress, burnout, and other negative effects (Carers UK, 2019a). This shows how financial inequalities can intersect with caring, creating different experiences depending on individual socioeconomic circumstances.

Social and cultural factors also play a role in shaping trends of caring within the UK. Different socio-cultural identity combinations are associated with different social norms regarding who would be expected to provide care, and who would be expected to work, and these norms influence decisions that individuals make. For example, persisting traditional gender roles mean that women provide a disproportionately large amount of domestic labour, including

care (Office for National Statistics, 2016). This also means that they are often combining multiple roles, such as care for a sick or elderly family member, as well as for dependent children, often defined as ‘sandwich’ care (Boyczuk and Fletcher, 2016). Women may also be more likely to reduce their working hours due to cultural norms and expectations around gender. Additional roles such as domestic labour, childcare and unpaid care may factor into this (Boyczuk and Fletcher, 2016). Similarly, certain ethnicities are more likely to provide care due to cultural expectations (Wells et al., 2025). These factors are also likely to vary across the life-course, and between different socioeconomic groups, highlighting the need to consider the multifaceted nature of caring.

Policy is also not doing enough to support carers, which may be further contributing to these inequalities. Key services that support carers are often inadequately funded. For example, respite care, which can allow carers an important and often needed break from their caring responsibilities is not always accessible (NHS, 2022). Many carers find that respite care is only confirmed at short notice, leaving them little time to plan or take advantage of the service. This lack of predictability can make it difficult for carers to benefit from the service, particularly if they have limited financial means. For example, carers with tight budgets may struggle to arrange last-minute travel or accommodation that is affordable, possibly making respite services less accessible. On the other hand, carers with greater financial resources may have more flexibility to make arrangements with short notice. This highlights another mechanism in which inequalities can affect carers differently. The lack of accessible respite care also has a ripple effect on carers' overall well-being. Without enough breaks, carers are more likely to face ongoing stress, exhaustion, and struggles with their mental health (Austin and Heyes, 2020; Carers UK, 2019a). This is particularly concerning for those who are already juggling financial strain and extended working hours alongside their caregiving responsibilities. For these individuals, the lack of effective policy and support could exacerbate the challenges they face, further reinforcing inequalities and making it more difficult to manage the demands of caring, particularly when combined with employment.

These findings highlight the benefit of applying an intersectionality framework to examine the experiences of carers. Accounting for the complex, intersecting relationship between socioeconomic and demographic factors will enable us to gain a deeper understanding into how inequalities may occur across different groups of people (Crenshaw, 1991; Bell, Holman,

and Jones, 2019). This is important to ensure that policies support carers more equitably, helping to prevent issues such as financial strain and poor mental or physical well-being from disproportionately impacting those who already face the greatest inequalities.

However, there remains debate over the extent to which MAIHDA models can capture intersectionality in the same depth as qualitative approaches, given that the unique nuances between individuals often go unrepresented in large datasets. One key limitation lies in the categorisation inherent to quantitative data, where individuals are often placed into predefined categories (for instance, of sex and ethnicity) that may not fully capture their lived experiences or evolving identities. This creates a risk of reducing intersectional experiences to static labels that may miss critical nuances and individual experiences. However, an inter-categorical approach has been used for this research as it focuses on understanding inequalities between different social groups in the context of labour market participation. This approach allows us to explore how factors like sex, ethnicity, generation and highest educational qualification intersect to shape people's experiences. By considering differences between groups, we can identify patterns of advantage and disadvantage and uncover wider inequalities. This is not to deny the existence of intra-categorical inequalities, and the approach acknowledges that while social categories are not fixed, they are useful for highlighting how relationships between groups contribute to broader inequalities in caring and labour market participation (McCall, 2005).

Secondly, the MAIHDA model functions optimally with a manageable number of categories in the strata variable; too many categories or variables can lead to too few data points in each intersectional strata, limiting statistical power and interpretability. On the other hand, using too few categories could remove meaningful detail from the analysis (Evans et al., 2024b). It is therefore important to make informed decisions about defining categories, basing decisions on theory and the existing literature to find a good balance between too few and too many categories.

Following an intersectional framework, this study positions itself as an exploratory analysis within the field of social care research, acknowledging intersectional inequalities without aiming to capture the full, in-depth diversity and complexity of individual experiences (Bell, 2024). This quantitative approach allows us to uncover patterns of inequality across intersectional strata, however, it is limited in its ability to capture the lived individual

experiences that qualitative or mixed method studies often highlight (Evans et al., 2024b). This work is therefore best understood alongside qualitative studies, where individual experiences and voices are central to the research. This would help explain some of the inequalities uncovered, and provide the depth that may be missed in this particular analysis. Combining qualitative and quantitative perspectives will provide a more well rounded picture of intersectional experiences.

Existing research

The relationship between caring and labour market participation has been well-studied from a quantitative perspective in the UK. Research consistently shows that caring negatively impacts an individual's ability to participate in the labour market (Brimblecombe et al., 2020; Carers UK, 2019a; King and Pickard, 2013). This is important because as research suggests, caring can lead to financial difficulties due to reduced work hours or exiting the workforce entirely, resulting in a loss of income (Brimblecombe et al., 2020; Petrillo et al., 2024; Watkins and Overton, 2024). At the same time, caring has financial costs, such as needing to pay for additional support or equipment (Schils, 2008; Watkins and Overton, 2024), and as a result can increase the need to participate in paid employment. This emphasises the need for policies that address the financial challenges faced by caregivers, such as improved access to support services and the promotion of more flexible working arrangements, such as flexi-time, remote working and part-time working to name a few (Carers UK, n.d., d). The literature highlights several factors that influence the relationship between caring and labour market participation, as outlined below:

Care intensity

Care and employment both often require a large time commitment, and can therefore compete for an individual's time (Henz, 2004; Jacobs et al., 2015; Raiber, Visser and Verbakel, 2022). It might be assumed that higher intensity caring makes labour market participation more challenging due to the greater number of hours dedicated to caring responsibilities. The intensity of care, typically measured by hours of care provided per week, is highlighted in the literature as an important factor influencing labour market participation. For example, King and Pickard (2013) found that in the English Longitudinal Study of Ageing (ELSA) dataset, higher care intensity negatively affected employment for both male and female carers aged between 50 and the state pension age. Carers providing more hours of care were less likely to

remain in paid work. In contrast, Carr et al., (2016), using the UK Household Longitudinal Study (UKHLS), found no significant association between the hours of care provided and exit from employment. The differences between these findings may be attributed to differences in the datasets used. Despite both studies focusing on individuals aged 50 and older, King and Pickard (2013) identified stronger associations suggesting that caring negatively impacts employment, more so than Carr et al. (2016).

Age

Age is a socio-demographic factor that may affect the relationship between caring and employment. The 2001 Census indicated that the highest rates of caring were among individuals aged 40 and above, likely due to the increased likelihood of caring for a parent. This is a group typically associated with greater job knowledge and experience (Yeandle and Buckner, 2007). At that time, 10% of working-aged men and 14% of working-aged women were carers (Yeandle et al., 2007b). This is re-emphasised in the 2021 census, where women between 55 and 59, and men between 60 and 64 are most likely to provide care (Office for National Statistics, 2023c). Some studies in the literature focus on specific age categories. For example, research on young carers (aged 16-25) shows that they are less likely to be employed and tend to have lower earnings than non-carers (Brimblecombe et al., 2020). King and Pickard (2013) also found that caring negatively affected employment for midlife carers (aged 50 to state pension age), even when providing as little as ten hours of care per week. To extend the research on age, this paper examines a broader age range than much of the existing literature, including all individuals aged 16 and above but under the state pension age (66 in 2021/22) (Department for Work and Pensions, 2023).

This paper uses generation as a measure of age in the analysis to reduce the number of categories of strata and improve the interpretability of results. While this is primarily a methodological choice, it is important to distinguish between age and generation conceptually. In a cross-sectional study, these are exactly correlated, and generation serves as a proxy for age. However, age reflects a person's stage in life, while generation encompasses shared social, cultural, and historical experiences that may shape behaviors and opportunities. For example, baby boomers in 2022-23 may be more likely to take on caregiving roles due to their age-related life stage, as caregiving often peaks in later adulthood (Office for National Statistics, 2019), particularly for men (Bauer and Sousa-Poza, 2015; Vlachantoni, 2010). However, generational

influences such as societal norms or economic conditions unique to the baby boomer cohort, could also play a role. This cohort may have been socialised into stronger familial caregiving expectations compared to younger generations, shaped by different norms and policies, particularly around women (Jacobs et al., 2015). In general, we expect age effects to be larger than generational effects, meaning, in this study, generational effects mainly reflect age-related patterns. That said, we cannot completely rule out the influence of broader generational factors. Although the cross-sectional nature of the analysis limits the ability to separate age and generational effects (Bell, 2020), using generation as a measure provides a valuable lens to explore inequalities in caregiving and labour market participation. This is, however, addressed in chapter five where the longitudinal nature of the analysis allows for age and generation to be separated.

Ethnicity

Ethnicity also plays a significant role in the provision and experience of unpaid care. Social and cultural expectations often differ across ethnic groups, often intersecting with gender (see below), and some ethnic groups such as Black Caribbean and South Asians, place a higher emphasis on providing care within the family (Wells et al., 2025). Certain ethnic groups, such as Asians, are more likely to live in multi-generational households (Office for National Statistics, 2023b), and as a result may be more likely to provide care to other family members, such as elderly parents or grandparents within the household. This may also be relevant in the context of 'sandwich-caregiving' (Boyczuk and Fletcher, 2016), as living in households with multiple generations, such as children and elderly parents, could increase the care responsibilities people, predominantly women, take on.

Certain ethnic minority groups, such as younger Indians and working-age Bangladeshis and Pakistanis, are more likely to live with someone who has a limiting long-term illness compared to white British individuals (Yeandle and Buckner, 2007). Consequently, Bangladeshi, Pakistani, and Indian individuals are more likely to provide care (Norman and Purdam, 2013). Evidence suggests that ethnic minority carers often face greater negative consequences, including poor health (Victor et al., 2019; Yeandle and Buckner, 2007) and financial insecurity (Carers UK, 2022c). These challenges can lead to further disadvantages, such as ill health, lower employability, and a lack of support within ethnic minority communities (Yeandle et al., 2007b). Ethnic minorities are also less likely to access services that could help support them

with caring, due to things such as structural inequalities, financial difficulties and language barriers (Wells et al., 2025). Ethnicity is therefore an important factor to consider in statistical analyses related to caring, particularly when examining labour market participation rates.

Sex/gender

Sex/gender plays an important role in shaping social experiences, particularly in the context of caregiving and labour market participation. Historically, caring is often gendered, with women more likely to take on caregiving responsibilities which can significantly affect their employment outcomes. Research from the 1990s found that the impact of caregiving on employment patterns was heavily gendered. Female carers were generally less likely to be in paid employment than their male counterparts, with caring having the most significant effect on employment for married women and the least for married men (Arber and Ginn, 1995).

Recent studies continue to show that gender remains a key factor in the relationship between care and employment. Pickard et al. (2015) found that gender continues to influence employment patterns, with women more likely to experience significant disruptions in their career trajectories due to caregiving responsibilities. King and Pickard (2013) also observed that women in their 50s who begin providing fewer than 10 hours of care per week are more likely to stay employed than those who have not started caring. However, both men and women who begin providing more than 10 hours per week are significantly less likely to remain employed. Similar findings were reported by Young et al. (2006), who noted that gender and type of employment influenced caring and employment patterns, with women employed in the public sector being more likely to provide over 20 hours of care per week.

The issue of caregiving and employment is further complicated by the different ways in which men and women engage with the labour market in response to caregiving needs. Some individuals may choose to reduce their working hours or even leave their jobs to provide care, a decision that is often more common among women, particularly in families where caregiving is seen as a predominantly female responsibility (Thompson, Jitendra, and Woodruff, 2023; Xue and McMunn, 2021). On the other hand, some may be unable to reduce working hours (Henz, 2004), and may take on additional work to pay for formal care services, which is more likely to occur in families under higher financial pressure.

Further research on female carers using the British Household Panel Survey (BHPS) between 2000 and 2005 found that, overall, the relationship between caring and employment was small but significant, but only for those providing co-resident care. This study showed that caring roles negatively affected future paid employment and vice-versa (Michaud, Heitmueller, and Nazarov, 2010). These findings highlight gender as an important socio-demographic characteristic to consider when conducting analysis on the relationship between care and employment.

Although it is recognised that sex and gender are not interchangeable, sex will be used in this analysis due to the availability of variables in the dataset.

Socio-economic status

Socioeconomic status has also been shown to affect caring and employment for a complex variety of reasons, with those of a higher socioeconomic status being generally more likely to remain in work when caring needs arise. Firstly, financial assets and income are important in being able to pay for services, such as private social care, meaning that more wealthy individuals may be more able to pay for these services and in turn be able to remain in paid employment (Carmichael, Charles and Hulme, 2010). Access to services has been found to have a positive impact on unpaid carers employment (Pickard et al., 2015), and could help support some of the care responsibilities and alleviate pressures, meaning carers are often able to provide less intensive care.

Secondly, being of a higher socioeconomic status often means higher pay, which would in turn mean more foregone earnings if working hours were reduced or stopped entirely in order to care. This may play an important role in an individual's decision to balance work and care, as shown in research by Carmichael, Charles and Hulme (2010), where higher earners were less likely to give up work to care. This again may reduce individuals' willingness to give up or reduce working hours to care. These findings indicate that socioeconomic status may affect the relationship between care and employment for multiple reasons.

In this paper, highest educational qualification is used as a measure of socioeconomic status, chosen over the NS-SEC classification, which relies on current employment status. This decision accounts for the fact that not everyone in the sample may be employed at the time of data collection. Educational attainment is widely recognised as a meaningful indicator of socioeconomic status (Miech and Hauser, 2001), and other studies have adopted this approach,

describing it as a “reliable measure of socioeconomic position” (Rodriguez Roca et al., 2023, p1).

It is important to recognise, however, that while socioeconomic status is often associated with income or wealth, the terms refer to distinct concepts. Income and wealth refer specifically to financial resources and may have a more immediate influence on decisions around work and caregiving (Carers Trust, 2024), such as the ability to afford paid care services (Watkins and Overton, 2024), or to compensate for lost earnings when reducing working hours. In contrast, education often reflects deeper, long-term influences on socioeconomic status, including access to opportunities, the strength of social networks, and the nature of available career paths (Tahir, 2022). Since income is not used, highest qualification effectively combines socio-economic status and income, as effects found will be produced by a combination of the two. Therefore, while the use of highest educational qualification as a measure does not capture income or wealth directly, it provides a reliable and meaningful alternative for understanding an individual’s socioeconomic position.

Intersecting socio-demographic Characteristics

Socio-demographic factors often intersect, influencing the likelihood and nature of caring, which can in turn impact labour market participation. For example, age and sex interact in shaping caring patterns. Women are more likely to take on caring responsibilities at younger ages, while men are more likely to take on caring roles later in life, particularly for a spouse (Bauer and Sousa-Poza, 2015; Vlachantoni, 2010). This reflects traditional gender roles that view caring as a primarily female responsibility. Although societal attitudes have evolved, women often remain the primary caregivers, and at younger ages (Office for National Statistics, 2023c), and men remain primary earners (Pomeroy and Fiori, 2025).

Age also intersects with socioeconomic status in caring decisions. Individuals approaching state pension age might decide to retire early to create more time availability to provide care, a choice often dependent on financial security which is related to education, job type and income (Costa-Font and Vilaplana-Prieto, 2023). On the other hand, older individuals at or above pension age may continue working to afford the costs associated with caring (Schils, 2008). These factors highlight the importance of financial stability in influencing decisions related to caring and labour market participation across the life-course.

Cultural differences may also shape choices made by individuals in relation to care and labour market participation. For example, some cultures have more 'traditional' views towards gender roles and expectations of care throughout the life-course. In some cultures it is the norm for women to take on the care responsibilities, particularly for older relatives (Zarzycki et al., 2023). These experiences could also vary across generations. These differing cultural expectations highlight the diversity in the experience of providing care, and the complex relationship between multiple socio-demographic factors.

To conclude, there is a lot of evidence to suggest that socio-demographic factors may affect the relationship between care and labour market participation. There is also evidence to suggest that these factors do not act individually, but also intersect to produce different experiences and outcomes. This is justification for an intersectional approach to be taken, to account for differences across intersectional groups to be accounted for.

Addressing the gaps in the literature

Although there is an existing body of literature exploring the relationship between care and labour market participation, to my knowledge, no studies have applied an intersectional framework to explore this relationship from a quantitative perspective. By adopting an intersectional approach, this research attempts to identify whether there are inequalities in the relationship between care and labour market participation, and whether those are additive or multiplicative in nature. That is: are differences in the care-labour market participation relationship driven by universal associations with socio-demographic variables, or do those socio-demographic variables combine to produce particular outcomes for specific combinations of socio-demographic characteristics (Crenshaw, 1991; Bell, Holman, and Jones, 2019).

To address this gap, this research employs MAIHDA (Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy) models, including models with random slopes, to investigate the potentially heterogeneous relationship between caring and employment (Evans et al., 2023). The inclusion of random slopes is particularly useful as it allows the effect of care intensity on labour market participation to vary across intersectional strata, whilst a more standard MAIHDA approach would simply look at mean differences in a single outcome. In doing so, it captures the diversity of experiences among carers, revealing whether the relationship between caring and employment is large for some intersectional strata, and small,

null, or even reversed for others. This methodological approach introduces advanced statistical techniques to social care research (Merlo, 2018) and provides a novel framework for examining how caring is associated with employment across different socio-demographic contexts.

The use of random slopes also addresses a theoretical gap by allowing the exploration of multiplicative effects associated with intersecting identities. Intersectionality theory highlights how overlapping characteristics such as gender, age, ethnicity, and socioeconomic status may create unique experiences of advantage or disadvantage (Cho, Crenshaw, and McCall, 2013; Crenshaw, 1991). Existing literature has highlighted the role of these individual factors in shaping the caring-employment relationship, however, the combined effects of these characteristics and the variability in their impact across different groups has not been studied.

Despite its potential, the application of multilevel regression models in social care research remains limited. One of the first studies to use multilevel models in this field, conducted by Zhang, Bennett, and Yeandle (2021), explored how Local Authority spending impacts subjective well-being. However, the use of intersectional multilevel models such as MAIHDA in social care research remains largely unexplored. MAIHDA models have mostly been used in health and epidemiology to study differences in outcomes such as depression and obesity (Evans and Erickson, 2019; Fisk et al., 2018; Merlo, 2018). One of the first studies to apply MAIHDA in social care looked at the age at which people first start caring, using European data (Alonso-Perez, 2024). This study found that there are intersectional differences in caring onset, both within and between generations, showing that MAIHDA can be a useful method in social care research. This demonstrates the potential of MAIHDA to uncover nuanced patterns in social care research. However, to my knowledge no research has yet applied MAIHDA to explore the relationship between caring and employment.

This is important as the existing literature highlights the importance of various characteristics such as age/generation, sex/gender, ethnicity and socio-economic status, in shaping the relationship between caring and employment. However, the impact of combining these characteristics remains underexplored. Intersectionality theory provides a lens to examine the complexity of multiple identities and their influence on individuals' societal experiences (Cho, Crenshaw and McCall, 2013). Understanding the multiplicative effects of these intersecting characteristics is crucial for understanding the diverse and unequal experiences (Crenshaw,

1991; Bell, Holman, and Jones, 2019) of groups such as carers. This research is important in informing policies and interventions that address these inequalities and contribute to positive social change (Gallagher, 2020).

Methodology

Data

This project used data from wave 14 of the Understanding Society dataset (U Essex, 2024). This dataset was selected as it is the most up-to-date wave, collected between 2022 and 2023, and provides large-scale information on labour market participation and caring among adults in the UK. At the time of writing, this was the most up-to-date source available for examining this topic on a national scale.

Variables

Caring is categorised into three groups to account for differences in care intensity while maintaining a sufficient sample size for analysis. The categories are as follows: individuals who provide no care (n=21,099), those who provide 1-19 hours of care per week (n=2,817), and those who provide 20 or more hours of care per week (n=1,211).

The outcome variable 'labour market participation' was measured by combining two employment variables, 'jbhrs' (how many hours, excluding overtime and meal breaks, are you expected to work in a normal week?) and 'jbstat' (Current labour force status). Jbstat was categorised first into a binary variable 'employed' and 'not employed'. 'Not employed' includes people who are unemployed, retired, or looking after family/home, and in the labour market includes people who are in part-time or full-time employment (U Essex, 2024). People in the 'not employed' category were assigned a value of 0 job hours. People who are self-employed are excluded as the process by which self-employed people make employment decisions are often different and jobs might be more flexible.

To capture the possible intersectional aspects of caring and employment, a new variable called 'strata' was created. This variable represents the intersectional groups to which individuals belong, and the term 'strata' was chosen to avoid the rigidity of categorical labels, which can unintentionally reinforce labelling and categorisation (Evans et al., 2018). The 'strata' variable is constructed using the following variables: generation, sex, ethnicity, and highest educational qualification, each of which is present in the dataset and is relevant to

intersectionality as we have outlined in the literature review, and are useful in the context of MAIHDA modelling (Bell, Holman, and Jones, 2019). The analysis includes a total of 160 strata: 2 sexes x 4 age groups (generation) x 5 ethnicity groups x 4 education groups. However, ten groups were empty, so were not included. The strata variable is outlined in table 3.1:

Table 3.1 Sample sizes of the strata variable

Min	Q1	Median	Q2	Max	Mean	SD	n	missing
1	5	26	88.5	2118	168.6867	387.3454	160	10

To balance the need for detailed representation of group differences and the model's ability to capture intersectional differences, some variables were re-coded to reduce the number of categories in each (Bell et al., 2024). Table 3.2 provides an overview of the variables and their categories. Age, initially a continuous variable, was re-coded into four 'generation' categories according to the data subject's year of birth. This was done to retain meaningful distinctions between groups whilst creating few enough categories for the analysis. There are discrepancies around which generations span what years, so we decided to follow the categorisation from Bell et al. (2024), using the groupings shown in table 3.2.

Similarly, ethnicity was reduced from 18 categories to 5, addressing low counts in certain smaller groups that could hinder detection of significant group differences. Educational qualifications were also re-coded: the categories 'Degree' and 'Other Degree' were combined, as well as 'A-levels' and 'GCSEs,' resulting in a final variable with four categories. These re-codings were necessary for the analysis. However, they also highlight the importance of considering this research alongside qualitative approaches that consider individual lived experiences. This will allow us to gain a wider and more nuanced understanding of intersectional inequalities in adult social care.

Even despite this categorisation, there remain some small strata, including strata with only one observation. This is common in MAIHDA analysis and is not a problem per-se, since shrinkage in the multilevel model will ensure that those strata are shrunk towards their expected values (see: Bell, Holman and Jones, 2019; Evans et al., 2024b). Where shrinkage is significant, it is difficult to interpret strata results as anything other than a combination of main effects, however, this is deemed a better solution than removing strata from analysis, or combining strata into overly reductive categories.

Additional control variables (other than the variables that make up the strata) are not added to prevent issues of over controlling, as the purpose of this paper is to identify intersectional differences and not their causes, following a similar approach to Bell et al. (2024). In the model, individuals are nested within their respective intersectional strata to examine variation in employment outcomes among carers both within and between these strata. The variables that made up the strata variable have also been used as control variables in some models, as described in the next section, and can be seen in table 3.1.

Table 3.2 Descriptive statistics: The variables used in the analysis and the observations in each category. Understanding Society wave 14 (U Essex, 2024)

Variable name	Variable code	No. obs.	% obs.
Dependent variable			
Average job hours worked per week		min: 0.00, mean: 26.62, max: 97.90	
Key independent variable			
Care intensity	0 Hours	21099	83.97
	1-19 Hours	2817	11.21
	20+ Hours	1211	4.82
Strata variables			
Sex	Male	10983	43.41
	Female	14320	56.59
Age (generation cohort)	Boomers (1956*–1963)	4968	19.63
	X (1964–1979)	8599	33.98
	Y (1980–1994)	6997	27.65
	Z (1995 onwards)	4739	18.73
Ethnicity	White	20924	82.69
	Mixed	636	2.51
	Black	2809	11.10
	Asian	818	3.23
	Arab & Other	116	0.46
Education	Degree	12188	48.17
	Secondary school (15-18 years old)	10789	42.64
	Other qualification	1321	5.22
	None	1005	3.97

* Boomer generation began in 1956 due to people over State Pension Age being excluded from analysis.

Models

All statistical analysis was conducted by the author in RStudio using R version 4.1.1 (R Core Team, 2021). To check whether a multilevel approach was appropriate, Akaike Information Criterion (AIC) scores were calculated for a null single-level model and a null two-level model:

$JobHours_{ij} = \beta0 + \varepsilon_{ij}$ (Null single-level model)

$JobHours_{ij} = \beta0 + (u_{0j} + \varepsilon_{ij})$ (Null two-level model)

Where $JobHours_{ij}$ is the average hours worked per week in paid employment. β0 is the intercept, in this case this is the estimated grand mean for job hours. $u0_j$ is the strata-level random effect, which is assumed to be normally distributed with a mean of zero and a variance that is estimated.

The null single-level model had an AIC score of 159929.2 and the null two-level model had an AIC score of 155846.1. The two-level model has a lower AIC score and is therefore accepted as the better fitting model (Garson, 2020). In other words, there is statistically significant strata-level variation in job status, and it was deemed appropriate to follow a multilevel approach.

In **model 1**, caring was added as a predictor variable in the model to identify the relationship between caring and labour market participation, to answer research question 1. Here, $CaresU20_{ij}$ is a dummy variable indicating the individual provides 1-19 hours of care, $CaresO20_{ij}$ is providing 20 or more hours of care, and u_{0j} is the strata random effects (intersectional groups):

$$JobHours_{ij} = \beta0 + \beta1 * CaresU20_{ij} + \beta2 * CaresO20_{ij} + (u_{0j} + \varepsilon_{ij})$$

In **model 2**, control variables are added to the fixed part of the model to identify how the relationship between caring and labour market participation changes once socio-demographic variables are controlled for. This model allows us to identify how care intensity is associated with labour market participation once socio-demographic factors are controlled for, and whether there are differences across intersectional strata in the likelihood of being in the labour market. Here, X_{kj} is the k dummy variables in the fixed part of the model, including categories of sex, generation, ethnicity and highest educational qualification:

$$JobHours_{ij} = \beta 0 + \beta 1 * CaresU20_{ij} + \beta 2 * CaresO20_{ij} + \sum_{k=3}^{K} A_k X_{kj} + (u_{0j} + \varepsilon_{ij})$$

In **model 3**, in order to answer research question 2, random slopes are added to account for any variation in labour market participation for each category of care intensity across intersectional strata. In other words, the variation in the association between providing certain intensities of caring has on labour market participation across intersectional strata. This model allows us to identify how care intensity is associated with labour market participation once socio-demographic factors are controlled for, and identify whether there are intersectional differences in whether someone is in the labour market or not for people who care for 1-19 hours and people who care for 20 or more hours :

$$JobHours_{ij} = \beta 0 + \beta 1 * CaresU20_{ij} + \beta 2 * CaresO20_{ij} + \sum_{k=3}^{K} A_k X_{jk} +$$

$$(u_{0j} + u_{1j} CaresU20_{ij} + u_{2j} CaresO20_{ij} + \varepsilon_{ij})$$

However, model 3 was unable to predict confidence intervals due to the small size of the effects/samples on high intensity carers (see: figure 3 in appendix), hence the introduction of a binary measure of care used in place of the ordinal measure for the random slopes in **model 4**:

$$JobHours_{ij} = \beta 0 + \beta 1 * CaresU20_{ij} + \beta 2 * CaresO20_{ij} + \sum_{k=3}^{K} A_k X_{jk} + (u_{0j} + u_{1j} CaresAny_{ij} + \varepsilon_{ij})$$

Finally, in **model 5**, in order to answer research question 3, interactions between care intensity and the strata defining variables are added to the fixed part of the model. This model allows us to identify whether the variation across intersectional groups can be explained by the two-way interactions between care and individual socio-demographic variables. Here, ϑ represents the two-way interaction effects between the k dummies X_{ij} and caring for 1-19 hours, where X again includes categories of sex, generation, ethnicity and highest educational qualification, and α represents the two-way interaction effects between X_{ij} and caring for 20 hours or more:

$$JobHours_{ij} = \beta 0 + \beta 1 * CaresU20_{ij} + \beta 2 * CaresO20_{ij} + \sum_{k=3}^{K} A_k X_{jk} + \sum_{k=3}^{K} \vartheta_k (X_{jk} CaresU20_{ij}) +$$

$$\sum_{k=3}^{K} \alpha_k (X_{jk} CaresO20_{ij}) + (u_{0j} + u_{1j} CaresAny_{ij} + \varepsilon_{ij})$$

Results

As displayed in table 3.3, in model 1, which does not control for socio-demographic variables, caring is associated with a decreased likelihood of being in the labour market. Caring for 1-19 hours is associated with working just over 1 fewer hours (approximately 62 minutes) per week in comparison to non-carers, whilst caring for 20 or more hours is associated with working almost 10 fewer hours (9 hours 45 minutes). The Intraclass Correlation (ICC) has a value of 0.24, indicating that in model 1, approximately 24% of the variation in labour market participation occurs across intersectional strata, implying significant inequalities in labour market outcomes between intersectional strata.

In model 2, the strata-defining socio-demographic variables are controlled for in the fixed part of the model. In this model, caring for 1-19 hours is associated with working just over 1 hour fewer per week (63 minutes) in comparison to non-carers, and caring for 20 or more hours is associated with working over 9 and a half hours fewer (9 hours 41 minutes). These results are similar to model 1, suggesting that adding control variables in the fixed part of the model does not account for much of the association between care and labour market participation. The ICC decreases in model 2 to 0.06. This suggests that approximately only 6% of the variation in labour market participation occurs across intersectional strata, once the additive effects of socio-demographic variables are controlled for.

To calculate how much of the variance in average job hours is explained by the addition of the control variables (additive effects of sociodemographic variables), the Proportional Change in Variance (PCV) was calculated. It is calculated using the following formula (Merlo et al., 2016):

$$PCV = \frac{\sigma^2[model1] - \sigma^2[model2]}{\sigma^2[model1]} = \frac{64.43 - 13.21}{64.43} = 0.7950$$

The PCV value of 0.7950 indicates that approximately 79.5% of the variance in average job hours between strata average job hours is explained by the additive effects of those strata's socio-demographic variables. Whilst this suggests that a large proportion of the variability in job hours across strata is additive, approximately 20.5% is multiplicative, suggesting that overall there may be some evidence of multiplicative effects of socio-demographic variables on job hours.

Table 3.3 Regression results, using Understanding Society wave 14 (U Essex, 2024).

	Null		**Model 1**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
Predictors	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*
(Intercept)	22.18 ***	0.80	22.92 ***	0.78	29.72 ***	1.29	29.92 ***	1.24	29.41 ***	1.29	29.59 ***	1.32
Care intensity (ref: 0 hours)												
> 20 hours			-1.03 **	0.32	-1.05 **	0.32	-0.87 *	0.39	-0.94	0.48	-2.32 *	0.94
20+ hours			-9.75 ***	0.49	-9.69 ***	0.49	-9.43 ***	0.85	-9.58 ***	0.59	-6.93 ***	1.51
Sex (ref: Male)												
Female					-6.49 ***	0.85	-6.51 ***	0.82	-6.26 ***	0.84	-6.84 ***	0.87
Generation (ref: Boomer)												
X					7.75 ***	1.19	7.71 ***	1.12	7.69 ***	1.18	8.09 ***	1.22
Y					6.20 ***	1.22	5.97 ***	1.16	6.09 ***	1.21	6.65 ***	1.25
Z					3.28 **	1.27	3.09 *	1.23	3.17 *	1.26	3.63 **	1.30
Ethnicity (ref: White)												
Mixed					-0.44	1.35	-0.19	1.34	-0.10	1.36	-0.81	1.40
Asian					-5.01 ***	1.08	-4.66 ***	1.04	-4.60 ***	1.07	-5.53 ***	1.11
Black					-0.68	1.26	-0.51	1.23	-0.44	1.26	-0.47	1.31
Other					-5.64 **	2.15	-5.62 **	2.13	-5.41 *	2.15	-5.69 *	2.30
Highest educational attainment (ref: Degree)												
s-school					-5.33 ***	1.03	-6.10 ***	0.97	-5.42 ***	1.02	-5.12 ***	1.05
Other					-7.80 ***	1.30	-8.21 ***	1.25	-7.80 ***	1.29	-7.44 ***	1.34
None					-15.68***	1.34	-15.68 ***	1.29	-15.41***	1.34	-16.20***	1.39
Care*Demographic interaction included	No		No		No		No		No		Yes	

Random Effects						
L1 var (individual)	204.34	199.69	199.65	198.91	199.27	199.05
L2 var (strata)	68.52	64.43	13.21	14.17	14.19	13.83
L2 var (slope: care)				1.41 $_{\text{1-19 hours}}$	3.48 $_{\text{Carer}}$	0.84 $_{\text{Carer}}$
				19.07 $_{\text{20+ hours}}$		
Corr. random effects				-0.08$_{\text{Intercept*1-19 hours}}$	-0.40 $_{\text{Intercept*Carer}}$	-0.29 $_{\text{Intercept*Carer}}$
				-0.56$_{\text{Intercept*20+ hours}}$		
				0.87$_{\text{1-19 hours*20+ hours}}$		
ICC	0.25	0.24	0.06	0.07		
N	142 $_{\text{strata}}$	142 $_{\text{strata}}$	142 $_{\text{strata}}$	142 $_{\text{strata}}$	142 $_{\text{strata}}$	142 $_{\text{strata}}$
Observations	19065	18956	18956	18956	18956	18956
Marginal R^2 / Conditional R^2	0.000 / 0.251	0.016 / 0.256	0.164 / 0.216	0.168 / 0.224	0.159 / 0.215	0.168 / 0.222
AIC	155846	154518	154360	154336	154352	154275

** p<0.05 ** p<0.01 *** p<0.001*

*** For a full regression table with interaction terms, see appendix table 1.*

In model 3 (see appendix table 1), random slopes are added, allowing the association between care and labour market participation to vary across intersectional strata. However, in figure 3 in the appendix, the results for providing 20 or more hours of care lack any clear findings without confidence intervals or much variation, possibly due to the model's inability to fully converge. This is likely due to the smaller sample size of people providing 20 or more hours of care, and subsequent lack of sample size in many of the strata (see: table 3.1). As a result, it was decided that we are unlikely to be able to detect intersectional effects for this group of carers using this model. To mitigate this, we used a binary measure of care (provides care vs provides no care) into the random part of the model, as shown in the equation for model 4. This increased the number of carers in each strata, allowing the model to converge.

In model 4, which uses a binary measure of care in the random part of the model, the relationship between caring for 1-19 hours and job hours is no longer significant (albeit only by a small amount). However, there is still evidence of a strong negative relationship between caring for 20 hours or more and job hours, with people providing high intensity care working on average, just over 9 and a half hours (9 hours 35 minutes) fewer per week compared to non-carers. Overall, we can conclude that the negative relationship between caring and job hours is most pronounced for high intensity caring.

The strata-level variance in the effect of being a carer allows us to understand the varying relationship between care intensity and job hours across intersectional strata. In model 4, the strata level variance (slope variance) is 3.48, suggesting that there is some variance in the effect of caring on job hours across intersectional strata. This is further supported by the AIC score that decreases from 154360 in model 4 to 154321, which suggests adding random slopes improves the model fit. These results indicate that the relationship between care and employment is likely to differ across differing socio-demographic groups.

Finally, in model 5, interactions between care intensity and the strata defining variables were added into the fixed part of the model, as shown in the equation for model 5. This model has the lowest AIC score (154275) and is therefore identified as the best-fitting model. This model aims to identify whether the variation across intersectional groups can be explained by the interaction between care and individual socio-demographic variables. In this model, the strata-level variance on the caring-employment relationship reduced to 0.84, suggesting that the two-way interactions between caring and the demographic variables account for most of the strata-level variance in the effect of caring. Figures 4 to 5 in the appendix highlight this

change. This is a fairly large decrease from model 4, indicating that much of this variation can be explained by the interactions between care and socio-demographic variables.

To answer RQ3, the slopes PCV was calculated to find the proportion of the variability in the slopes that is explained by the two-way interactions (Merlo et al., 2016):

$$Slopes\ PCV = \frac{\sigma^2[model4] - \sigma^2[model5]}{\sigma^2[model4]} = \frac{3.48 - 0.84}{3.48} = 0.7586$$

The value of 0.7586 suggests that approximately 75.86% of the variance in the effect of being a carer, between intersectional groups, is explained by the two-way interactions between care and the socio-demographic variables. These findings imply that most of the between-group variation in how care is related to job hours, can be explained by the direct interactions between care and individual socio-demographic characteristics (such as care*ethnicity and care*gender), rather than more complex interactions between intersecting socio-demographic characteristics (e.g. sex*ethnicity*generation*socioeconomic status*care). In other words, the relationship between care and job hours varies primarily by individual characteristics, rather than by the intersectional combination of multiple socio-demographic variables. However the remaining 24.4% is still a fairly significant amount, and is more than might be expected in many MAIHDA analyses where PCV scores tend to be around 80-90% (Evans et al., 2024b). This suggests that there may still be evidence of some multiplicative effects between socio-demographic variables, although no clear significant differences have been identified by the model (see appendix figure 5). It is evident that there is some variance, however the analysis is unable to comment on precisely where. The inability to identify any particular significant strata may be due to many of the strata having small sample sizes and therefore being shrunk towards the mean due to shrinkage (Bell, Holman and Jones, 2019; Evans et al., 2024b).

The two-way interactions are visualised in figures 2.1 to 2.4.

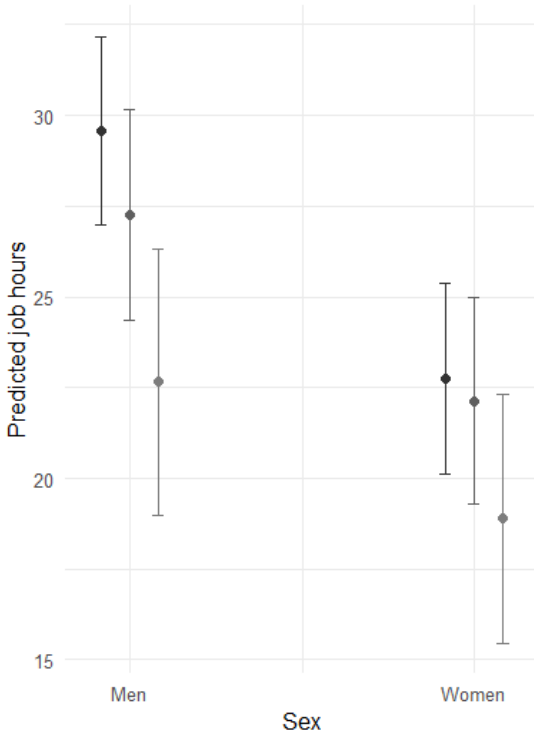

Figure 3.1 Predicted probabilities of being in the labour market: interaction between care and sex. Understanding Society wave 14 (U Essex, 2024).

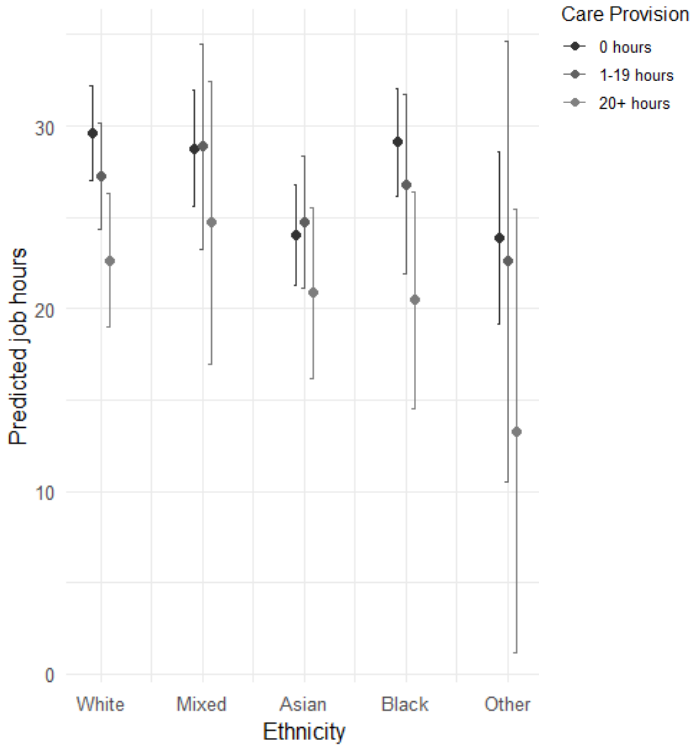

Figure 3.2 Predicted probabilities of being in the labour market: interaction between care and ethnicity. Understanding Society wave 14 (U Essex, 2024).

There are several significant interactions that demonstrate how caregiving modifies the likelihood of being in the labour market for different socio-demographic groups. In figure 3.1, female carers appear to be slightly more likely to be working similar hours to their non-caring female counterparts, particularly when caring for 1-19 hours. The difference in predicted job hours between male non-carers and male carers is much wider. The results for providing 20 hours or more are particularly significant, showing that men who provide 20 or more hours or care per week are very likely to work fewer hours than men who provide no care. Interestingly, men providing higher intensity care are on average, are more likely to work more hours than women providing higher intensity care.

Figure 3.2 suggests that there are similarities in the effect of high intensity caring on job hours across different ethnic groups, but some slight differences in the effect of low to moderate intensity caring. Across all ethnicities, providing 20 or more hours of care is associated with a reduction in job hours on average, in comparison to non-carers. Providing 1-19 hours is associated with a reduction in job hours for White, Black, and Other ethnic groups, but a slight (non-significant) increase in job hours for Mixed and Asian ethnic groups. What is perhaps the most interesting finding is that amongst the Asian ethnic group, the job hours between

categories of care intensity are fairly similar. However, the confidence intervals do overlap and so these results should be interpreted with caution.

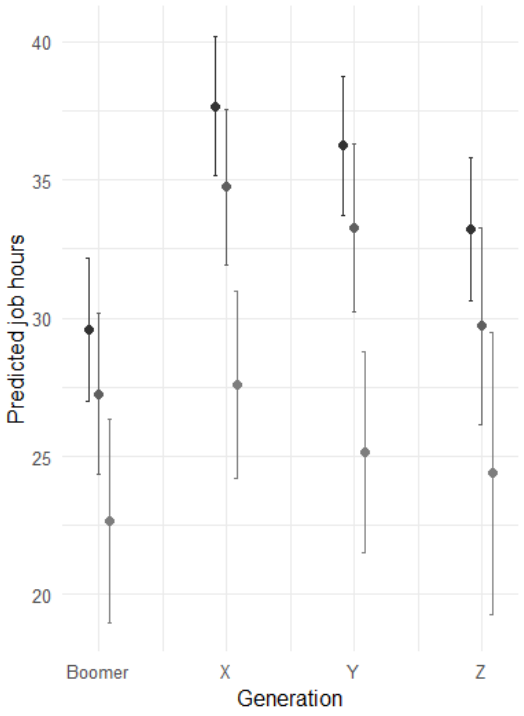

Figure 3.3 Predicted probabilities of being in the labour market: interaction between care and generation. Understanding Society wave 14 (U Essex, 2024).

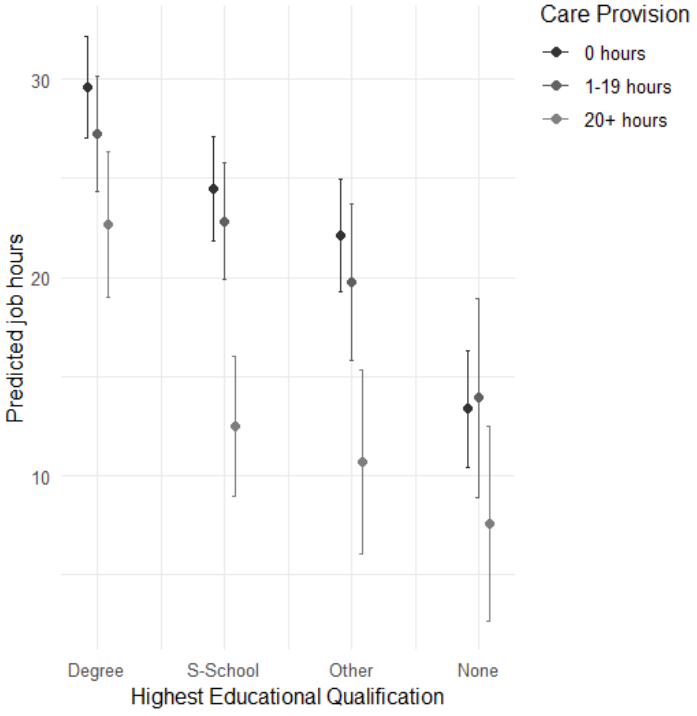

Figure 3.4 Predicted probabilities of being in the labour market: interaction between care and education. Understanding Society wave 14 (U Essex, 2024).

In figure 3.3, carers who care for 20 or more hours who are part of generation X or Y appear to work considerably fewer hours than people who provide less care or no care from the same generation, a trend that is less pronounced for boomers and generation Z. However, from figure 3.3, generation X and Y have a higher proportion of people working more hours, particularly amongst non-carers. Despite there being a wider difference in job hours between non-carers and carers amongst generation X and Y, those providing 20 hours or more care work on average, a similar or slightly greater number of hours in comparison to generation Z and boomers.

In figure 3.4, there are some clear differences in the relationship between care and job hours between different levels of socioeconomic status (highest educational qualification). Those with degree-level education work the highest number of hours, even across differing levels of caring. Those with no qualifications work amongst the lowest number of hours, particularly those who provide the most care. For both those with degrees or no qualifications, the variation in job hours is similar across different levels of caring. In contrast, amongst those

with secondary education (GCSEs or A-Levels), and those with other qualifications, carers providing 20 hours of care or more appear to have much lower predicted job hours in comparison to people within these groups who provide 1-19 hours of care or no care. Carers providing the highest level of care with secondary education or other qualifications have similar predicted job hours to non-carers and carers providing 1-19 hours of care who hold no qualifications. This suggests that the effect of caring on job hours may be highest for people with secondary school or other qualifications.

Discussion

The findings from this analysis align closely with much of the existing literature, which consistently shows that caring is associated with reduced labour market participation (Brimblecombe et al., 2020; Carers UK, 2019a; King and Pickard, 2013). Part time and flexible working patterns are more compatible with providing care (Carers UK, n.d., d), hence carers are more likely to work fewer hours. Therefore, the results presented in this paper are not surprising. One benefit of this study is its use of more recent data, collected in the period following the COVID-19 pandemic. The fact that these findings remain consistent with pre-pandemic studies suggests that the negative impact of caring on labour market participation has persisted, indicating that the challenges faced by carers in balancing work and care responsibilities have not significantly changed in recent years. This emphasises the ongoing need for effective policy initiatives and service provisions such as respite care (NHS, 2022) to better support caregivers in managing both caring and paid employment.

There are some key similarities with previous studies. When answering RQ1, one expected finding is that while caring at any intensity is associated with reduced labour market participation, the strength of this association is stronger for those providing higher intensity care (20 hours or more per week) compared to those providing lower intensity care (1-19 hours per week). This is consistent with existing studies, which show that higher intensity caring has a greater impact on reducing labour market participation (Dixley, Boughey and Herrington, 2019).

There are various explanations for this finding. Firstly, the competing nature of care and employment for time (Henz, 2004; Jacobs et al., 2015; Raiber, Visser and Verbakel, 2022). Providing more hours of care leaves fewer hours remaining to participate in the labour market. This means that those providing higher intensity care may be more likely to work part time or leave the labour market entirely to provide care (Carers UK, 2019a; Van Houtven, Coe and

Skira, 2013). Secondly, benefits such as Carer's Allowance are only accessible when providing at least 35 hours of care per week (UK Government, 2025). This means that carers providing lower intensity care will be less likely to to be able access financial support through CA, meaning they may be more reliant on income from employment, particularly as carers may have additional costs relating to their caring role (Peytrignet, Grimm and Tallack, 2023).

As this research finds that caring may negatively impact the ability to participate in paid employment at lower intensities than the CA eligibility criteria requires (UK Government, 2025), it is argued that CA needs to be reassessed. By reducing the number of hours carers must care for to receive CA, for example, to 20 hours, a larger proportion of carers whose employment and subsequent income is negatively affected by providing care would be supported financially, which could in turn have a positive knock on effect on things such as their mental well-being through reduced stress (Carers UK, 2019a; The Health Foundation, 2024).

With continued review, CA may also benefit from working on a scale, to increase accessibility. For example, caring at lower intensities than 20 hours a week may also negatively impact employment. Increasing CA payments for those who provide the most care (and may as a result incur higher costs of providing care, combined with being less able to do paid work), but still allowing those who care at lower intensities (10 hours or more) financial support through reduced payments could be beneficial. It is however recognised that this would be difficult to implement due to difficulties in monitoring individuals' hours worked.

One additional way to improve the reach of CA that is more feasible to implement, is to increase the income Carers can make through paid employment but still be eligible to receive CA. This would allow more carers to remain in paid employment whilst still receiving the support that is so valuable in enabling carers to carry out their caring responsibilities. This would be beneficial for carers well-being, as well as improving the economy through increased tax payments.

To answer RQ2, the analysis was unable to find evidence that the impact of caring for 20 or more hours per week on labour market participation varies between intersectional strata in relation to higher order multi-way interactions (although multiplicative effects are present in two-way care-socio-demographic interactions), due to the model being unable to compute confidence intervals. It is difficult to determine whether this is due to the smaller sample size

for higher intensity care, which may make it more difficult to pick up associations. However, as MAIHDA has not yet been applied in the field of care and employment, there is little to compare these results to. For providing 1-19 hours of care, once socio-demographic variables are controlled for and an interaction is added between care and the socio-demographic variables, most of the slope variation is absorbed. As seen in appendix figure 5, there is limited significant evidence to suggest that the effect of care on labour market participation varies significantly between intersectional strata once care*demographic two-way interactions are accounted for. Overall the findings indicate that the effects of socio-demographic characteristics are mostly additive rather than multiplicative, except for the multiplicative relationship between care and individual socio-demographic characteristics which resulted in some interesting findings.

To answer RQ3, the results indicate that a large proportion of the relationship between care and employment across intersectional strata can be explained by two-way interactions between intersectional demographics and caring. For example, in model 5, the slope proportional change in variance (PCV) indicates that approximately 75.86 percent of the intersectional variance is explained by controlling for socio-demographic interactions with caring. This suggests that the effects of caring and socio-demographic characteristics on labour market participation are predominantly additive, or multiplicative when combined with caring, but not between each other. The caterpillar plot for model 5 (see appendix figure 5) also supports this finding. However, this PCV value indicates that there may be some multiplicative effects, as approximately 24.14 percent of the variance may be explained by the multiplicative relationship between socio-demographic variables. As above, the analysis is unable to determine the specifics of this variation, possibly due to model shrinkage (Bell, Holman and Jones, 2019; Evans et al., 2024b) making it difficult for the model to detect significant differences between strata.

The key findings from visualising the interactions are as follows. Female carers, particularly those providing 1-19 hours of care, are more likely to work similar hours to their non-caring female counterparts. In contrast, male carers show a greater reduction in working hours compared to male non-carers, especially when providing 20 or more hours of care per week. Notably, among those providing higher-intensity care, men are more likely to work more hours than women. Some of this may be explained by persisting traditional views on gender roles. For example, persisting expectations of the male breadwinning role (Pomeroy and Fiori, 2025)

may put pressure on male carers to remain in employment in order to fulfil this expectation. Women are also more likely to be part of the 'sandwich generation' where they are providing care for dependent children as well as other family members (Boyczuk and Fletcher, 2016). Women also disproportionately take on most of the domestic labour, such as housework (Office for National Statistics, 2016). This may put more pressure on the ability to participate in the labour market due to reduced time availability (Henz, 2004; Jacobs et al., 2015; Raiber, Visser and Verbakel, 2022), explaining some of the disparities between men and women.

The findings from the interaction between care and ethnicity suggest that while high-intensity caregiving is consistently linked to reduced job hours across all ethnic groups, the effects of low to moderate caregiving vary. Providing 20 or more hours of care per week is associated with a clear reduction in working hours across all ethnic groups, indicating that the demands of high-intensity caregiving have a broadly similar impact regardless of ethnic background. This aligns with previous research highlighting the time commitment involved in higher-intensity care, which often limits carers' capacity to engage in paid work (Henz, 2004; Jacobs et al., 2015; Raiber, Visser and Verbakel, 2022).

Amongst individuals from Mixed and Asian ethnic backgrounds, low to moderate caring appears to be associated with working similar, or slightly more job hours compared to non-carers. One possible explanation could be cultural or family dynamics that shape how care responsibilities are distributed. Research has shown that some ethnic minority communities have stronger expectations of shared care responsibilities within extended family networks (Wells et al., 2025), potentially allowing some carers to remain more engaged in paid work. However, more research is needed to fully understand the relationship between care, employment and ethnicity, as the overlapping confidence intervals in this study mean we cannot make any strong claims about this relationship.

The interaction between care and generation highlights differences in job hours between generational groups for differing levels of caring. For generation X and Y, there is a wider gap in job hours between those providing 20 or more hours of care and those providing between 0 and 19 hours of care, compared to Boomers and generation Z. Overall, high intensity care is associated with working fewer job hours across all generations. While this may partly reflect the higher baseline job hours for non-carers in these cohorts, particularly in comparison to Boomers, the findings suggest that high-intensity care is strongly linked to reduced working hours, regardless of age or prime working years. This aligns with existing literature, which

indicates that intensive caring may reduce the time available for labour market participation (Henz, 2004; Jacobs et al., 2015; Raiber, Visser and Verbakel, 2022), making the choice to combine care with employment more difficult.

For Generation X, this pattern may reflect their position in the 'sandwich generation,' where they are simultaneously caring for older parents and younger children (Boyczuk and Fletcher, 2016). These dual responsibilities can compete for time. This can in turn put strain on an individual, making it harder to participate in full-time employment (Henz, 2004; Raiber, Visser and Verbakel, 2022).

For Generation Y, caregiving responsibilities often coincide with key financial pressures such as housing costs and childcare expenses. These pressures may have been intensified by the COVID-19 pandemic, further straining their ability to maintain stable employment. Balancing work, care, and financial demands can increase stress (Carers UK, 2019a) and potentially lead to labour market withdrawal, especially where affordable childcare (Local Government Association, 2023) or eldercare (Age UK, 2022a) is limited.

Generation Z, the youngest cohort, may face unique challenges as they begin entering the workforce while also taking on caring roles. These findings are consistent with findings from Brimblecombe et al. (2020), who suggests many 'young' carers may have been caring as a child or teenager, which could have negatively impacted their school education. Brimblecombe et al. also suggests that carers had higher drop out rates from higher education. With limited professional experience, the added pressures of providing care could disproportionately affect their ability to engage with employment. Another factor to consider is the ongoing shift toward 'gig' economy jobs (Cockett, 2023), while potentially offering flexibility for carers, may not provide the stability or benefits required to sustain long-term participation in the labour market.

For carers providing 1-19 hours of care, those in generation X and Y appear to work more job hours on average than their Boomer and generation Z counterparts. This is perhaps expected, as Boomers are closer to state pension age and may be more likely to take early retirement or work part-time, particularly if they have high levels of financial security (Centre for Longitudinal Studies, 2024). On the other hand, generation Z, being younger, may not have fully entered the workforce or may have only recently joined, explaining why their average job hours are lower. Despite the effect of caring at lower intensities being less pronounced

compared to caring at high intensity care, figure 3.3 still provides evidence to suggest that support in either balancing work and care, or financial support to support carers who are working fewer hours, is necessary.

Analysing the interaction between care and highest educational qualification, it is evident that people with degree-level education consistently work the highest number of hours, while those with no qualifications work the fewest, regardless of their caring responsibilities. However, for people with secondary or other qualifications, those providing 20 or more hours of care have much lower predicted job hours compared to their non-caring counterparts, suggesting a stronger negative impact of caregiving in these groups. This is perhaps expected as those without qualifications often work fewer hours, so the effect of caring is likely to be limited as the baseline amount of job hours is already lower than the average of the population. For those with degrees, the job opportunities may be greater, and they may also be in higher paying roles as a result. This would mean that the opportunity cost of giving up employment is higher, as it would result in a greater loss of income (Rebaudo, Calahorrano and Hausmann, 2025). This group may also have greater financial resources which would mean they are more able to pay for formal care services as well as equipment and technology (Watkins and Overton, 2024), which may help support their caring role. These factors may also make it easier to remain in full-time or part-time employment, even amongst higher intensity carers, highlighting the additional choices having financial resources creates (Carers Trust, 2024).

Those with A-levels or GCSEs (secondary school education) lie somewhere in the middle, hence the baseline job hours lie in between that of people with degrees or no qualifications. These groups may be in employment that does not pay as highly as groups with degrees, meaning there is a lower opportunity cost of working fewer hours to provide care (Rebaudo, Calahorrano and Hausmann, 2025). Similarly, since the baseline value of job hours is fairly high for these groups in comparison to those with no qualifications, it is unsurprising that the effect of providing care at high intensities would have a greater negative effect. This suggests that the socio-economic groups who lie somewhere in the middle may be important to support from a policy perspective.

Overall, the findings from this analysis highlight the persistent challenges carers face in balancing employment and care responsibilities, aligning with existing research that care is associated with reduced labour market participation. The consistency of these trends in post-pandemic data emphasises the ongoing impact caring may have for labour market

participation, further highlighting the need for policy interventions, such as more accessible respite care (NHS, 2023), flexible working patterns (Carers UK, n.d., d), and improved access to benefits such as Carer's Allowance (Carers UK, 2020b), in order to better support carers from all socio-demographic backgrounds.

Some more targeted interventions can be suggested from the findings. In terms of gender, the general suggestions relating to support in combining care and employment such as respite and flexible working arrangements apply, as there appears to be a negative relationship between caring and employment for both men and women. However, female high intensity carers work the fewest hours, suggesting that support specifically for female carers could be useful, particularly as this is the demographic who also carry out most of the other domestic/household labour (Boyczuk and Fletcher, 2016; Office for National Statistics, 2016). Co-designing policy and support services with female carers will be important, for example, through organising focus groups to find out what support female carers think would support them. Indirectly related policies such as those related to improved childcare services may also have a positive impact due to reducing some of the domestic load.

Whilst care can negatively impact the employment of all ages, it may be important to focus particular attention on the younger generations (X, Y and Z), as these carers are mostly either in their prime working years or just entering them. This is a time where the loss of income may be greatest, and potential consequences of being out of employment can be greater throughout the life-course. Negative effects can have a cumulative effect over the life-course (Cho, Crenshaw and McCall, 2013). Ensuring that younger generations are able to combine care with employment (if possible) will be important in ensuring that they have the best chance to succeed in their career throughout their life. For example, gaining valuable employment experience, and being offered and able to take on promotions and other opportunities that can support career progression. Providing education and support needs to start at younger ages, for example within schools education should be provided about what carers are and some support available. This will help young carers also who are going through a transitional period. Workplaces should also provide better information about what is available as it could be daunting for younger people earlier in their career to be able to ask, although this would also support all ages.

People with fewer qualifications (theorised of being lower socio-economic status due to being less likely to have certain jobs) seem to work the fewest hours in employment when providing

high intensity care. This group may have lower income already so may struggle working part time or have fewer assets in savings to support them with their caring role, re-enforcing the need to have better financial support for carers who are not in employment. For example, improving CA by increasing the amount received as well as reducing the number of hours carers need to care for to receive it, may prevent people from facing financial hardship, particularly people with fewer savings and assets who may be struggling, or earning less from employment.

However, the groups with the largest effect of caring on employment are the middle educated (secondary school or other) high intensity carers. This group should be deemed important from a policy perspective as it may be that caring has a particularly high impact on employment for these carers, in comparison to those with degrees who may be earning a high income, and those with no qualifications who are more likely to be working fewer hours to begin with. Expanding CA by increasing the income and number of hours carers can work could allow more carers in this group to remain in employment as they would still be able to receive additional financial support. More education to employers, for example through Carers UK 'Education for Employers' (Carers UK, n.d., a) as well as education for employees could help employers be able to support these types of carers, as well as carers understand what support they are entitled to that will aid them in being able to combine care with employment.

Conclusion

To conclude, this research has shown how novel statistical methods can be applied to research on adult social care to account for intersectional differences in experiences of labour market participation. The analysis provides evidence to suggest that caring significantly reduces the likelihood of labour market participation, and that socio-demographic characteristics interact with care to shape labour market participation outcomes. These findings are important as they reinforce the significant impact caring responsibilities may have on labour market participation (Brimblecombe et al., 2020; Carers UK, 2019a; King and Pickard, 2013). Understanding this relationship is important for developing policies and support systems that help carers balance caring with labour market participation, reducing the risk of financial instability and social inequality. This research emphasises the importance of developing targeted interventions that consider the diverse experiences of carers based on multiple factors. This can lead to more inclusive and effective policy-making that supports all carers, contributing to a better, fairer society.

Given that the influence of intersectionality on the relationship between caring and employment has been relatively unexplored, these findings represent a novel contribution to the field. Future research should further investigate these dynamics by applying an intersectionality framework and MAIHDA models to different datasets, such as the English Longitudinal Study of Ageing (ELSA) (NatCen Social Research, University College London, Institute for Fiscal Studies, 2020) or the Census (Office for National Statistics, n.d. b). This would help determine whether these patterns hold across different populations and data sources, thereby deepening our understanding of how caring and employment intersect across various social groups.

Limitations

This project has limitations. Firstly, in order to maintain sufficiently large sample sizes, the study re-categorised care intensity into broader categories (see: table 3.2). While this approach ensures a large enough sample size for statistical analysis, it inevitably leads to a loss of detail. For example, nuances within the categories, such as variations in caring intensity, are not fully captured. Secondly, the measurement of care intensity in this study does not account for fluctuations in caring responsibilities over time. For example, a carer might provide very high-intensity care one week and none at all the next, which could significantly affect their employment experiences and overall well-being (Simard-Duplain, 2022). Additionally, the study does not consider the emotional and individual aspects of caring, such as how different caring tasks might be experienced differently by each individual. Carers are not a homogenous group (Gallagher, 2020) and it is therefore difficult to quantify care intensity. Therefore, this research should be considered alongside qualitative research to understand carer's experiences of labour market participation at an individual level. This will help understand the ways in which care intensity is experienced differently (Bauer and Sousa-Poza, 2015).

Chapter Four: What has the relationship between unpaid caring and employment looked like over time? A longitudinal analysis of the Understanding Society dataset 2009-2022/23.

Abstract

Context: This paper investigates the relationship between providing unpaid care and labour market participation, and how it varies over time. Past research suggests that caring is associated with lower rates of labour market participation, but what has been unexplored from an intersectional quantitative perspective is how this relationship changes year-on-year. This research is important to ensure policy is targeted effectively.

Aims: The following research questions are addressed: **RQ1:** What is the relationship between unpaid care and hours of paid employment for men and women? **RQ2:** Has the relationship between unpaid care and hours of paid employment changed over the period 2009-2022/23?

Methods: Random-intercept mixed effects models are employed to analyse the Understanding Society dataset between 2009-2022/23, with repeated individual observations over time nested within each person.

Key findings: For both men and women, caring at any intensity is associated with a higher likelihood of being out of the labour market, even after socio-demographic factors are controlled for. This relationship is the most pronounced for highest intensity carers, and is mostly persistent over time, although there are some fluctuations, particularly following large scale events such as the COVID-19 pandemic.

Recommendations: Due to the persisting disparities in job hours compared to non-carers, particularly amongst high intensity carers, as highlighted within the results, improved support is needed to support carers in combining care and employment, as well as financial support those carers who are unable to work full-time so they are not at a financial disadvantage. We argue that improved access to respite services, continued support for flexible working arrangements, improved access to Carer's Allowance, and the introduction of paid leave for Carers, will have a positive impact on carers experiences.

Limitations: The sample size of carers in the data is not large enough to explore labour market participation in relation to job type, meaning detail is missed. Measuring care intensity in average weekly hours does not account for the type of care provided or the nature of the relationship between the carer and the recipient.

Conclusion: Future research should explore individual caring experiences, including the relationship between carer and care recipient, and examine variations in employment types. We also suggest that dynamics across different age groups and regions should be accounted for.

Introduction

The ageing population and reduced access to public social care services (Heitmueller, 2007) have led to a shift in the UK away from institutional care (HM Government, 2008), to more care being provided by family and friends (Carmichael et al., 2008). Unpaid care in this paper is defined as 'looking after or giving help to someone who is sick, disabled or elderly, such as a friend, relative or partner' (U Essex, 2023), and is referred to simply as 'care/carer/carers' throughout this paper. Since 2001, the largest nationally representative dataset, the Office for National Statistics Census, has tracked caring in England and Wales. Between 2001 and 2011, the number of carers increased by 600,000 to approximately 5.8 million (Office for National Statistics, 2013a). The most recent Census, in 2021, found that, although the overall number of people stating that they were carers had fallen to approximately 5 million, the proportion of people providing higher intensities of care (20-49 hours and 50 or more hours per week) had increased to 1.9% from 1.5%, and 2.8% from 2.7% respectively (Office for National Statistics, 2023d). These figures highlight the need for care-centred policies to support this. To focus policy efforts effectively, continued research into the characteristics and experiences of carers is necessary to ensure a greater understanding of what challenges carers face and how they can best be supported.

The focus of this paper is employment and labour market participation. Over the last few decades, policy has begun to address the needs of carers, and legislation around recognition of carers and the right to request flexible working has been introduced to support carers combining caring and employment (UK Parliament, 2014b; UK Government, n.d., a). Despite this, existing studies have shown that carers are more likely to have lower rates of labour market participation than non-carers (Drinkwater, 2015; King and Pickard, 2013; Young and Grundy, 2008) and carers who leave the labour market are unlikely to rejoin, even after they stop providing care (Dixley, Boughey and Herrington, 2019). What has been underexplored is the dynamic nature of these relationships over time, accounting for the complex interplay of changing social, political and economic contexts of the UK. In this paper we take a longitudinal approach, using the Understanding Society dataset between the years 2009 and 2022/23 (U Essex, 2024) to explore the changing relationship between care intensity and labour market participation over that period to address the stability of carers' labour market participation over time in comparison to non-carers, and provide recommendations for support for carers.

In this paper, we use multilevel regression models to assess the relationship between labour market participation and caring, for men and women, and how that changes over time. At the time of writing, this paper is the first to consider the temporal variation of this relationship using random-intercept mixed effects models to account for individual-level heterogeneity. The goal of this paper is to consider how the relationship between care and employment has varied over time, and how this may relate to the wider social, political and economic contexts in the UK over this period. This research is one of the first studies to take a longitudinal approach, including data shortly following the financial crash in 2008, to the years following the COVID-19 pandemic. This is a significant contribution to the literature, as it allows us to identify how labour market participation outcomes have changed for carers over an unique period of time, socially, economically and politically. It is important to note, however, that causal claims relating to the implementation of different policies will not be possible, due to the impact of these policies having not been measured by the UK government. Similarly, due to the complexity of events, policy and an overall changing society, we cannot say for certain that any of the results can be directly linked to a specific event. We are however, able to paint a picture of the care and employment relationship over a time period characterised by social change and ongoing periods of political and economic uncertainty (Alarilla, Grimm and Stafford, 2021; Bank of England, 2019; Stuckler et al., 2017).

The key findings from the analysis include the negative association between providing care at any intensity and job hours, for both men and women, with the association being greatest amongst high intensity carers. The gap between non-carers and carers job hours also fluctuates at points. This is possibly related to the economic and political context, related to widespread and persisting austerity and uncertainty. The findings overall suggest that carers, particularly those caring at high intensities, work fewer hours than non-carers, and this persists over time. Carers may as a result be at a higher risk of loss of income which can negatively impact well-being (Carers UK, 2019a; The Health Foundation, 2024).

Literature review

Background

The UK has seen increasing numbers of people combining unpaid care with employment (Carers UK, 2019a; Heitmueller, 2007). However, findings suggest that carers struggle to manage both roles, and would benefit from additional support (Carers UK, 2019a, 2022; Yeandle and Buckner, 2017). There is also a large amount of evidence showing that care is associated with reduced labour market participation (Drinkwater, 2015; King and Pickard, 2013; Young and Grundy, 2008). This can be a result of carers reducing their working hours or leaving the labour market entirely due to providing care (Carers UK, 2019a; Thompson, Jitendra and Woodruff, 2023), or of carers being more likely to work part-time, or to be have been out of the labour market prior to becoming a carer (Young and Grundy, 2008).

Reducing their labour market participation can equate to carers having reduced income. In some cases, this may lead to increases in financial insecurity resulting in poorer life chances, mental health issues such as stress (Carers UK, 2019a), and poor health (The Health Foundation, 2024). There are many reasons behind this, which include: limited access to services that promote healthy living such as private health care, gyms and leisure centres; increased stress and anxiety; and poorer access to healthy food options (Williams et al., 2022). This is important from a policy perspective as understanding the relationship between caring and labour market participation is important in enabling the Government and Local Authorities to provide effective support, or promote better health and well-being amongst carers. The support needed could be services that help carers combine work and care, such as flexible working (Dixley, Boughey and Herrington, 2019), respite services (NHS England, 2014), and access to paid leave to manage caring responsibilities (Carers UK, 2024a, 2024d).

Not only can this negatively affect carers themselves, but leaving employment as a result of caring has also been estimated to cost England around 2.9 billion per year in public spending (Pickard, 2019), through reduction in the tax take, and an increased uptake of benefits and health services (Cartagena-Farias and Brimblecombe, 2023). Age UK also recognises this, claiming that an extra £5.3 billion could be put into the economy as a result of carers being able to participate in the labour market (Age UK, 2016). This again, reinforces the need for policy to support working carers. However, it is also recognised that unpaid care is of great value to society (NHS England, 2014; Petrillo and Bennett, 2023). Some carers may not wish to, or may be unable to combine care and employment (Austin and Heyes, 2020). For this reason,

we also emphasise the importance of comprehensive financial support for carers who work fewer hours or are out of the labour market entirely as a result of caring, through increased access to benefits such as Carer's Allowance (Carers UK, 2024c).

Policy over time

To provide context for the time period of the analysis, a policy overview is provided. Although it is not clear to what extent these policies have supported carers, particularly in relation to employment, it is important to understand the timeline of progression in order to set the scene for the research.

Over time, carers are becoming increasingly recognised for their important contribution to society (NHS England, 2014), and modest policies have been put in place to support carers. Policies, initiatives and service provision can all support working carers' health and well-being. Flexible working is one of the most notable things that can help working carers fit their caring responsibilities around their employment (Carers UK, 2022a). Over the last few decades, flexible working has been increasingly advocated for, and policies have been put in place to encourage this. Flexible working arrangements have also often been developed by employers themselves.

The policy landscape includes a growing number of policies directly referencing carers. It should be noted that some of these policies/legislation came about because of Private Member's Bills. This is significant, as these bills have been developed in collaboration with carers' organisations, and often address issues that may not be government priorities but are important to society. This section of the paper outlines notable policies and initiatives related to carers and flexible working, for time periods before and during the scope of this analysis, as seen in table 4.1 and 3.2:

Table 4.1 An overview of the relevant policy landscape prior to 2009.

Time Period	Policy or Initiative	Description	Significance for Carers
Pre 2009	**Carers (Recognition and Services) Act 1995**	This Act arose from a Private Members Bill, allowing carers to request an assessment of their needs by their local authority (UK Parliament, 1995).	This was a significant step in recognising carers' needs, driven by advocates outside of the government. The Act highlighted growing recognition of the contributions of carers.
	Community Care (Direct Payments) Act 1996	Enabled Local Authorities to make cash payments to individuals, allowing them to purchase their own care services (UK Parliament, 1996; Roll, 1996). However, only disabled people aged 18-65 were eligible, excluding carers (Yeandle & Stiell, 2007).	Although this Act increased autonomy for disabled people, the exclusion of carers limited its significance for supporting carers financially.
	Employment Relations Act 1999	One of the first employment policies to benefit carers, granting people the right to take a few days' unpaid leave for family emergencies.	Provided some flexibility for carers dealing with emergencies, though not directly aimed at them (Yeandle and Buckner, 2017). Carers' Leave was only formally established in 2024, after it was introduced as a private members bill by Liberal Democrat MP Wendy Chamberlain (Carers UK, 2024a, 2024d; UK Parliament, 2023a).
	Carers and Disabled Children Act 2000	Preceding the Care Act 2014, this private members bill introduced by Labour MP Tom Pendry, improved access to local authority assessments and aimed to improve support for carers, such as providing breaks from caring (The Health Foundation, n.d. a; Bate, 2015).	Marked an important step towards recognising the needs of carers, providing access to support services, and offering respite care to help balance work and caring duties.

	Part-time Workers (Prevention of Less Favourable Treatment) Regulations 2000	Introduced protections for part-time workers, covering pay, pensions, holidays, training, career development, and opportunities for career breaks (UK Parliament, 2000; UK Government, n.d., b). This was enacted to make the UK compliant with EU law.	Benefitted carers, many of whom work part-time due to caring responsibilities (Carers UK, 2019a). This regulation aimed to reduce workplace inequality and improve working conditions for part-time employees.
	Carers (Equal Opportunities) Act 2004	Another Private Members Bill, introduced by Labour MP Hywel Francis that aimed to ensure that carers were informed of their rights and able to access carer assessments and support services (UK Parliament, 2004).	This legislation empowered carers by raising awareness of their rights and improving access to assessments and services, promoting better support for their dual roles as workers and caregivers.
	Work and Families Act 2006	Originating as a Government bill, introduced the right for individuals with caring responsibilities to request flexible working, extending the right initially introduced for parents of disabled children in the Employment Rights Act 2002 (UK Parliament, 2014b).	This was a key advancement in enabling carers to balance employment with caring, allowing for more flexibility in working hours and conditions.
	National Carers Strategy (for England) (2008)	This second national carers strategy recognised the multiple roles of carers, especially women, balancing paid and unpaid work. The strategy aimed to centre carers in family policy and improve their mental, physical, and financial well-being (HM Government, 2008).	This strategy helped bring greater recognition to carers in national policy, with a focus on promoting their well-being and embedding support for carers within wider family policy frameworks.

Carer's Allowance (ongoing)

Carer's Allowance (already mentioned) has been in existence across the whole of this policy overview. First introduced in 1976, Carer's Allowance (CA - known as Invalid Care Allowance at the time) is a benefit available to carers who are unable to work full-time in paid employment due to caring, and is meant to contribute to replacing this loss of income (Fry et al., 2001; Kennedy, 2020). In 2025, CA stands at £83.30 a week. To qualify, carers must care for at least 35 hours a week, and must not earn more than £196 per week after tax (UK Government, 2025).

CA may benefit some working carers who work part-time, by increasing their income. However, CA has been criticised, especially for being hard to access and for payments being too low (Carers UK, 2022b; Fry et al., 2011). The strict rules for accessing CA have also been criticised for having an unintended disincentive effect on employment among carers, despite the slight increase in earnings limit (Carers UK, 2025a). The eligibility requirements also require carers to care for a greater amount of hours than this paper considers to be 'high intensity' caregiving (35 hours per week to receive CA versus 20 hours or more per week to be considered providing high intensity care). The findings of this paper will therefore consider whether the strict eligibility criteria of CA should be reviewed in order to better support carers at risk of loss of income.

Carer's allowance (formerly Invalid Care Allowance) is the main benefit provided to Carer's in order to supplement lost income from paid employment. The strict eligibility criteria (outlined above) of Carer's Allowance currently makes the benefit accessible to only a small group of carers, whilst many carers who are not eligible would also benefit from the additional financial support. For example, the majority of carers care for fewer than 35 hours per week, but may also experience having additional costs from caring (Watkins and Overton, 2024) or be unable to work full time hours in paid employment. This paper focuses on care at much lower intensities than 35 hours per week or more, with the aim to highlight that a re-evaluation of the current eligibility criteria is needed in order to effectively support carers.

This policy context provides an overview of what has been implemented over the timeline of the analysis in this paper. To summarise, these acts begin to highlight some of the support for carers. However, policies up to this point have been criticised for not fully meeting carers' needs (Carmichael et al., 2008). Leading up to the 2010s, policy was beginning to recognise carers, and measures were being implemented to support them. Further policies and initiatives were introduced in the following decade, including the Care Act 2014, which had a greater impact on recognising and supporting the role of carers.

The analysis in this paper begins in 2009, shortly after the 2007-2008 financial crisis. It is important to consider how this may have shaped both the policy landscape and the lived experiences of carers during this period. Society was affected greatly by the financial crash. The UK Government's response to the financial crash caused widespread austerity in the UK (Stuckler et al., 2017), and government funding to local authorities fell by almost 12% between

2011 and 2012, changing the way services and policy were able to be implemented (Meegan et al., 2014). Cuts to adult social care have also been made following austerity (Hernandez, 2021). During this time, inequalities increased, and more people were living in poverty (Michi, 2022). The decreased access to social care and health services (Stuckler et al., 2017), meant that more of the care burden was put on friends and family. In turn, some carers may have left the labour market to provide care. On the other hand, the inability to afford services due to their rising cost (The King's Fund, 2025), meant carers may have had no choice but to work alongside their caring role.

This introduction highlights the complex interplay of the state, carers, the market and community in meeting the demand for care. Unpaid care, paid care, policy and society all intersect, and changing social, economical and political contexts can shape care demands and decisions (Daly, 2021). To conclude, over time the policy landscape has provided improved support, through increased recognition, and evolving policies on flexible working arrangements and financial support. This has the potential to improve the well-being of some working carers, by making it easier to balance caring responsibilities and employment. However, current policies fall short of meeting the needs of working carers, and more needs to be done in supporting them, for example, improving the accessibility of CA (Carers UK, 2024c), providing more respite services (NHS England, 2014), and introducing paid leave for carers (Carers UK, 2024a, 2024d). The UK government has also not measured the impact of these policies, so we are unable to know with certainty how well carers have actually been supported as a result. Despite this, it still sets the scene for the analysis this paper sets out.

Table 4.2 An overview of the relevant policy landscape between 2009 and 2022.

Time Period	Policy or Initiative	Description	Significance for Carers
2009-2021/22	**Care Act 2014**	Arising out of a review of all existent social care law by the Law Commission (The Health Foundation, n.d. b), the act aimed to transform adult social care, and put a greater emphasis on local authorities as responsible for providing support. Building upon the *Carers (Recognition and Services) Act 1995* (Bate,	The Care Act (CA) 2014 is one of the most notable pieces of legislation in England related to carers and entitled carers to support for the first time (Department of Health and Social Care, 2016). However, the implementation of many of the initiatives from the Care Act were stalled, cancelled or poorly

		2015) and the *Carers and Disabled Children Act 2000*, it aimed to further improve access to carer's assessments and support (Bate, 2015; Carers UK, n.d., b, c) by allowing more carers to access breaks from caring, emotional support, advice and practical support (Carers UK, n.d., e).	provided for (Age UK, 2022b; Hay, 2023). As a result, the reach of the Care Act has not been as successful or meaningful for carers as was initially hoped.
	Flexible Working Regulations (2014)	These regulations relate to the Children and Families Act 2014 (UK Parliament, 2014a). Gave all employees with at least 26 weeks of continuous employment the right to request flexible working arrangements, including changes to hours, schedules, or work location (UK Parliament, 2014b; UK Government, n.d., a). This pre-dates the Flexible Working Act 2023 (UK Parliament, 2023b).	Flexible working is suggested to be highly beneficial in helping carers combine their caring responsibilities with employment (Carers UK, 2022a). The introduction of this legislation was of huge importance in supporting carers. Flexible working arrangements, such as working from home, have become common practice (Carers UK, 2020b), particularly since the onset of the COVID-19 pandemic. Social distancing and isolation measures at that time meant that workers who were able to, were advised or required to work from home. Since then, increased use of technology, such as online meeting platforms, mean flexible working remains acceptable in many workplaces.
2023-2024	**Carer's Leave Act 2023**	Another Private Member's Bill. Established the right for carers to take up to five days of unpaid leave from employment to provide care (Carers UK, 2024a, 2024d; UK	While this Act was a positive step in supporting carers, the unpaid nature of the leave was criticised as financially inaccessible for many. It has been suggested that future

		Parliament, 2023a). Unlike the *Employment Relations Act 1999* that was aimed at family responsibilities (Yeandle and Buckner, 2017), this directly covers caring responsibilities.	policies should provide paid leave to better support carers (Carers UK, 2024a, 2024d).

Existing literature from the UK

The existing literature on the association between caring and labour market participation in the UK highlights the challenges carers face in combining work and caring responsibilities. Continued research into the experiences of working carers is therefore crucial for informing effective policy implementation (Dixley, Boughey, and Herrington, 2019). Much of the research from the 2000s, based on data collected between 2000 and 2010, consistently shows that caring is associated with a reduction in labour market participation. For example, Drinkwater's (2015) analysis of 2001 Census data from the South Wales Valleys, a region with high levels of care, uses probit models to examine the relationship between care and labour market participation. Despite the data being somewhat outdated by the time of publication, Drinkwater argues that the findings likely still hold. The study found that providing care was associated with reduced labour market participation for both men and women, with women more likely to reduce their working hours. This suggests that caring can negatively impact employment, putting carers at risk of reduced earnings, particularly women, who are more likely to be working part-time (Women's Budget Group, 2020). However, as this was a cross-sectional study, it did not track changes over time, making future research using more recent data necessary to see if these patterns persist.

Longitudinal studies further support these findings. Michaud, Heitmueller, and Nazarov (2010) used data from the British Household Panel Survey (2000-2005) to explore the impact of caring on future labour market participation among women. They found that caring for someone in the same household was associated with lower future employment, while caring for someone outside the household had no significant effect. This mirrors findings from existing literature, suggesting carers are more likely to leave the labour market when providing care to someone in their own home (Dixley, Boughey, and Herrington, 2019). However, as Michaud, Heitmueller and Nazarov's (2010) study focuses exclusively on women, there remains scope for future research to explore the impact of caring on men and to uncover any gender-specific patterns.

King and Pickard's (2013) study, based on data from the English Longitudinal Study of Ageing (2002-2009), looked at individuals aged 50 to state pension age and examined the relationship between care intensity and labour market participation. Their logistic regression models found that men who provided 10 or more hours of care per week were less likely to be employed in the future. For women, the relationship was more nuanced. Women who began providing fewer than 10 hours of care per week were more likely to stay employed, while women providing 10 or more hours of care experienced a reduction in the likelihood of being in employment. These results suggest that caring for more than 10 hours a week may have a negative impact on employment for both men and women.

Young and Grundy's (2008) analysis of data from the ONS Longitudinal Study (1971-2001) also supports the idea that care is associated with lower labour market participation. They found that men who provided care in 2001 had historically lower levels of employment, while women were more likely to be out of the labour market. Their work emphasises the complex relationship between care and employment, showing how factors such as previous employment care roles can influence current labour market participation. Like Heitmueller (2007), Young and Grundy (2008) recognise the bidirectional nature of this relationship: previous employment can influence the decision to provide care, just as providing care can impact future employment opportunities. This complexity highlights the need for further research to deepen our understanding of how these dynamics unfold over time.

The evidence from existing studies strongly suggests that carers, particularly those providing care within the household or for more than 10 hours a week, are at greater risk of reduced labour market participation (King and Pickard, 2013). Many researchers argue for increased funding for services and support to enable carers to balance work and care responsibilities (King and Pickard, 2013; Young and Grundy, 2008). This paper seeks to build on this existing literature by exploring whether the relationship between care and employment has changed over time, or if current findings continue to support the case for improved support services for working carers.

There are various reasons why carers may be less likely to participate in the labour market. Care responsibilities are often mentally, physically, and emotionally demanding, as well as time-consuming (Public Health England, 2021). Since both paid employment and care compete for time (Henz, 2004; Raiber, Visser and Verbakel, 2022), carers may struggle to participate in full-time employment. The decision to provide care or reduce work hours is influenced by

multiple factors, including socioeconomic status and income (Henz, 2004), and these intersect with changing social, political and economic contexts, including how carers interact with social services and the welfare state (Daly, 2021). Those with higher incomes may be more likely to afford private care services, enabling them to remain in the labour market. Seedat and Rondon (2021) use the example of higher income individuals being able to pay for care services and domestic help which frees up time for them to be able to spend more time with their children. This example can be applied also to providing care to adults, as being able to afford additional help with care and other domestic responsibilities allows more time to be spent doing other things, such as paid employment. These various factors may also vary year-on-year, as the social context changes. For example, economic fluctuations, policy changes and large-scale events may affect individuals ability or need to provide care, participate in employment, as well as their overall well-being which can also have an indirect effect on the care-employment relationship.

Those with higher incomes may be less likely to leave employment, as the financial loss would be more significant than for someone on a lower income. On the other hand, individuals with lower incomes may be unable to reduce their hours or leave the labour market entirely because they cannot afford to do so (Henz, 2004). These dynamics are also shaped by broader societal factors. The financial crisis of 2007/2008, for example, led to widespread austerity and increased poverty (Stuckler et al., 2017), making it harder for many carers to afford necessary resources and services, which in turn could have affected employment patterns among carers.

Gender differences have also been identified across the literature. Generally, men are more likely to remain in the labour market than women, and women are more likely to work part-time (Drinkwater, 2015; Women's Budget Group, 2020). Traditional gender roles and expectations, though gradually declining, remain influential. Women are often expected to take on the majority of care and domestic duties (Thompson, Jitendra and Woodruff, 2023), such as the housework, childcare and caring for adult family members (Xue and McMunn, 2021), which contributes to the differences between men and women in both care and labour market participation. This could also put women at a disproportionately higher risk of experiencing a loss in income in comparison to men as a result of providing more care (Thompson, Jitendra and Woodruff, 2023). This is evidence that the gendered division of labour remains an important factor in understanding the employment patterns of carers.

Contribution to the literature

This research aims to make both a methodological contribution and advance understanding in the field. By using the Understanding Society dataset, which provides yearly data points from 2009 to 2022/23, we were able to employ longitudinal random-intercept mixed effects models. This allowed us to take full advantage of the longitudinal nature of the data, covering a time period from just after the 2007/2008 financial crisis up to the following years post the COVID-19 pandemic. This is a novel statistical method that, to my knowledge, has not been previously applied within this specific context. It is therefore a significant methodological contribution to adult social care research. The time frame of the available data also allows us to research a particularly interesting period, marked by changes in the economic climate, policy landscape, and in public health. At the time of writing, this is the first study to longitudinally examine the relationship between labour market participation and caring for men and women from the financial crash through to the 2020s.

Methods

Research aims and objectives

The study aimed to investigate the relationship between unpaid care, at different levels of caring intensity (0, 1-9, 10-19, 20+ hours per week), and labour market participation. This aim was addressed using the following research questions:

> **RQ1** What is the relationship between unpaid care and hours of paid employment for men and women?
>
> **RQ2** Has the relationship between unpaid care and hours of paid employment changed over the period 2009-2022/23?

Data

The analysis uses Waves 1 to 13 (2009 to 2022/23) of the Understanding Society dataset (U Essex, 2024). This dataset was selected due to its large sample size, annual data points, and reputation as one of the most stable longitudinal datasets globally (Understanding Society, n.d.). This makes it one of the few UK datasets that allows caring and labour market participation to be tracked over time. The data was stratified by sex to account for differences in labour market and caring trends, such as the higher prevalence of part-time employment among women (Drinkwater, 2015; Women's Budget Group, 2020). Additionally, evidence suggests that women are more likely to combine caring with employment and to provide care at younger ages,

particularly before retirement (Young and Grundy, 2008). To ensure a sufficiently large sample size, respondents aged 16 to 60 were included in the analysis.

Variables

The *dependent variable* (average job hours worked per week), measures labour market participation. In the survey data subjects who were employees were asked:

> *"Thinking about your job, how many hours, excluding overtime and meal breaks, are you expected to work in a normal week?"* (U Essex, 2024).

Respondents who were classed as 'out of the labour market' (retired, home and family care, unemployed), were coded as having an average job hours worked per week value of '0'.

Some categories have been removed from analysis for simplicity. Self-employed people are not included. This decision was made as being self-employed can be quite different to being an employee. For example, it is a possibility that they are able to work more flexible hours and are also entitled to different rights than employees. It would be interesting to consider the effects of caring responsibilities on self-employed individuals in a separate study. People who are out of the labour market due to being long term sick or disabled have also been removed from analysis: in most cases it is not a choice to be out of the labour market for this reason, and so those individuals are not particularly of interest here.

Similarly, people over state pension age have also been removed. This allows for people who have retired before they reach state pension age to be accounted for, which is deemed important as some carers may take early retirement as a result of providing care (Civil Service Pensions, 2022, The Eurocare Team, 2024). As we only had access to an individual's year of birth, we were unable to accurately match an individual to the exact date at which they reach state pension age. As an imperfect solution, we decided to remove all people over the age of 60 as this is the lowest age state pension age could be reached in the sample. The downside of this is that we are unable to consider people who retire early between the ages of 60 and the retirement age at that time, a group that are relatively likely to have elderly parents who are in need of care.

The main independent variable of interest is measured as the average hours of care provided per week. It includes care provided both inside and outside the carer's household. Respondents were asked:

> *"Now thinking about everyone who you look after or provide help for, both those living with you and not living with you - in total, how many hours do you spend each week looking after or helping them?"* (U Essex, 2024).

This variable was used as it contains information on care intensity, rather than simply whether someone provides care or not. This decision was made as care intensity has been shown to be an important factor in labour market participation (Dixley, Boughey and Herrington, 2019). To maintain a large enough sample size in each category, the variable has been re-coded into 4 categories: 0 hours, 1-9 hours, 10-19 hours and 20+ hours.

The literature highlighted many factors that may be associated with care and/or labour market participation, such as socioeconomic status, ethnicity and household composition. Highest educational qualification was used as a measure of socioeconomic status. This was used rather than NS-SEC, as people who were out of the labour market had no value for NS-SEC. Although this is an imperfect measure, highest qualification is found to be strongly associated with socioeconomic background (Social Mobility Commission, 2024).

Ethnicity is selected as differences in care provision (Yeandle and Buckner, 2007) and labour market participation have been found across different ethnic groups. The 'ethnic group' variable is re-categorised into five groups (see table 2 in appendix), following the Office for National Statistics classification (Office for National Statistics, 2023a). Although using only five categories will likely miss some key detail within categories (Race Disparity Unit and Race Equality Unit, 2020), using wider categories would lead to issues of small counts within categories which would reduce the power of the analysis.

Finally, household composition is selected to account for both having extra people to help provide care, and having additional people to care for within the household, for example, children. One example of this is middle aged individuals who are often defined as being part of the 'sandwich generation', where they often provide care for elderly parents at the same time as dependent children, adding additional stress (Boyczuk and Fletcher, 2016). The 'Composition of household' variable is re-categorised into six categories (see table 2 in appendix) to improve the interpretability of the results.

Table 4.3 Descriptive statistics: The variables used in the analysis and the observations in each category.

Name	Variable code	Men		Women	
		No. obs.	**% obs.**	**No. obs.**	**% obs.**
Job hours	Average job hours worked per week	min: 0, mean: 32.3, max: 97.9		min: 0, mean: 22.9, max: 97.9	
Care intensity	0 Hours	138570	87.99	167417	82.76
	1-9 Hours	13032	8.27	20817	10.29
	10-19 Hours	2315	1.47	4974	2.46
	20+ Hours	3575	2.27	9080	4.49
Ethnicity	White	341215	74.32	385608	74.87
	Mixed	11540	2.51	14842	2.88
	Asian	71721	15.62	72747	14.13
	Black	26860	5.85	34006	6.60
	Arab & Other	7777	1.69	7801	1.51
Household composition	1 adult, no children	18787	10.61	17008	7.92
	1 adult with children	3145	1.78	17954	8.36
	2 adults, no children	37613	21.25	44816	20.87
	2 adults with children	60749	34.31	70684	32.92
	3+ adults no children	31192	17.62	33941	15.81
	3+ adults with children	25548	14.43	30340	14.13
Highest educational qualification	Degree	126478	27.89	150190	29.87
	Other degree	43937	9.69	60917	12.12
	A levels	118646	26.17	116882	23.25
	GCSEs	103805	22.89	112876	22.45
	Other qualification	30261	6.67	28714	5.71
	No qualification	30294	6.68	33215	6.61

Model

The study used random-intercept mixed effects models to explore how the outcome variable, labour market participation (job hours), varied between individuals and over time, using a two-level structure. Repeated observations for a single case over time are shown at level one, and individuals are at level two. The model terms are defined as:

JobHours is the predicted average job hours worked per week.

β0 is the intercept, in this case this is the estimated log odds of the mean probability of being in the labour market.

β1… … β*x* are the fixed terms in the model, including the variables care and age.

α represents the fixed terms for waves (the measure of time).

ω represents the fixed terms for the socio-demographic control variables, represented by X.

X_{ijm} represents the dummy socio-demographic control variables, including ethnicity, household composition and highest educational qualification.

ϑ represents the interaction terms between the care and wave variables.

i is individual observations over time, and *j* is the individual that they are nested within.

k is the index for the waves and K is the total number of waves, each with a parameter estimate α_k.

l is the index for the parameters of care

m is the index for covariates X_{ijm}, each with parameter ω_m

u_{0j} is the individual-level random effect, which is assumed to be normally distributed with a mean of zero and a variance that is estimated.

A series of modes that gradually build in complexity are used, allowing us to answer increasingly nuanced questions about the relationship between caring and labour market participation:

Model 1: This model allows us to answer research question 1. It identifies whether there is an overall relationship between job hours and care intensity, before socio-demographic factors are accounted for. *Hours of care (aidhrs)* were added as the main independent variable in the fixed effects model to identify the overall relationship between caring and labour market participation.

$$JobHours = \beta0 + \beta1 * LowCare_{ij} + \beta2 * ModerateCare_{ij} + \beta3 * HighCare_{ij} + (u_{0j} + \varepsilon_{ij})$$

Model 2: Wave is added as a control variable to the model. This allows us to see the overall relationship between job hours and care intensity, once time is controlled for, ensuring that the relationship observed in model 1 was not driven by temporal changes in both care and job hours.

$$JobHours = \beta0 + \beta1 * LowCare_{ij} + \beta2 * ModerateCare_{ij} + \beta3 * HighCare_{ij} + \sum_{k=1}^{13} \alpha_k * Wave_{ijk} + (u_{0j} + \varepsilon_{ij})$$

Model 3: This model also addresses research question 1. Additional independent variables were added to be controlled for, based on variables available within the dataset (U Essex, 2024) that previous studies have found to be associated with care and or employment (see pages 101-102). These include age, age squared, ethnicity, household composition and highest educational qualification. This allows us to identify how the relationship between labour market participation and care intensity changes once socio-demographic factors are accounted for.

$$JobHours = \beta0 + \beta1 * LowCare_{ij} + \beta2 * ModerateCare_{ij} + \beta3 * HighCare_{ij} + \beta4 * Age_{ij} + \beta5 * Age^2_{ij} + \sum_{k=1}^{13} \alpha_k * Wave_{ijk} + \sum_{m=1}^{14} \omega_m X_{ijm} + (u_{0j} + \varepsilon_{ij})$$

Model 4: To answer research question 2, an interaction term between care provision and wave was added into the fixed effects part of the model. This model allows us to identify whether predicted job hours vary across different categories of care intensity over time.

$$JobHours = \beta 0 + \beta 1 * LowCare_{ij} + \beta 2 * ModerateCare_{ij} + \beta 3 * HighCare_{ij}$$
$$+ \sum_{k=1}^{13} \alpha_k * Wave_{ijk} + \sum_{l=1}^{3} \sum_{k=1}^{13} \vartheta_{kl} (Care_{ijl} * Wave_{ijk}) + (u_{0j} + \varepsilon_{ij})$$

Model 5: Again, to answer research question two, the control variables (ethnicity, household composition and highest educational qualification) were added back into the model, to identify how predicted job hours varies over time for each category of care intensity, once socio-demographic variables were controlled for.

$$JobHours = \beta 0 + \beta 1 * LowCare_{ij} + \beta 2 * ModerateCare_{ij} + \beta 3 * HighCare_{ij} + \beta 4 * Age_{ij}$$
$$+ \beta 5 * Age^2_{ij} + \sum_{k=1}^{13} \alpha_k * Wave_{ijk} + \sum_{m=1}^{14} \omega_m X_{ijm} + \sum_{l=1}^{3} \sum_{k=1}^{13} \vartheta_{lm} (Care_{ijl} * Wave_{ijk}) + (u_{0j} + \varepsilon_{ij})$$

Although the topic of care and labour market outcomes has been widely researched (Drinkwater, 2015; Heitmueller, 2007; King and Pickard, 2013, Michaud, Heitmueller and Nazarov, 2010; Young and Grundy, 2007), to my knowledge, this is the first time random-intercept mixed effects models have been used to take advantage of the longitudinal nature of Understanding Society to consider the relationship between carer and labour market outcomes. This allows for exploration of variation across individuals, change over time and socio-demographic factors, helping to inform suggestions for future policy and support.

Results

Analysing the results for men in table 4.4, in model 3, where socio-demographic variables are controlled for, the AIC score is the lowest (883491). This suggests that adding these control variables improves the model fit. In this model, men caring at low intensities work on average 0.45 fewer hours (27 minutes) per week compared to non-carers. Moderate carers work 1.88 fewer hours (1 hour 53 minutes) and high intensity carers work 5.51 fewer hours (5 hours 31 minutes). These findings provide evidence to suggest that carers are more likely to work fewer hours than non-carers, particularly amongst those who provide the most care. These findings are also similar to the results in models 1 and 2, which suggests that socio-demographic variables do not control for much of the relationship between care and job hours.

The ICC for model 3 is 0.62, which suggests that once socio-demographic variables are controlled for, approximately 62% of the variation in job hours occurs across individuals, and 38% occurs within individuals over occasions. As expected, most of the variation occurs between people, however, 38% variation occurring over time suggests that job hours are not universally stable over time for a given individual.

Analysing the results for women, as shown in table 4.4, similarly to the results for men, in model 3, where socio-demographic variables are controlled for, the AIC score is also the lowest (1214023), again suggesting that adding these control variables improves the model fit. In this model, women caring at low intensities is associated with working 0.61 fewer hours (37 minutes) per week compared to non-carers. Carers caring at moderate intensities work on average 1.87 fewer hours (1 hour 52 minutes) in comparison to non-carers and carers caring at high intensities work on average 4.34 fewer hours (4 hours 20 minutes). These findings provide evidence to suggest that carers are more likely to work fewer hours than non-carers, particularly amongst those who provide the most care.

Similarly to the results for men, the results for women providing care at any intensity are consistent across models one to three. In all models, the findings suggest that those providing care at any intensity work fewer hours than those who do not care, with high intensity carers working the fewest hours. This indicates that there is a negative relationship between care and job hours even once socio-demographic variables are controlled for.

In comparison to the findings for women, men providing low and moderate intensity care have a slightly lower negative coefficient, however, men providing high intensity care have a slightly larger coefficient estimate, in comparison to their non-carer counterparts. This suggests that, although on average men work more hours than women across all groups, the difference in hours worked between high intensity carers and non carers is on average greater for men than women. In other words, the difference between carers and non-carers is wider for men than it is for women, as shown in figures 3.1 and 3.2 below.

Table 4.4 Regression results for men and women **

	Men						Women					
	Model 1		**Model 2**		**Model 3**		**Model 1**		**Model 2**		**Model 3**	
Predictors	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*
(Intercept)	29.76 ***	0.09	29.15 ***	0.13	37.94 ***	0.14	21.81 ***	0.08	20.96 ***	0.11	35.10 ***	0.20
Care provision (ref: 0 hours)												
Low (1-9 hours)	-0.43 **	0.13	-0.44 ***	0.13	-0.45 ***	0.13	-0.52 ***	0.09	-0.57 ***	0.09	-0.61 ***	0.09
Moderate (10-19 hours)	-1.71 ***	0.28	-1.75 ***	0.28	-1.88 ***	0.27	-1.83 ***	0.17	-1.91 ***	0.17	-1.87 ***	0.17
High (20+ hours)	-5.20 ***	0.27	-5.28 ***	0.27	-5.51 ***	0.26	-4.31 ***	0.16	-4.54 ***	0.16	-4.34 ***	0.15
Random Effects												
L1 var (observations)	92.07		91.88		86.33		80.06		79.56		74.75	
L2 var (individual)	178.78		178.79		140.19		169.71		168.50		124.01	
Intraclass corr. (ICC)	0.66		0.66		0.62		0.68		0.68		0.62	
No. observations	26243		26243		25695		33368		33368		32571	
Observations	115832		115832		114660		162849		162849		160934	
Marg. / Cond.l R^2	0.002 / 0.661		0.003 / 0.662		0.140 / 0.672		0.003 / 0.681		0.007 / 0.682		0.178 / 0.691	
AIC	903893		903748		883491		1246653		1245664		1214023	

** p<0.05 ** p<0.01 *** p<0.001*

** The results for the control variables have not been included in this table, and can be seen in the full results table in table 3 and 4 of the appendix. Model 4 and 5 include interaction terms hence are included only in the appendix as they are used to plot figures 3.1 and 3.2 but the coefficients are not interpreted.

To answer RQ2, interactions were added to the models 4 and 5; full model estimates can be seen in the appendix (table 3 and 4). Model 5 was used to plot the relationship between care provision and the predicted average job hours per week between 2009 and 2022-23, as shown in figures 3.1 and 3.2.

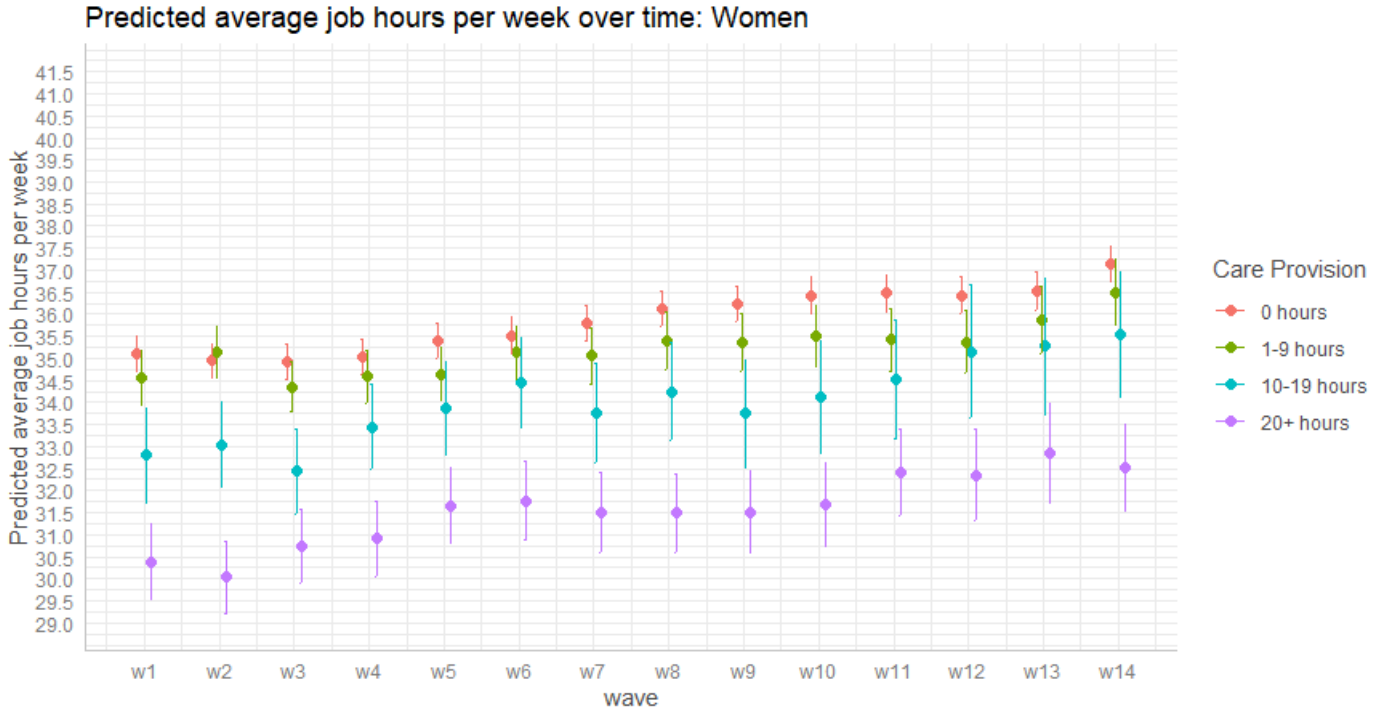

Figure 4.1 Women: Predicted probabilities of being in the labour market: interaction between care provision and year. Based on model 5 Understanding Society waves 1-14 (U Essex, 2024).

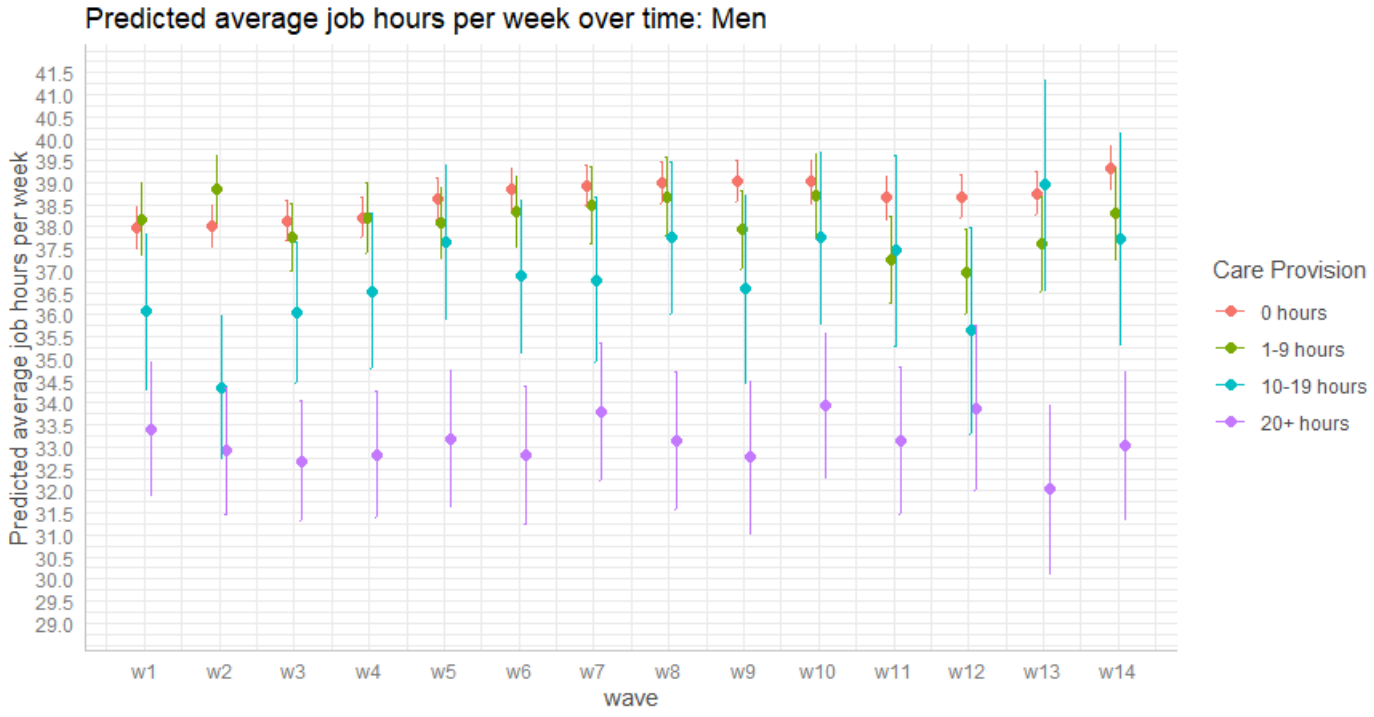

Figure 4.2 Men: Predicted probabilities of being in the labour market: interaction between care provision and year. Based on model 5. Understanding Society waves 1-14 (U Essex, 2024).

For women overall, there is a gradual increase in job hours over time. The clearest differences, as expected, are between caring at high intensities and non-caring or caring at lower intensities; caring for 20 or more hours per week is consistently associated with working the fewest job hours compared to all other categories of caring between wave 1 (2009-2019) and wave 14 (2022/23). This highlights the persisting inequalities in job hours experienced by the highest intensity carers.

Caring at moderate intensities is also negatively associated with job hours in comparison to both non carers and low intensity carers in earlier waves. However, there is a shift in wave 4 (2012/2013) where caring at moderate intensities may become less negatively associated with job hours in comparison to caring at low intensities, visualised in figure 4.1 where the confidence intervals for moderate, low intensity and no care begin to overlap.

However, overall there is no clear evidence of change over time for different levels of caring, as evidenced by the lack of significant interaction coefficients (see model 5 in the appendix table 4) and overlapping confidence intervals, particularly for low intensity carers. The results should therefore be interpreted with caution.

There are some clearer differences in the results for men, notably a statistically significant divergence between non-carers and low-intensity carers. Shortly after the financial crash in wave 1 (2009-2010), men providing care at low intensities appear to be on average, working more job hours, particularly compared to wave 10 (2018) onwards, where they are working on average fewer hours, particularly in comparison to non-carers. This trend begins to decrease in the later half of the data, particularly in wave 9 (2017/2018), and waves 11 (2019/2020) onwards, following the pandemic. This follows a similar, but more pronounced trend in comparison to women, where the negative relationship between low-intensity care and labour market participation is most pronounced around wave 11 and 12 (2019-2021), and least pronounced in wave 2 (2020-2011).

In figure 4.2, the predicted job hours for carers providing moderate intensity care also appear to dip during the onset of COVID (wave 11 to 12), but rise again in wave 13 (2021/22). Overall, providing moderate care appears to be more negatively associated with job hours in comparison to non-carers in the years after large scale societal events such as the financial crash (wave 2: 2010/2011) and Brexit/COVID (wave 12: 2020/2021). Similarly to the results for women, providing high intensity care is consistently associated with providing the fewest job

hours on average across time. However, there are no statistically significant coefficients for moderate or high intensity care interactions with wave, hence these results should be approached with caution.

Discussion

This study offers an understanding of the relationship between care responsibilities and labour market participation between 2009 and 2022/24. The findings from these results are consistent with the existing literature (Carers UK, 2019a; Drinkwater, 2015; King and Pickard, 2013; Thompson, Jitendra and Woodruff, 2023; Young and Grundy, 2008), finding that overall, there is significant evidence to suggest that carers work on average fewer hours per week compared to non-carers, with this finding being the most pronounced for high intensity carers. This is a finding that persists over time, reinforcing the need for improved policy interventions to support carers combine care with employment, should they wish to and be able to do so.

Caring intensity

The results for low-intensity care are perhaps surprising, as previous research has not found strong negative associations between low-intensity care and labour market participation. King and Pickard (2013), for example, were among the first to identify a significant relationship between lower-intensity care and reduced employment in midlife adults, but only at care levels of 10 hours per week or more. In contrast, this study finds that carers caring for just 1-9 hours per week work on average 27 to 37 minutes fewer per week, for both men and women. While this may seem like a small difference, it is nonetheless important, as it suggests that care-related employment impacts may occur at much lower intensities than previously recognised. This highlights a clear policy need to support working carers even at lower levels of care provision.

Figures 3.1 and 3.2 also highlight why this study may be among the first to identify these differences between low-intensity carers and non-carers (particularly for men in figure 4.2). Much of the existing literature relies on older data, meaning that recent trends have not been fully captured, such as the widening gap between low intensity carers and non-carers in waves 11 and 12. This is important from a policy standpoint, as recent policies have claimed to improve support for working carers (see pages 92-97). These shifts are particularly relevant for carers providing 1-9 hours of care, who are ineligible for Carer's Allowance (Age UK, 2024; Carers UK, 2024b) and are therefore more likely to depend on paid employment or other

benefits if they qualify. This suggests that current policy may not be doing enough to support carers with lower levels of care provision.

This finding is also particularly interesting, as the biggest divergence appears to be around the period of the COVID-19 pandemic and subsequent lock downs in the UK. Whilst this analysis is unable to directly attribute the results to a specific public health emergency, it may be possible (and unsurprising) if the pandemic had some impact on the care employment relationship for low-intensity carers. For example, additional factors and pressures such as mental and physical well-being related to the uncertainty and changing routines due to the pandemic and lock-downs may have made it more difficult to remain in full-time employment, particularly when care needs arise. It may be plausible that many people may have become carers during the pandemic, highlighted by research that supports this finding (Onwumere et al., 2021). In this scenario, carers may be unfamiliar with the role and responsibilities, and may have not had much time to plan and organise routines around care responsibilities or organise support (Sacco et al., 2023), which could affect carers ability to participate in employment, even if they are caring only at low-intensities.

However, these findings should be interpreted with caution, particularly regarding the direction of the relationship between caring and employment. It is possible that people who are already out of the labour market, such as those caring for the home or family, are more likely to take on low-intensity caring roles due to their greater availability of time. Previous research has highlighted the time competition between employment and caring (Henz, 2004; Raiber, Visser and Verbakel, 2022), so this explanation would not be unexpected. Similarly, the relationship between care and employment is often understood to be bi-directional (Heitmueller, 2007; Young and Grundy, 2008), meaning some of the observed association could reflect reverse causality, where being out of the labour market makes it more likely that an individual can take on caring responsibilities.

The strong negative relationship between high-intensity care (20+ hours per week) and labour market participation is less surprising and is consistent with previous research (Dixley, Boughey, and Herrington, 2019). This study finds that men providing the highest intensity care work over five hours fewer per week, and women just under four and a half hours fewer, compared to non-carers. This is likely explained by the time constraints of intensive caring, which leaves fewer hours available for paid work (Henz, 2004; Raiber, Visser and Verbakel,

2022). Not all carers will be able to, or want to maintain full-time employment alongside high-intensity care, but policy must ensure that both options are viable. This requires better support both for carers who wish to remain in or return to work, and for those who are unable to work due to caring responsibilities. In particular, improving Carer's Allowance, both in terms of its value and its eligibility criteria, would be a necessary step to reduce the financial penalties faced by carers who leave paid work (Carers UK, 2024c). It is evident that many carers who care for fewer than 35 hours per week, which is the criteria for receiving Carer's Allowance (UK Government, 2025), work fewer hours than their non-carer counterparts. This emphasises a need for improved financial support to ensure these carers are not at a loss of income. A complete re-evaluation of the Carer's Allowance eligibility criteria is therefore necessary, for example, reducing the amount of care required to receive the benefit from 35 hours per week to 20 hours per week. This would allow a greater number of carers to be financially supported, which could in turn support their overall mental and physical well-being.

When comparing the results for men and women, women providing low and moderate care work fewer hours on average compared to their non-carer counterparts, than men providing low and moderate care in comparison to their non-carer counterparts. This suggests the impact of low to moderate care on employment may be greater for women. This is perhaps unsurprising, as findings from the 2011 ONS Census show that economically active women in part-time and full-time employment provide more care than men (Office for National Statistics, 2013b). This could be due to lingering social norms and expectations that consider women to be naturally more "nurturing," with an assumption that caregiving roles are inherently theirs (Thompson, Jitendra, and Woodruff, 2023; Xue and McMunn, 2021). As a result of these expectations, women may be more likely to combine care with employment, viewing caring as a normative responsibility. This aligns with the concept of the "second shift," where women often manage both paid employment and the majority of domestic labour (Hochschild and Machung, 2002). While this is usually described as childcare and household chores, it can also extend to care responsibilities, which are often categorised as time-consuming, unpaid labour (Stall, Shah, and Bhushan, 2023).

However, in comparison to female carers and non-carers, men providing high intensity care work fewer hours in comparison to male non-carers. This suggests that the difference between

job hours is greater between men providing high intensity care and no care, than between women providing high intensity care and no care.

One consideration is that, at the baseline level, women are less likely to be in the labour market than men are, so this does not necessarily mean that they are overall more likely to be in the labour market than men. As shown in figures 3.1 and 3.2, women work on average fewer hours than men. What we can see between these two figures, is that men and women who provide high intensity care work similar hours to each other, particularly in the later years of the data. This suggests that overall, the demanding nature of providing high intensity care in terms of time availability (Henz, 2004; Raiber, Visser and Verbakel, 2022) and mental and physical well-being (Public Health England, 2021), may be experienced similarly by both men and women (although in the data more women provide higher intensity care than men so it is difficult to make clear comparisons).

What is interesting is that the predicted job hours for providing high intensity care slightly increase for women over time, and slightly decrease for men, to come to a similar point. This could represent the declining prevalence of gender norms and expectations that traditionally point to women being the primary caregivers and men being the primary breadwinners (Thompson, Jitendra, and Woodruff, 2023; Xue and McMunn, 2021). For example, it may be seen as more acceptable for men to reduce their working hours to provide care, and for women to increase their working hours and share the care responsibilities. This may have been increased by the increased need for family care, particularly since COVID (Alarilla, Grimm and Stafford, 2021).

Overall, these findings reinforce the possible risks of financial insecurity for carers providing the highest levels of care, due to their reduced working hours. This financial strain can contribute to poor mental health and wider health inequalities (Carers UK, 2019a; The Health Foundation, 2024), and is therefore an important policy consideration. Addressing this requires a combination of financial support, improved service provision, and greater recognition of the value of unpaid care, as all of the above intersect to shape caring decisions (Daly, 2021). Increasing the value and reach of Carer's Allowance would be an important starting point (Carers UK, 2024c), but broader systemic change is needed to create a labour market and welfare system that supports and values unpaid carers.

Relationship over time

The overall increase in job hours for women across all levels of caring may reflect wider societal changes in women's labour market participation. As gender roles and expectations have shifted, more women, including carers, have moved into full-time employment (Yeandle and Joynes, 2012), gradually increasing their working hours over time. Whilst many of these changes occurred prior to the scope of the analysis, particularly throughout the 1980s onwards (Roantree and Vira, 2018), shifts have likely still taken place post 2009.

However, persistent inequalities in job hours over time between non-carers and carers, particularly high intensity carers suggests carers are still at risk of a loss of income due to working fewer hours (Petrillo et al., 2024; Watkins and Overton, 2024). Cuts to public spending and public services (Stevenson et al., 2024) may have further exacerbated these challenges; women, who disproportionately provide both childcare and elder care, particularly those in the 'sandwich generation' (Boyczuk and Fletcher, 2016), may face additional pressures on their time availability. This may contribute to why high intensity carers consistently work fewer hours than non-carers, even in more recent years.

Female carers who provide moderate care are working more similar hours to low intensity carers and non-carers over time. This indicates that the job hours for moderate carers has increased at a slightly faster rate than for low intensity carers and non-carers. Persisting economic uncertainty following the recession (Stuckler et al., 2017), Brexit (Bank of England, 2019) and COVID pandemic (Alarilla, Grimm and Stafford, 2021), combined with increasing costs of services (The King's Fund, 2025) and cost of living (Carers UK, 2022b) could have possibly contributed to this. Many carers may have multiple additional costs associated with caring (Watkins and Overton, 2024), which combined with the overall increased cost of living, may mean more carers are reliant on paid employment to help afford these additional costs. This highlights the need to support working carers to alleviate some of the pressures of combining multiple roles (Carers UK, 2019a, 2022; Yeandle and Buckner, 2017).

In comparison to men, there are fewer sharp changes in the relationship between care and job hours following large scale social events, such as the recession (Stuckler et al., 2017), Brexit (Bank of England, 2019) and the COVID pandemic (Alarilla, Grimm and Stafford, 2021). There appears to be a slight increase in job hours for low to moderate intensity carers following on from the pandemic, which could suggest that the increased cost of living (Carers UK, 2022b)

may have increased dependence on paid employment, particularly for carers who may face additional costs relating to their caring responsibilities (Watkins and Overton, 2024). However, this is much in line with the gradual increase in women's job hours seen overall between 2009 and 2023. As a result, it is difficult to determine whether COVID could partially explain this increase, or whether it is more likely related to the wider societal shift that has seen a greater participation of women in the labour market (Yeandle and Joynes, 2012).

For men, the findings suggest that the relationship between care provision and men's employment has shifted over time, particularly in the context of broader economic and societal changes. Although it is difficult to make any claims with certainty, as many factors could contribute to the change in findings over time, persistent periods of economic and social uncertainty, following on from the financial crash (Stuckler et al., 2017), Brexit (Bank of England, 2019) and COVID pandemic (Alarilla, Grimm and Stafford, 2021), may have exacerbated the challenges faced by male carers. The widening gap in job hours between carers and non-carers (excluding moderate carers) may reflect not only the growing difficulties in combining high intensity care with employment, but also wider societal changes related to economic uncertainty, increasing costs of services (The King's Fund, 2025) and the cost of living crisis (Carers UK, 2022b).

This could be partially reflected in the social context at the time, where increased financial pressures related to the financial crash, could mean people whose care responsibilities are perhaps less demanding time wise, were working additional hours in paid employment in order to support themselves. In the later years, and after the onset of the pandemic, one may expect to see a similar pattern, due to the increased recognition of carers and increased shift towards flexible working arrangements possibly making it easier to balance care and employment. However, real time cuts to public spending (Stevenson et al., 2024) and the disruption of COVID on the labour market (Francis-Devine, Powell and Clark, 2022) could make it more difficult for carers to remain in full-time employment. This further emphasises the complex interplay between the state, family, market and civil society (Daly, 2021), and the importance of understanding how these intersections may impact the care-employment relationship.

Similarly, the disruption caused by COVID and lack of care services (Alarilla, Grimm and Stafford, 2021) may have made it temporarily difficult to remain in full-time employment. This

is perhaps unsurprising, due to the cuts in public spending (Stevenson et al., 2024) and long term austerity in the UK following the financial crash in 2007/8 (Stuckler et al., 2017) and Brexit (Bank of England, 2019), making it particularly difficult for people providing high intensity care to afford additional support in combining care and employment should they wish to and be able to do so. This again highlights the need for policy to be implemented to better support working carers, including respite care to allow carers breaks supporting their mental and physical well-being (NHS, 2022), access to paid carers leave to allow carers flexibility (Carers UK, 2024a, 2024d), and continuing to focus on flexible working (Dixley, Boughey and Herrington, 2019).

However, those providing moderate care, particularly men, are working more similar hours to non-carers over time. This could be a reflection of the increased flexible working policies, although ultimately this is impossible to measure. A shift towards flexible working (specifically part-time work) becoming more acceptable (Carers UK, 2020b; UK Parliament, 2014b; UK Government, n.d., a), could mean that more people are able to work part-time alongside their caring responsibilities, when they may have previously been stuck between choosing between part-time and full-time employment, or taking up a part-time job that is perhaps less well paid.

However, it may also be down to the lack of support for carers, through lack of public spending on care services (Stevenson et al., 2024), lack of investment into benefits such as Carer's Allowance, and lack of prioritising unpaid carers within policy, with the implementation of many policies and initiatives being pushed back or abandoned (Burn et al., 2024). This lack of investment into or support for unpaid carers, has meant that more of the care responsibilities are being expected to be carried out by friends and family members (Carmichael et al., 2008; HM Government, 2008). Many carers may also rely more heavily on their wage from employment to pay for the additional costs associated with their responsibilities (Watkins and Overton, 2024), since they lack support from public services and government funding.

Overall, the negative association between providing care and job hours in comparison to non-carers, is a finding that is persistent over time, particularly for high intensity carers, and this is true for both men and women. The gap between non-carers and carers over time, as seen in figures 3.1 and 3.2, highlight that people providing care at high intensities, continue to be likely to work fewer hours than non-carers. This is an important policy consideration, due to the increased potential for lack of earnings through a reduction in paid employment

(Petrillo et al., 2024). As highlighted previously, this can have negative consequences, such as financial insecurity, which may lead to worsened mental and physical well-being (Carers UK, 2019a; The Health Foundation, 2024). To prevent this, improved support to help carers balance care and employment is necessary. However, carers providing the highest intensity care may be less able to combine care with employment due to the competing time demands (Henz, 2004; Raiber, Visser and Verbakel, 2022). It is therefore important that financial support (Carers UK, 2024c) is improved for carers who are not able to work full-time and experience a financial loss as a result, especially high intensity carers.

We argue that this indicates that policy has not done enough to support carers in combining care and employment. The Carer's Leave Act 2023, which came into effect in 2024 (Carers UK, 2024a, 2024d; UK Parliament, 2023a), may have a positive impact on carers in the future. However, as it only offers five days of unpaid leave, its effect is likely to be limited. Future research should focus on data collected after the pandemic and the implementation of the Carer's Leave Act to assess whether these changes impact the relationship between care and labour market participation.

Concluding remarks and policy suggestions

In conclusion, this research has found that providing caring is negatively associated with job hours for both men and women, even once socio-demographic characteristics were accounted for. These findings align with existing literature that care negatively impacts paid employment for both men and women (Drinkwater, 2015; King and Pickard, 2013). This is an important issue, as reduced labour market participation often leads to decreased income, which can negatively affect carers' mental and physical well-being (Carers UK, 2019a; The Health Foundation, 2024). The persistent gap in working hours between carers and non-carers, particularly at high intensities, suggests that current policy measures may not have been sufficient in supporting carers to balance work and care, should they wish to and be able to do so. This reinforces the need for enhanced policy interventions.

Support and services to help carers combine work and care are necessary (Dixley, Boughey and Herrington, 2019; King and Pickard, 2013, Young and Grundy, 2008), particularly as many carers would like to be able to participate in paid employment alongside providing care (Fry et al., 2011). Increased investment in respite care services is important to give carers the breaks they need (NHS, 2022), reducing stress and allowing them to remain in the workforce.

Additionally, promoting and improving flexible working arrangements can help carers manage multiple roles (Dixley, Boughey and Herrington, 2019; UK Parliament, 2014b; UK Government, n.d., a). Policies should ensure that flexible working options are widely available and accessible.

Similarly, supporting the extension of the Carers Leave Act to include longer periods of paid leave, as advocated by Carers UK (2024, 2024a), would allow carers to take necessary time off work without financial strain. This would particularly benefit those carers who cannot afford to take unpaid leave, making it easier for them to remain in the labour market while fulfilling caring responsibilities. Implementing these policy measures would alleviate pressures on working carers, improve their financial stability, and support their continued participation in the labour market.

The findings also suggest that many carers are not able to, or do not wish to combine care with full time (or part-time in some cases) employment, evidenced by the negative relationship between care employment. As unpaid care is extremely valuable to society (NHS England, 2014; Petrillo and Bennett, 2023), and also has the potential to be mentally and physically demanding as well as time consuming, we also suggest that benefits such as Carer's Allowance need to be improved in order to support carers who are at a financial disadvantage due to working fewer hours in paid employment. Currently, CA is £83.30 per week, a modest increase from the previous £81.90 per week prior to April 2025. CA is only accessible for people providing at least 35 hours of care per week and earning no more than £196 after tax and national insurance (Age UK, 2024; UK Government, 2025). Despite this slight improvement, CA remains one of the lowest paying benefits in the UK (Hamblin, Heyes and Allard, 2024), and this increase is not satisfactory in being able to support carers. CA should therefore be increased, as currently it is not sufficient in covering carers costs, particularly in the cost of living crisis that the UK currently faces (Carers UK, 2022b). The reach of CA should also be widened. We believe that carers caring at lower intensities should also be able to access financial support. We therefore agree with Carers UK (2024b), that CA needs to be continually reviewed, in order to better support carers, and we argue that the eligibility criteria should be re-evaluated to allow carers caring for 20 hours or more (rather than 35 hours) to be eligible to receive the benefit. It is recognised that implementing this may increase the number of carers out of employment due to having improved financial support, however the combination of

improved financial support as well as support to work whilst caring is important to mitigate the financial difficulties experienced by carers.

The introduction of the Carer's Leave Act 2023, offers five days of unpaid leave for reasons related to caring (Carers UK, 2024a, 2024d; UK Parliament, 2023a). Whilst this represents a step in the right direction, it is unlikely to have a substantial impact given its limited scope. Future research should explore whether post-pandemic shifts toward flexible working and recent legislative changes lead to improvements in carers' ability to remain in the labour market. Addressing these challenges remains critical to ensuring carers' financial stability and well-being.

Although much of the discussion has been around the social, political and economic contexts throughout the time period of the analysis, and how these might have impacted some of the results, it is recognised that it is impossible to make any causal claims about the effect of certain policies or large scale events on the relationship between care and employment. This is particularly true since the UK government has not officially measured the impact of policies on carers. Although we can make inferences and suggestions based on the wider trends, having more information surrounding these policy changes would improve the ability to make future policy suggestions with carers in mind. To improve, the UK government should conduct research into the effectiveness of policy in supporting carers. For example, through surveys, focus groups and polls.

For future research

This paper identifies three areas for further research. Firstly, future research should explore additional factors that could influence the relationship between caring and labour market participation. Caring is often a highly individualised experience, shaped by factors that are difficult to capture through quantitative analysis due to limitations in the data available. Researchers could consider the complexity of care by examining the type of care provided (such as how demanding it is), as well as the nature of the relationship between the carer and the care recipient, and whether care is provided inside or outside of the household (Michaud, Heitmueller, and Nazarov, 2010). Secondly, given that caring and employment dynamics vary across different age groups (Dixley, Boughey, and Herrington, 2019; Office for National Statistics, 2023c), it would be beneficial to stratify the analysis into smaller age categories for more detailed comparisons. The large sample size of the 2021 Census, once available, will

provide an excellent data source for this kind of analysis. Finally, regional differences within the UK also warrant further investigation, as suggested by Drinkwater (2015). This paper was limited in its ability to analyse data at the Local Authority level due to small sample sizes. Future research could use data from the 2001, 2011, and 2021 Census Longitudinal Studies (Office for National Statistics, n.d. b) to identify regional effects and track their changes over time. At the time of writing, the 2021 longitudinal study data was not yet available to analyse.

Study limitations

This study is not without its limitations. The overall sample size is large, but data relating specifically to carers, especially when also examining caring intensity and sex is nevertheless limited. To address this concern, the hours of caring categories were reduced (by combining some data) from ten to four (see table 2 in appendix). However, this does sacrifice some of the detail in the analysis. The sample size also declines over time due to people leaving the study or moving outside of the UK, which may make it more difficult to identify trends in the later years of the survey compared to the earlier years. This is unavoidable; it is claimed that the Understanding Society dataset is one of the most stable longitudinal studies over time (approximately 90% of respondents in the previous wave will respond in the next wave) (Understanding Society, n.d.), but it may have some small negative implications on the analysis.

Causality is also important to address. We are unable to say with certainty that carers are reducing their working hours as a result of caring. Whilst we can infer from existing research that this may be the case for many (Carers UK, 2019a; Drinkwater, 2015; King and Pickard, 2013; Thompson, Jitendra and Woodruff, 2023; Young and Grundy, 2008), it is not necessarily true for all. There are a number of complex social processes that may be driving some of the results, that we are unable to fully capture in this analysis. Other research has highlighted that the direction of the care-employment relationship may be important. For example, those who work fewer hours or are out of the labour market already may be more likely (or able to) take on care responsibilities (Heitmueller, 2007). This highlights the importance of considering this study alongside a wider body of research.

Information on the experiences of providing care, such as the type of care provided was not available for analysis. Similarly, information on employment type, and experiences with employers, was not included due to model complexity issues. Hence, labour market

participation is measured simply as the average hours worked per week. However, research has shown these factors to be important in the relationship between caring and labour market participation (Carmichael et al., 2008; Dixley, Boughey and Herrington, 2019). Considering this paper alongside studies that focus on individual experiences of caring and employment is therefore important in order to create a wider understanding of the issue.

Chapter Five: Unpaid Care and Paid Employment Trajectories: An Intersectional Life-Course Approach

Abstract

Context: Providing care can make it difficult to participate in paid employment due to both roles competing for time. Previous research finds differences in care and employment trends across different socio-demographic groups. There is, however, a lack of research surrounding the relationship between care and employment over the life-course, particularly in the context of long-term care and how this differs across different combinations of socio-demographic characteristics.

Aims: We aim to answer the following research questions: **RQ1a** What is the overall relationship between unpaid care and job hours? **RQ1b** When allowing care to intersect with socio-demographic variables, how do job hours vary between these intersectional strata groups? **RQ1c** Can the intersectional variance be explained by controlling for socio-demographic variables and two-way interaction terms? **RQ2a** What do trajectories of employment look like over the life-course between different levels of care provision? **RQ2b** Is there intersectional variability in these life-course trajectories of employment?

Methods: Three-level Longitudinal Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy (MAIHDA) Regression models with random slopes for age are used to analyse waves 1-14 (2009-2023) of the Understanding Society dataset. Repeated observations over time are nested in individuals, nested in intersectional strata.

Key findings: Providing care is negatively associated with job hours, particularly for long-term carers. Male carers with degrees work amongst the highest hours in comparison to other carer groups. Female carer groups work amongst the least hours, but female carers with degrees work more hours in comparison to other female carer strata. There is evidence of intersectional variation in life-course employment trajectories, where the relationship between caring, age, and employment differs across specific socio-demographic groups. There is also evidence of possible disparities in job hours between white and other ethnic groups, particularly the Black group, although confidence intervals overlap. Long-term carers with lower educational qualifications work much fewer hours than varied or non-carers, particularly in mid-life.

Limitations: Key detail is missed in the categorising care into three wide categories. For example, care intensity (av. hours of care per week) is likely to affect the relationship with job hours. Within category differences may also be overlooked, for example, using the five-category ethnicity coding does not account for differences within each ethnic group.

Recommendations: Due to the disparities in hours worked over the life-course for long term carers in comparison to non-carers, we argue for mandatory paid leave for a minimum of ten working days for care needs, improved access to respite services, and increased financial support through continuously reviewed Carer's Allowance, to benefit carers primarily in their prime working years. We also argue for improved education and awareness of available support, and for the co-production of support services with carers themselves.

Introduction

An increasing number of people in the UK require care, due to societal changes related to population ageing (Pomeroy and Fiori, 2025; Royal Economic Society, n.d.; van de Ven, Bronka and Richiardi, 2024) and reduced spending on adult social care services (Beaufils, Geiger and Glaser, 2024). As it stands, care is becoming an increasingly common experience within the life-course (Zhang, Bennett and Yeandle, 2019). This means that unpaid carers, who will be referred to simply as 'carers' for the remainder of this paper, are an increasingly important resource, yet they often remain unrecognised and their role lacks visibility (Onwumere et al., 2021; Serafini et al., 2023). Unpaid care in this paper is defined as 'looking after or giving help to someone who is sick, disabled or elderly, such as a friend, relative or partner' (U Essex, 2023).

Simultaneously, state pension age is also being increased, meaning there is an even greater pressure on carers to combine care with paid employment (Carmichael and Ercolani, 2016; Royal Economic Society, n.d.), particularly later on in the life-course. This is significant as many carers struggle to combine care and paid employment despite wanting to, and many of them reduce working hours or leave the labour market entirely to provide care (Carers UK, 2019a; Watkins and Overton, 2024). Carers are also less likely to rejoin the labour market even after their caring responsibilities have stopped, suggesting that the effect of caring may persist beyond the duration of the caring event (Evandrou and Glasner, 2003; van de ven, Bronka and Richiardi, 2024), impacting future trajectories of employment. Carers are therefore an important group to study. Improving our awareness of carers' experiences of employment over the life-course can help the government, local authorities and policymakers make informed decisions about how best to support carers.

In this paper we take a quantitative, intersectional life-course approach to research the relationship between care, socio-demographic characteristics and employment trajectories. We employ three-level Longitudinal Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy (MAIHDA) Regression models, where individual observations over time are nested in individuals, who are nested within intersectional strata (time-invariant socio-economic characteristics). This allows us to explore the relationship between care and paid employment across the life-course, and understand whether this varies across socio-demographic groups (intersectional strata). At the time of writing, this is the first paper in the field of adult social care that employs intersectional MAIHDA to explore care-employment relationships across the life-course. This is important as identifying

differences across intersectional strata and across the life-course can be useful in gaining a more nuanced understanding of the relationship between care and employment.

The analysis finds that overall, providing care, particularly long-term, is negatively associated with hours worked in paid employment. This is a finding that is consistent across the life-course and across different socio-demographic groups. Men with degrees work the most hours on average, but men with degrees who are long-term carers work the most out of this group, with non-carers working the fewest. Female long-term carers with no or other qualifications work amongst the fewest hours on average. This highlights possible class and gender disparities.

There was also evidence of multiplicative (intersectional) effects, suggesting that there is evidence of higher order multi-way interactions between socio-demographic characteristics (including care) in shaping employment outcomes. However, there was a large amount of variation present in the socio-demographic characteristics between these groups, hence it is difficult to explain why these specific strata work greater or fewer hours than would be expected given the fixed effects. This emphasises the need for further research to be done in this field to explore the intersectional relationship between these characteristics.

There were also some key differences in employment trajectories across different levels of care and demographic groups. The effect of long-term care appears to be greatest within mid-life or prime working years. Overall the trajectories for men and women were similar across care categories. Some ethnic minorities (particularly the Black ethnic group) and those with the fewest qualifications were more likely to work fewer hours, particularly prior to mid-life when providing long-term care in comparison to non-carers. There also appears to be a large number of long-term carers with few qualifications working limited job hours up until 30-35 years old, suggesting there may be a number of carers out of the labour market within this group. The findings point to the need for policy to focus support on minority groups, particularly to support them during their transition into paid employment and ensure that employment is sustainable throughout prime working years. This will allow carers to have more autonomy over their life-course pathways (Alonso-Perez et al., 2024; Carmichael and Ercolani, 2016), leading to improved health and well-being throughout the life-course.

Literature Review

Background

Who cares?

As approximately 65% of people will provide care in their adult lifetime (Zhang, Bennett and Yeandle, 2019), it is unsurprising that the demographic characteristics of carers varies considerably. Some groups, however, provide more care than others, and some may experience the effects of combining care and employment to a greater extent. Currently in the UK, more women are participating in the labour market than ever before. Although gender norms and expectations still persist, the traditional role of men being the sole breadwinner is becoming increasingly less common (Scott and Clery, 2013). However, despite this shift away from traditional gender roles, across all ages except from in older age, more women provide care than men (Office for National Statistics, 2023c). This suggests that social norms still influence patterns of care, re-emphasising the expectation that caring is a 'natural' part of the life-course for women (Carr et al., 2018; Pomeroy and Fiori, 2025; Watkins and Overton, 2024).

This partial shift away from traditional gender roles has meant that women are increasingly participating in the labour market, whilst simultaneously left with the lingering expectation that they will provide the majority of the domestic labour (including care). As a result, an increasing number of women are now carrying out multiple roles in paid and unpaid labour, labelled the 'second shift' (Hochschild and Machung, 2002). This could raise potential additional challenges and stresses due to the time commitment required from both roles.

Whilst this can affect both men and women, women are disproportionately exposed to 'sandwich caring', where in mid-life, they find themselves caring for elderly relatives at the same time as caring for children (Ansari-Thomas, 2024; Pomeroy and Fiori, 2025). This can reduce the likelihood of them being able to participate in the labour market due to competing time constraints (Ansari-Thomas, 2024; Office for National Statistics, 2024a; Verbakel and Boot, 2024). 'Sandwich Carers' that also participate in the labour market could be faced with even more difficulties, due to the lack of time available for their own leisure (Royal Economic Society, n.d.). This could lead to increased stress and exhaustion, leading to poor mental well-being (Office for National Statistics, 2024b), something that has previously been associated with providing care (Carers UK, 2025c; Redican et al., 2024).

Another important social change is the increasing state pension age in the UK. Since the state pension age has increased to 66 for both men and women, and is continuing to increase (Age

UK, 2025; Royal Economic Society, n.d.), more older workers are combining care with paid employment (Beaufils, Geiger and Glaser, 2024; Carmichael and Ercolani, 2016), including women. This is interesting, because previously, providing spousal care was more likely to occur during retirement. Since people are now retiring later, they are more likely to provide spousal care whilst they are still below state pension age, highlighting the potential additional pressures faced by carers in today's society, and the shifting experience of providing care and employment later in the life-course. Gender is also an important factor, as this change may be experienced differently for women, whose retirement age has been increased to 66 to match that of men (Age UK, 2025; Royal Economic Society, n.d.). As previously stated, despite changing gender roles, women still carry out most of the domestic labour and caring responsibilities. The increase in state pension age may therefore have a more negative impact on women who would have previously been able to provide care whilst receiving a pension. However, it is also important to note that this is the only age group where men provide more care than women, as over the age of 80 more men provide care, usually to a spouse (Office for National Statistics, 2023c), and therefore the rising pension age may also have a significant negative impact on male carers.

Socio-economic status may also play a role in decisions to care and participate in the labour market. Those of a higher socio-economic status, who perhaps have larger savings, or work jobs that offer early retirement, may be more likely to take early retirement (Cribb, 2023; Mein et al., 2000). This puts this demographic at a greater advantage, as they have greater choice over decisions due to their higher rates of financial security. Similarly, research by Rebaudo, Calahorrano and Hausmann (2024) finds that an increase in wages is associated with a decrease in the willingness to provide care. This is unsurprising, as giving up work or reducing work may come at a greater cost when wages are higher, as there would be more to lose financially. Secondly, increased pay from employment puts an individual in a greater position to be able to pay for formal care services, or pay for additional support (Floridi, Carrino and Glaser, 2021). This highlights how decisions to care, as well as to work, are complex, and often influenced by a range of factors, including financial constraints. Overall, this shows how different aspects of inequality can have a cumulative effect on shaping choices and trajectories of care and employment over the life-course (Alonso-Perez et al., 2024; Carmichael and Ercolani, 2016; Sacco et al., 2023).

Other important factors include cultural norms and expectations, often connected to traditional expectations of gender, family structures and relationships. For example, amongst some ethnic minority groups, gender norms have a stronger role, where women take on most of the domestic labour, and are often expected to take on the care roles within the family (Carers UK, 2023). In some communities, the cultural differences mean that they may take longer to recognise themselves as a carer, as care is often seen as an expected part of the life-course should it arise (Banks, 2022; Carers UK, 2025b; Wells et al., 2025). As a result, some communities may be less likely to access support services related to caring (Greenwood et al., 2015).

Another consideration is social disadvantage faced by ethnic minorities in the UK. Research highlights the fact that ethnic minority women often work lower paying jobs (Hall, Manning and Rose, 2024). They also face disadvantages later in the life-course if they do give up paid work as a result of their caring responsibilities (Holman and Walker, 2021). These findings highlight the need to consider a range of factors when exploring the relationship between care and employment. It is also evident from the literature, that many of these factors may be interlinked, and this should therefore be accounted for in the research.

What is the problem?

Understanding the relationship between caring and employment, and trajectories of employment across different intersectional strata, is important to improve our understanding of how to best support carers. Currently, many carers who combine work and care suffer from poor mental and physical health due to the increased stress and difficulty they face in combining multiple roles (Carers UK, 2019a; Hlebec, Monarres and Šadl, 2024; Verbakel and Boot, 2024). Paid employment and caring can both compete for time (Pomeroy and Fiori, 2025; Sacco et al., 2023). The spillover from both roles can lead to difficulties such as poor mental health and an increased likelihood of needing to take sick leave from work (Verbakel and Boot, 2024). This may in turn make it more difficult for carers to remain in full-time employment which could have negative consequences for their well-being and future employment later in the life-course.

Caring may also come at a financial cost for both carers who balance care with paid employment, and carers who do not (Bolin, Lindgren and Lundborg, 2008). Research by Carmichael and Charles (2003) found that both men and women earned less than non-carers even when they were in paid employment. Carers in paid employment may also be less likely

to be offered promotions due to discrimination by their employer (Watkins and Overton, 2024), and feel less able to take promotions when offered due to the stress of taking on additional responsibilities (Ansari-Thomas, 2024; Office for National Statistics, 2024b; Verbakel and Boot, 2024). This highlights how carers in employment may face aspects of disadvantage that reduces their income, which may lead to increased financial insecurity. These experiences may also have a knock on effect for the future (Sacco et al, 2023). Having less security through earnings or being less able to make choices that will benefit earnings may have a long lasting effect on a carer's well-being if they lack financial resources that can support them (Carers UK, 2019b). This indicates that carers may lack choices related to employment, which can in turn affect longer-term trajectories of employment and well-being.

Carmichael and Charles (2003) also found that the more care that is provided, the greater the loss of earnings is. They find that the loss of income is greater for men, possibly because jobs that are more flexible around care responsibilities are often lower paid and disproportionately carried out by women. For example, public sector roles that are mostly associated with 'female' roles, or part-time work (UK Women's Budget Group, 2021) have disproportionately more women working in them (UK Women's Budget Group, 2023) in comparison to leadership and management roles that are on average higher paid and disproportionately carried out by men (Adamecz-Völgy and Shure, 2022). They also found that the risk of reducing paid employment was greater for females than for males (Carmichael and Charles, 2003). These findings indicate that whilst women were more likely to leave the labour market due to care, men who do so experience a greater loss of income. It would be interesting to explore how this relationship plays out more recently in the UK, taking a longitudinal life-course approach to identify whether these demographic differences differ at different stages in the life-course.

Recent research by Petrillo et al. (2024) used individual synthetic control in a novel study to estimate the wage penalty experienced by carers compared to if they were not providing care. They found that there is an average relative income gap of up to 45%, which is explained by an average decrease of £162 in monthly income. They also found that this income penalty was more pronounced for women than men, and varied by ethnicity and age, highlighting the intersectional nature of care and socio-demographic characteristics. Unlike Carmichael and Charles (2003), these findings suggest that women are at a greater risk of loss of income due to caring, although male carers may also be at a disadvantage in comparison to non-carers. These results emphasise the need for continued research into the relationship between care and

employment, particularly from an intersectional perspective, in order to fully understand how carers can best be supported.

Theoretical approach

Experiences of care and employment are related to many social, economic, demographic and environmental factors, many of which can vary at different parts of the life-course (Elder and Giele, 2009; Holman and Walker, 2021), and can be experienced differently by different groups of people. This research is therefore grounded in an intersectional life-course approach.

Life-course approach

life-course research became increasingly visible throughout the 1960s and 1970s (Heinz et al., 2009), with an increased emphasis put on longitudinal data collection such as panel studies. The life-course approach considers life as a temporal process, where experiences are shaped by a combination of social and historical contexts, social structures and biological factors, as well as individual decisions (Elder and Giele, 2009). Transitions, events and experiences across the life-course, can influence future trajectories and can be experienced differently depending on when in the life-course they occur (Alonso-Perez et al., 2024). This is important to consider when researching care which can shape experiences and trajectories related to future care and employment.

Care episodes are often more likely to occur at particular stages across the life-course (Keating et al., 2019). For example, individuals are more likely to provide care in mid to later life, from around 45 onwards (Alonso-Perez et al., 2024). During mid-life, individuals may be more likely to have older parents who require care, increasing the likelihood of providing care. At the same time, and particularly for women, individuals are more likely to simultaneously have care responsibilities for their dependent children. As previously mentioned, this is known as 'sandwich caring' (Ansari-Thomas, 2024; Pomeroy and Fiori, 2025). In later life, the likelihood of providing care also increases, particularly for men due to caring for a spouse (Office for National Statistics, 2023c). This is also a time where individuals are likely to have the most job experience, and more likely to be in higher paying management or leadership roles (Chartered Management Institute, 2022), which could make the opportunity cost of leaving employment higher (Carmichael and Charles, 2003; Carmichael, Charles and Hulme, 2010; Miller and Sedai, 2022). It is therefore important to analyse employment trends over the life-course in order to account for the fact that both care and employment can differ over time.

The time at which someone becomes a carer is also important. Carers who first start caring at a younger age, for example, for sick or disabled parents or siblings, may face additional difficulties. Their trajectories over the life-course may also look different to non-carers. Caring at a younger age may make it more difficult to engage with education and higher education (Brimblecombe et al., 2020) due to their care responsibilities taking up a large amount of their time (Pomeroy and Fiori, 2025; Sacco et al., 2023) and financial resources (Watkins and Overton, 2024). Research finds that young carers have on average, poorer educational attainment, and are less likely to enter higher education (Brimblecombe et al., 2020; Robison, Inglis and Egan, 2020; Xue et al., 2023). These inequalities may have a cumulative effect (Alonso-Perez et al., 2024; Carmichael and Ercolani, 2016; Sacco et al., 2023), shaping the pathways these individuals take later on in life, such as job roles, particularly if these care responsibilities are ongoing over a long period of time (Keating et al., 2019). Length and periods of caring are also likely to affect experiences across the life-course for other age groups. This is explained further under the section titled 'conceptualising care'.

Intersectionality

Intersectionality is a term that has developed out of black feminism, first used by Kimberlé Crenshaw to explain that the experience of being a Black woman was different to the experience of being Black or being a woman individually. In this example, the effects of gender and ethnicity are multiplicative rather than additive (Crenshaw, 1991). This is important, as it considers how social characteristics can be amplified by another characteristic, which considers the fact that the effect of belonging to certain identities may not be as simple as being layered advantages or disadvantages (Holman and Walker, 2021). This accounts for the fact that experiences are often linked to multiple different factors simultaneously, without prioritising only one characteristic (Hankivsky et al., 2014). Socio-demographic characteristics that are often recognised as being linked to inequality are sex/gender, ethnicity, age and socioeconomic status (Hankivsky et al., 2014; Holman and Walker, 2021), and therefore are important to consider when exploring intersectionality.

Intersectionality is particularly relevant to the field of social care. Providing care can have social and individual costs, and these can be experienced differently across different social groups (Hamilton and Cass, 2016). This is evident through existing studies that find differences in care experiences across gender (Ansari-Thomas, 2024; Carers UK, 2023; Petrillo et al., 2024; Pomeroy and Fiori, 2025), ethnicity (Carers UK, 2023; Wells et al., 2025), age (Office for National

Statistics, 2023c) and socioeconomic status (Petrillo, Bennett and Pryce, 2022). Whilst quantitative research has considered some of these differences, the effects have been considered predominantly individually as additive effects. There is currently a gap in the field of quantitative social care research to explore the intersectional effects of socio-demographic characteristics in relation to care and employment, which this research hopes to fill.

Recent methodological developments within quantitative methods has seen a novel methodological approach called Multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA) be developed. The MAIHDA approach allows for a descriptive application of intersectionality in quantitative statistical analysis. This specific MAIHDA model was first introduced by Evans (2018) and originated in epidemiology (Evans and Erickson, 2019; Fisk et al., 2018; Merlo, 2018). Since its introduction, it is becoming increasingly used across multiple disciplines (Bell at el., 2024), and has even more recently begun to be used within the field of social care research in Europe (Alonso-Perez et al., 2024). The longitudinal MAIHDA approach is an even more recent development by Bell et al. (2024), who published a methods paper on applying longitudinal MAIHDA to map intersectional age-generation trajectories related to health using panel data. This is an important contribution as it accounts for the changing nature of inequalities and experiences over the life-course.

A combined intersectional and life-course approach

An intersectional life-course approach is useful when exploring the relationship between caring and employment. The intersectional life-course perspective takes into account that systems of discrimination related to socio-demographic characteristics such as age, ethnicity, gender and socioeconomic status are unequally distributed and can intersect over time. This temporal nature of inequality and intersectionality is important to consider as it influences people's experiences across the life-course (Holman and Walker, 2021).

Regardless of care status, paid employment varies across the life-course. This variation occurs at the national level, with more general trends such as reduced employment around age of compulsory education and state pension age (Carmichael and Ercolani, 2016). This variation also occurs at the individual level, related to external factors such as whether an individual is in full-time higher education, periods of sickness, travel and becoming a parent to name a few.

These individual factors may also be linked to socio-demographic factors. For example, gendered expectations of paid and unpaid labour, although reducing, are still prevalent in

society (Pomeroy and Fiori, 2025). Men are predominantly expected to take on the 'breadwinner' role, whilst women are often expected to provide more unpaid labour, such as caring for the household and dependent children, as well as caring for family and friends (Carr et al., 2018; Watkins and Overton, 2024). These factors can also be related to cultural norms and expectations that may differ across ethnic groups (Banks, 2022; Carers UK, 2025b).

Age and life-course stages are important in shaping experiences of care provision (Carmichael and Ercolani, 2016; Hamilyon and Cass, 2016). Understanding the multifaceted factors that shape different experiences across the life-course, particularly related to caring, are important to consider when informing policy decisions (Lawless et al., 2023). Taking a longitudinal approach to research will help understand how experiences of care differ over the life-course for different socio-demographic groups. This will allow existing policy to be assessed and future policy to be targeted effectively.

Conceptualising Care

Providing care can influence an individual's identity and significantly impact experiences and decisions made across the life-course (van de Ven, Bronka and Richiardi, 2024; Watkins and Overton, 2024). For the purpose of the analysis, care across the life-course is conceptualised as an 'identity characteristic' in a similar way to other socio-demographic variables such as sex, ethnicity and socioeconomic status. By 'identity characteristic', we refer to the fact that over the life-course, certain experiences can become part of one's identity. For example, providing long-term care is likely to affect and shape experiences and decisions made throughout the life-course that may have a knock-on effect on an individual's experience later in life (Sacco et al, 2023) in the way that gender or ethnicity might. These decisions may differ compared to someone who provides shorter spells of caring, or does not provide care at all across the life-course. It is recognised that there are many factors that may influence life experiences and decisions (Elder, 1994), hence the choice to take a longitudinal intersectional approach.

To do this, care was categorised into three distinct categories: non-carer, varied carer and long-term carer. Non-carers are defined as providing no care over the life-course. Non-carers may have fewer considerations to make when taking on paid employment in comparison to carers. For example, care and paid employment compete for time (Henz, 2004; Jacobs et al., 2015; Raiber, Visser and Verbakel, 2022; Sacco et al., 2023), meaning that it may be more difficult to combine the two. Many carers face feelings of stress, exhaustion and burnout as a result of combining multiple roles (Carers UK, 2019a; Hlebec, Monarres and Šadl, 2024;

Verbakel and Boot, 2024), which may lead to poor mental and physical health outcomes that may in turn make it difficult to participate in full-time employment. For long-term carers, the effect of care on employment may be the greatest, due to the long-term care commitments that continually compete for time with employment (Pomeroy and Fiori, 2025; Sacco et al., 2023). Similarly, many carers in this category may fall into what Keating et al. (2019) describes as 'career care', where caring consecutively for a long period of time is often associated with close relationships between the caregiver and cared for person, such as caring for a child with a long-term disability. This type of caring may be particularly demanding, especially emotionally. However, it could be argued that long-term carers may be more comfortable combining care with employment, as in many cases their care responsibilities are often more routine and expected, meaning they have had more time to adjust to a routine that works for them (Sacco et al., 2023). They may also have more access to support and additional help such as respite care, again due to having more time to create an organised routine, and gain more understanding of or access to support. Episodes of care for varied carers may come on more unexpectedly or abruptly, which could negatively impact employment. However, overall you may expect this group to have greater participation in the labour market due to the periods of time over the life-course where they are not caring.

Splitting carers into three categories for this research has been done for two reasons: firstly, it allows us to answer specific questions about care across the life-course that are particularly interesting to address. Using the three category measure of care allows us to explore whether there are differences in employment over the life-course for long-term carers in comparison to varied carers and non-carers. This allows us to identify whether long-term care has a different impact on employment than providing varied care, and whether this varies across the life-course. This will indicate how different lengths of caring affect different groups of individuals over a longer period of time, which will be useful in making policy suggestions that help support carers.

Secondly, carers have been categorised into three groups to ensure that an individual's propensity to care and what this means can be analysed. In order to include care as a strata defining variable in a longitudinal MAIHDA approach, care was conceptualised as being time-invariant. Whilst possible to use a cross-classified model, where individuals can move in-and-out of strata over time, this would add additional complexity that would take away from the proposed research questions this chapter aims to address. It is important that individuals

do not change strata over time in order to be able to plot accurate life-course trajectories where care is conceptualised as an identity characteristic. A further practical reason is the consideration of sample size. Creating wider categories of care would not have been sensible for the purpose of the model. The proportion of empty strata would increase and it would be difficult for any meaningful analysis to be conducted (Evans et al., 2024b). To conclude, it was deemed optimal to have three categories of care as this allowed us to answer important questions without having to compromise on the sample size and analysis.

It is recognised, however, that this approach comes with limitations. Experiences of providing care are often diverse (Keating et al., 2019). Using such wide categories of care misses key details, such as the intensity of the care provided. Existing studies have consistently found that care intensity (measured in hours of care) is associated with labour market participation. The most common finding is that providing higher intensity care is associated with a reduction in labour market participation (Brimblecombe et al., 2020; King and Pickard, 2013; Stanfors, Jacobs and Neilson, 2019; Young and Grundy, 2008), whether that be through a reduction in working hours or leaving the labour market entirely (Carers UK, 2019a; Watkins and Overton, 2024). Within the long-term care category, individuals may care for a range of hours, with some individuals caring for only a few hours per week, with others providing over 20 hours. This could have an effect on the experience of providing care, which could affect employment outcomes. Time availability is an important concept here, as previously mentioned care and employment compete for time (Henz, 2004; Jacobs et al., 2015; Raiber, Visser and Verbakel, 2022; Sacco et al., 2023). Caring for a greater number of hours may make it more difficult to participate in full-time paid employment, something that will not be able to be captured in this research. We therefore suggest that future research should apply similar models on larger datasets, such as the Office for National Statistics Census (Office for National Statistics, n.d. a) that are more suitable for looking at smaller categories. This would enable us to gain a more nuanced understanding of the intersectional relationship between care and socio-demographic variables.

Another key limitation is that by conceptualising care as a time-invariant identity characteristic, care status that is partly determined by later waves, may predict employment hours in earlier waves (where a person is not yet a carer). This may negatively impact the predictions of job hours. However, the combination of all the data, including multiple factors such as sex, ethnicity, generation, socio-economic status, as well as care status, allows for the

creation of this time-invariant identity characteristic that is important in being able to answer the research questions this chapter is interested in addressing.

Existing literature

The relationship between care and employment is a topic that has been well explored within the literature. Many quantitative UK studies find that unpaid care is negatively associated with paid employment (Brimblecombe et al., 2020; King and Pickard, 2013; Stanfors, Jacobs and Neilson, 2019; Young and Grundy, 2008), particularly when caring at higher intensities (Drinkwater, 2015). This is consistent with earlier studies. For example, Carmichael and Charles (2003) found that both men and women who provide high levels of unpaid care are less likely to be in the labour market. Similarly, whilst they did find a large diversity in experiences, Henz (2004) also found evidence to suggest that caring had a negative impact on employment for many carers.

The UK has seen an increase in carers aged 50 years and over in recent years, as well as an increasing number of older carers combining care with employment (Yeandle and Buckner, 2017). Research on mid-life and older carers also finds a negative relationship between care and work. An early study by Evandrou and Glaser (2003) found that carers, particularly women, reduced working hours or left the labour market as a result of caring. Similar findings were also found by King and Pickard (2013), who found that carers providing at least ten hours of care per week were more likely to work fewer hours in employment. Despite Carr et al. (2018) not finding a significant association between care intensity and a reduction in employment, they did find that female carers were more likely to reduce their working hours, and carers providing co-resident care were more likely to exit employment. These findings suggest that the impact of caring on employment may persist throughout the life-course.

More recent research by Beaufils, Geiger and Glaser (2024) also finds a negative relationship between care and employment. They found that the onset of care decreases the likelihood of being in employment and decreases the likelihood of working full-time. This suggests that carers often respond to becoming a carer by reducing working hours or leaving the labour market entirely, emphasising how life-course transitions, such as the onset of caring, may impact employment. They did not find, however, any significant gender differences in the outcome, which differs from other studies.

These findings are also mirrored across quantitative studies from other European countries (Bolin, Lindgren and Lundborg, 2008). One early study that explores the relationship between

care and hours in paid employment was by Spieß and Schneider (2003) on midlife women in Europe between 1994 and 1996. In this study, Spieß and Schneider find that a change in work hours, whether that be a decrease or an increase, is negatively associated with becoming a carer or increasing the number of hours spent caring. There was also no association found between stopping caring or reducing the number of hours spent caring, and hours worked. They argue that this indicates that hours spent in paid employment are not likely to increase even once care responsibilities stop, suggesting that caring could lead to cumulative disadvantages over the life-course due to this negative impact on employment, which may lead to reduced income and ability to contribute into pension schemes (Cribb et al., 2024; Watkins and Overton, 2024). Spieß and Schneider (2003) also found some differences between Northern European countries (excluding Ireland) and Southern European countries (including Ireland). They found that in Northern Europe, starting to provide care was associated with a significant reduction in hours worked, but found no association between changes in care intensity and work hours. On the other hand, in Southern Europe they found that changes in care intensity, but not starting care, was associated with both increases and decreases in work hours.

Similarly, in Germany it was found that the onset of caring was associated with reduced working hours, for women when providing any level of care intensity, and men at high levels of care intensity (Raiber, Verbakel and Visser, 2022). In the Netherlands, providing high intensity care was associated with a reduction in working hours for women, and leaving the labour market entirely for both men and women (Josten, Verbakel and de Boer, 2024). A negative association between care and employment was also found for mid-life women in Spain (Casado-Marín,García-Gómez and López-Nicolás, 2011).

The qualitative literature in the field also highlights the negative impact care can have on their ability to participate in the labour market. For example, Murphy and Cross (2021) found that carers were more likely to experience financial, physical and emotional stresses that can have a negative effect on their employment. They found that carers were more likely to take unpaid leave, reduce their working hours or leave the labour market entirely. Watkins and Overton (2024) also provide an overview of the risk care has for employment, including reducing working hours, being unable to take on promotions or being treated unfairly by employers, and potentially taking early retirement, further emphasising the cumulative negative impacts of providing care throughout the life-course (Cho, Crenshaw and McCall, 2013). This is consistent with other research, with organisations such as Carers UK also highlighting similar

findings relating to poor physical and mental well-being of (Carers UK, 2025c; Office for National Statistics, 2024b; Redican et al., 2024) and carers working reduced hours or leaving the labour market (Carers UK, 2019a).

Combining the qualitative and quantitative research in this field highlights the possible negative consequences care can have on employment. The existing studies consistently find that care is negatively associated with participation in employment, suggesting that many carers find it difficult to remain in full-time employment whilst providing care, particularly at higher intensities (Drinkwater, 2015; Watkins and Overton, 2024). This is a good indication that carers are not sufficiently supported, and that research should focus on highlighting the issue so that support can be effectively targeted. What is less clear, from a quantitative perspective, is the impact of providing long-term care over the life-course and its intersection with other socio-demographic characteristics, which has not yet been explored.

There is an existing body of literature in the UK that uses a life-course approach to social care research, although this predominantly focuses on care trajectories themselves. One study, that also takes an intersectional approach, aimed to investigate whether the onset of care provision across the life-course differs across different intersectional socio-demographic groups (Alonso-Perez et al., 2024). This research found evidence of socio-demographic characteristics being both additive and multiplicative, with evidence of caring onset occurring earlier across some groups. This study highlights the influence of socio-demographic characteristics on care patterns, which may also be interesting to apply to employment patterns.

Experiences across the life-course may also influence care and employment pathways later in the life-course. A variety of socio-demographic factors, including family characteristics can shape caring pathways later in the life-course (Di Gessa and Deindl, 2024). Research by McMunn, Lacey and Webb (2020) found that women partaking in full-time employment for longer periods over the life-course were less likely to take on care responsibilities later in life, a trend not as prevalent for men. These are just some of the factors that may accumulate over the life-course to shape life-course pathways (Sacco et al., 2023).

Quantitative research has begun to explore care and employment over the life-course. Research by Carmichael and Ercolani (2016) explores trajectories of care and employment across the life-course. They find that income decreases the most for highest intensity carers. They also found that well-being was poorest for carers, and the gap in well-being increased over time between carers and non-carers. Social norms and gender roles also played a role, as

they found a positive relationship between holding traditional values and caring intensively over the life-course. Carmichael and Ercolani (2016) also indicate that it may be difficult for individuals to re-enter the labour force after long periods out of it, and that this can "lock-in" individuals into caring roles. This research is interesting as it highlights differences in trajectories between different career pathways, revealing inequalities experienced by high intensity carers. It also points out some socio-demographic differences, emphasising the importance of gender roles and expectations. This further justifies the need for exploration of care and employment from a life-course perspective that also considers intersectionality.

Contribution

At the time of writing, to my knowledge there are only two papers that take a MAIHDA approach in the field of adult social care (see: Alonso-Perez et al., 2024; Pomeroy and Fiori, 2025). Pomeroy and Fiori (2025) use MAIHDA to assess the additive and interactive and additive role of competing demands in influencing the provision of unpaid care for parents in the UK. They find that although factors such as gender and employment are associated with the provision of care, these factors are additive rather than multiplicative. Alonso-Perez et al. (2024) use MAIHDA to explore whether there are differences across intersectional strata in the age of caregiving onset in Europe. They find that age of caregiving onset is mostly associated with additive effects, with a very small proportion being explained by multiplicative effects.

Whilst these studies are a significant methodological advancement in the field of social care, there are still large gaps to be filled. This research focuses on paid employment as the outcome, which has not yet been explored using this approach (other than in chapter three). Additionally, this research builds on the existing research by using a longitudinal MAIHDA approach, that to my knowledge, has not been used in this field. This gap in the literature presents an opportunity to utilise the longitudinal MAIHDA model to explore the relationship between care and employment from an intersectional life-course perspective. This will allow us to investigate how caring patterns across the life-course (continuous care versus varied care versus non-caring) can intersect with other socio-demographic characteristics to shape employment outcomes. This is a novel approach that will allow us to more fully understand this issue which in turn will support improved policy to better support carers.

Carers often face long-term disadvantages in the labour market, yet the way that care responsibilities shape employment trajectories over time remains underexplored. Previous research highlights that many carers struggle to remain in full-time employment (Carers UK,

2019a; Watkins and Overton, 2024). This has serious financial consequences, especially given that carers receive some of the lowest levels of financial support in the UK welfare system (Hamblin, Heyes and Allard, 2024). These outcomes suggest that current policy and workplace structures are not equipped to support carers in combining paid work with caregiving. However, what is missing from the literature is a deeper understanding of how care influences employment patterns across the life-course, and for whom these effects are most pronounced. By adopting an intersectional life-course approach, we can begin to understand the unequal ways in which caregiving impacts employment trajectories, shaped by the interplay of sex, ethnicity, socioeconomic status and generation cohort. This perspective allows us to move beyond static, cross-sectional understandings of disadvantage, and towards a more nuanced understanding of how care responsibilities can impact employment over time.

Methods

This paper uses longitudinal multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA) models to explore the relationship between care and employment over the life-course. In order to apply the longitudinal MAIHDA approach to study longitudinal trajectories of employment across care intensity, this paper follows the framework outlined in the methods paper by Bell et al. (2024). The longitudinal MAIHDA approach is an extension of the traditional MAIHDA approach, where individual observations over time, are nested within individuals (as in a traditional panel structure), who are nested in their corresponding strata group, shown in figure 5.1. In these models 'strata' refers to an intersectional group composed of the following identity characteristics: life-course care provision, generation, sex, ethnicity and highest educational qualification.

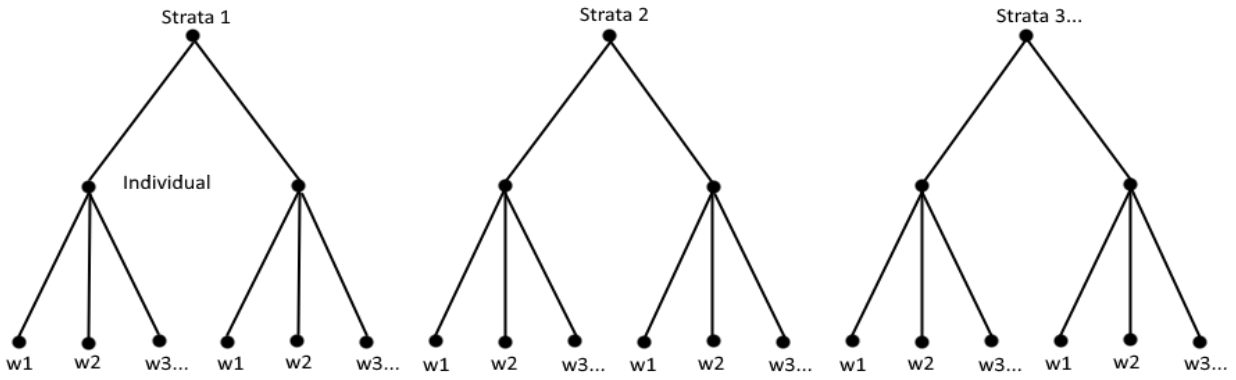

Figure 5.1 An example of the hierarchical longitudinal MAIHDA model structure.

These models are constructed to help answer the following research questions:

RQ1a What is the overall relationship between unpaid care and job hours?

RQ1b When allowing care to intersect with socio-demographic variables, how do job hours vary between these intersectional strata groups?

RQ1c Can the intersectional variance be explained by controlling for socio-demographic variables and two-way interaction terms?

RQ2a What do trajectories of employment look like over the life-course between different levels of care provision?

RQ2b Is there intersectional variability in these life-course trajectories of employment?

Longitudinal MAIHDA models will be conducted in RStudio using R version 4.1.1 (R Core Team, 2021), using data from the UK Household Longitudinal Study (UKHLS) 2009-2022/23 (U Essex, 2024). The UKHLS will be used due to it being a panel study with (approximately) annual data points. This data also contains information about carers, employment, as well as socio-demographic characteristics, meaning it is suitable for studying trajectories of employment across different demographics. Additionally, it is one of the most stable longitudinal datasets due to low drop out rates (Understanding Society, n.d.), making it appropriate for the longitudinal nature of this research.

Variables

The outcome variable of interest is labour market participation. Labour market participation is measured using the average hours worked per week, ranging from 0 to 98 hours, with an overall mean of 26.94 hours. Those who work 0 hours can include people who are not employed due to looking after the family or home, being unemployed, or retired. Only employees with a positive value for average job hours are included in this analysis. Self-employed individuals are excluded as being self-employed is often very different to being an employee, and should therefore be studied separately. For example, being self-employed may in some cases mean an individual has more autonomy over their work (Henley, 2021; Williams et a,. 2017), which may make the relationship between work and care look different to that for employees. A full list of excluded variables and the re-coding process can be found in the appendix (table 8).

People over state pension age have also been removed, as this group may be less likely to be in employment due to being able to receive their state pension, and including them may complicate analysis. This also allows us to account for people who may take early retirement, a

point of importance as some carers might choose to retire early as a consequence of their caring duties (Civil Service Pensions, 2022, The Eurocare Team, 2024). Due to the lack of information of birth dates other than birth year, we lacked the ability to accurately categorise people within their specific state pension age category. As an imperfect solution, we chose to exclude all individuals aged over 60, as this represented the minimum age at which state pension could be claimed within our sample. A restriction of this decision is the inability to account for individuals who retired early between the ages of 60 and the then-current retirement age, a group with a relatively higher likelihood of having older parents in need of care.

The key independent variable of interest is care provision. Care in the UKHLS is measured as the average hours of care provided per week. It includes care provided both inside and outside the carer's household. Respondents were asked:

"Now thinking about everyone who you look after or provide help for, both those living with you and not living with you - in total, how many hours do you spend each week looking after or helping them?" (U Essex, 2024).

Due to the complexity of the model, and needing to analyse an individual's propensity to care over the life-course, the care variable has been simplified (see pages 135-137). At each cross-section, care is categorised into a binary measure of care: 'provides care' or 'does not provide care'. The care variable was then re-categorised into three categories, where care is considered an 'identity characteristic' suitable for longitudinal analysis: firstly, 'continuous non-carer', where an individual must provide no care in each of these waves in which they are measured. Secondly, 'Continuous carer', where an individual must provide care for at least ten of the fourteen waves. Finally, 'Care varies', where an individual must have a combination of both care and non-care responses across waves, but with between 1 and 10 waves in which they were carers. Individuals who responded to the question in fewer than ten waves were removed from the sample.

Conceptualising care in this way allows us to include care as a strata defining variable. This research is interested in understanding how care as an identity characteristic and long-term experience may intersect with other socio-demographic characteristics; a strata variable has therefore been constructed to include care, sex, ethnicity, socioeconomic status and generation. This is a slight variation to the categories used by Bell et al. (2024) allowing us to

incorporate care as an intersectional characteristic. The strata defining variables are shown in table 5.1.

Table 5.1 Variable statistics

Variable name	Variable code	No. obs.	% obs.
Average job hours worked per week		Min: 0.00 Mean: 28.68 Max: 97.90	
Age		Min: 16 Mean: 44 Max: 65	
Care	Non-carer	71119	48.70
	Carer	7347	5.03
	Varies	67567	46.27
Sex	Male	57988	39.71
	Female	88045	60.29
Generation cohort	Boomers (1956*–1963)	46288	31.70
	X (1964–1979)	62684	42.92
	Y (1980–1994)	34614	23.70
	Z (1995 onwards)	2447	1.68
Ethnicity	White	130229	89.18
	Mixed	2463	1.69
	Asian	9128	6.25
	Black	3630	2.49
	Arab & Other	583	0.40
Education	Degree	77705	53.21
	Secondary school	56539	38.72
	Other qualification	8692	5.95
	None	3097	2.12

* Boomer generation began in 1956 due to people over State Pension Age being excluded from analysis.

In the strata variable, generation is used as it is stable over time and people within the same generation may have similar upbringings in terms of shared societal norms and social contexts. Ethnicity is re-categorised into five categories following the Office for National Statistics categorisation (Office for National Statistics, 2023a). Although recognising that there are likely to be differences within each ethnic category (Race Disparity Unit and Race Equality Unit, 2020), using smaller groupings would not be possible due to the small counts within strata groups. Highest qualification achieved is used as an indicative measure of socioeconomic status as there is a strong relationship between highest educational qualification and socioeconomic status (Social Mobility Commission, 2024), and does not rely on the person being in employment, which measures such as NS-SEC require.

As shown in table 5.2, 210 strata were empty, leaving 270 total strata available for the analysis. This is due to there being small numbers of individuals within certain demographics, for example, the 'Arab or other' ethnic category. Since 270 is still a large number of strata, we decided not to recategorise demographic characteristics into wider categories (such as non-ethnically minoritised vs ethnically minoritised), as we believe this would miss critical nuances that are important to consider when taking an intersectional approach.

Table 5.2 Sample sizes of the strata variable

Min	Q1	Median	Q3	Max	Mean	SD	n	missing
3	17	53	226.5	8614	540.863	1435.726	480	210

Models

A series of multilevel models were created following a bottom up approach. This allowed for model complexity to be increased gradually, using Akaike Information Criterion (AIC) scores to assess model fit at each stage. This approach ensures that we are able to determine whether adding additional complexities adds value to the analysis. The full model building process including equations are outlined in the appendix (figure 6). The models included within the final analysis are as follows (letters represent model building process, numbers represent models included in final analysis):

Model 1 adds age cubed into the fixed part of the model. This is done to identify whether adding this term improves the model fit, in order to identify whether the overall age trajectory takes a cubic (or potentially higher order) polynomial form. Where: β0 = the intercept, u_{0j}= j represents level 2 (individual) random effects, v_{0k}= k is the level 3 (strata) random effects and ε_{ijl}= the error for repeated observations over time, nested in individual, nested in strata.

$$JobHours_{ijk} = \beta0 + \beta1Age_{ijk} + \beta2Age^{2}_{ijk} + \beta3Age^{3}_{ijk} + (u_{0jk} + v_{0k} + \varepsilon_{ijk})$$

Model 2 adds the strata variables as main effects into the fixed part of the model. This is done to identify how much of the relationship between care and job hours can be explained by socio-demographic variables. Where $A_m X_{ijmk}$ represents the strata defining variables, including care, generation, sex, ethnicity and highest educational qualification (note that care is now represented in the X_{mk} term).

$$JobHours_{ijk} = \beta0 + \beta1Age_{ijk} + \beta2Age^{2}_{ijk} + \beta3Age^{3}_{ijk} + \sum_{m=1}^{M} A_m X_{mk} + (u_{0jk} + v_{0k} + \varepsilon_{ijk})$$

Model 3 adds random slopes for the linear age component to the strata and individual level. This allows the relationship between care and job hours across strata and individuals to vary for age.

$$JobHours_{ijk} = \beta 0 + \beta 1 Age_{ijk} + \beta 2 Age^{2}_{ijk} + \beta 3 Age^{3}_{ijk} + \sum_{m=1}^{M} A_m X_{mk} + (u_{0jk} + u_{1j} Age_{ijk} + v_{0k} + v_{1k} Age_{ijk} + \varepsilon_{ijk})$$

Model 4 adds two-way interactions between care and the other strata variables into the model. This allows the proportion of the strata variance that is explained by care-strata interactions to be analysed.

$$JobHours_{ijk} = \beta 0 + \beta 1 Age_{ijk} + \beta 2 Age^{2}_{ijk} + \beta 3 Age^{3}_{ijk} + \sum_{m=1}^{M} A_m X_{mk} + \sum_{m=1}^{M-2} \vartheta_m (X_{mk} CareConst_k) + \sum_{m=1}^{M-2} \varphi_m (X_{mk} CareVaries_k) + (u_{0jk} + u_{1j} Age_{ijk} + v_{0k} + v_{1k} Age_{ijk} + \varepsilon_{ijk})$$

Model 5 adds two-way age interactions for the strata variables. This allows us to identify whether socio-demographic characteristics interact with age. Here, ω represents the two-way interaction effects between X_{jk} and Age, where X includes sex, generation, ethnicity and highest educational qualification. Here, ω represents the two-way interaction effects between X_{mk} and Age, where X includes all the strata defining variables.

$$JobHours_{ijk} = \beta 0 + \beta 1 Age_{ijk} + \beta 2 Age^{2}_{ijk} + \beta 3 Age^{3}_{ijk} + \sum_{m=1}^{M} A_m X_{mk} + \sum_{m=1}^{M-2} \vartheta_m (X_{mk} CareConst_k) + \sum_{m=1}^{M-2} \varphi_m (X_{mk} CareVaries_k) + \sum_{n=1}^{M} \omega_m (X_{mk} Age_{ijk}) + (u_{0jk} + u_{1j} Age_{ijk} + v_{0k} + v_{1k} Age_{ijk} + \varepsilon_{ijk})$$

Results

What is the overall relationship between unpaid care and job hours?

To answer research question 1a, table 5.3 highlights some significant findings for the overall relationship between unpaid care and job hours. In model 2, once socio-demographic variables are controlled for, providing long-term care is associated with working just over six fewer hours in comparison to providing no care long-term. Providing varied care is also associated with a decrease in working hours, although this is less pronounced at just over two and a half hours fewer in comparison to providing no care long-term.

Table 5.3 Regression results for models 1 to 5 where average job hours per week is the outcome. A full table with interaction terms can be found in the appendix table 5.

	Model 1		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
Predictors	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*
(Intercept)	30.16 ***	0.50	41.74 ***	0.71	48.75 ***	1.06	47.96 ***	1.39	46.80 ***	1.30
Age, centred										
Age	-0.05 ***	0.01	-0.05 ***	0.01	0.05	0.05	0.05	0.05	-0.27 ***	0.07
Age squared	-0.04 ***	0.00	-0.04 ***	0.00	-0.05 ***	0.00	-0.05 ***	0.00	-0.05 ***	0.00
Age cubed	-0.00 ***	0.00	-0.00 ***	0.00	-0.00 ***	0.00	-0.00 ***	0.00	-0.00 ***	0.00
Care provision: ref = Continuous non-carer										
Long-term care			-6.08 ***	0.88	-7.06 ***	1.20	-8.74 *	3.78	-8.43 *	3.62
Varied care			-2.62 ***	0.61	-2.78 **	0.86	-2.66	2.05	-2.50	1.89
Ethnicity: ref = White										
Mixed			-1.82	1.00	-3.88 **	1.41	-2.76	2.01	-2.01	1.88
Asian			-3.24 ***	0.72	-3.94 ***	1.01	-3.20 *	1.51	-2.95 *	1.39
Black			-2.11 *	0.89	-4.42 ***	1.24	-2.59	1.81	-1.46	1.67
Other			-3.83 **	1.48	-5.55 **	2.02	-3.92	2.77	-4.18	2.65
Generation: ref = Boomer										
X			1.41	0.79	15.15 ***	1.40	18.36 ***	1.82	19.29 ***	1.88
Y			3.25 ***	0.66	12.01 ***	1.10	13.21 ***	1.49	15.96 ***	1.48
Z			-0.97	0.55	5.40 ***	0.80	5.82 ***	1.13	8.58 ***	1.08
Highest educational attainment: ref = Degree										
S-School			-2.43 ***	0.65	-5.48 ***	0.92	-4.54 **	1.41	-4.14 **	1.30
Other			-5.73 ***	0.87	-10.03 ***	1.20	-7.62 ***	1.81	-6.38 ***	1.67
None			-8.74 ***	1.03	-13.17 ***	1.42	-11.22 ***	2.08	-9.98 ***	1.93
Sex: ref = Men										
Women			-8.05 ***	0.56	-9.94 ***	0.79	-10.10 ***	1.18	-9.43 ***	1.09
Care*Strata interactions included	No		No		No		Yes		Yes	
Age*Strata interactions included	No		No		No		No		Yes	
Random Effects										
L1 Var: wave	88.38		88.38		66.42		66.42		66.41	
L2 Var: ind	93.41		93.57		123.73		123.70		123.54	
L2 Slope var					0.89		0.89		0.89	
L2 RE corr.					-0.03		-0.03		-0.03	
L3 Var: Strat	46.17		8.71		20.96		19.55		13.44	
L3 Slope var					0.31		0.32		0.06	
L3 RE Corr.					0.45		0.39		0.08	
ICC	0.61		0.54							
No. strata	270		270		270		270		270	
No. individuals	13859		13859		13859		13859		13859	
Observations	146033		146033		146033		146033		146033	
Marginal R^2 / Conditional R^2	0.077 / 0.642		0.165 / 0.613		0.183 / 0.852		0.175 / 0.851		0.132 / 0.825	
AIC	1103251		1103022		1086676		1086604		1086467	

** p<0.05 ** p<0.01 *** p<0.001*

(Note: RE = random effects)

When allowing care to intersect with socio-demographic variables, how do job hours vary between these intersectional strata groups?

To answer research question 1b the average predicted job hours for each strata were plotted, as shown in figure 5.2. Overall, men with degrees are amongst those with the highest projected job hours across all levels of care provision. Of men with degrees, those who are long-term carers work on average fewer hours than men with degrees who are non-carers over their life-course, with an average gap of approximately five hours. This gap is less pronounced between varied carers and non-carers.

On the other hand, women with fewer educational qualifications (none and other) work amongst the fewest hours across different levels of care provision. Similarly to men, there is a gap between non-carers and long-term carers, where women with none or other qualifications work fewer hours than the women with similar qualifications who provide no care across the life-course. Of the strata groups that consist of long-term female carers, the groups with the highest predicted job hours also have degree-level education.

In terms of ethnicity and generation, the picture is less clear, as there appears to be a lot of variation across these groups in predicted job hours. Overall there does appear to be fewer strata containing generation Z towards the right of the graph, indicating that generation Z are working on average fewer job hours per week, although this may be expected due to this being the youngest generation who may be in a transition period into full time employment.

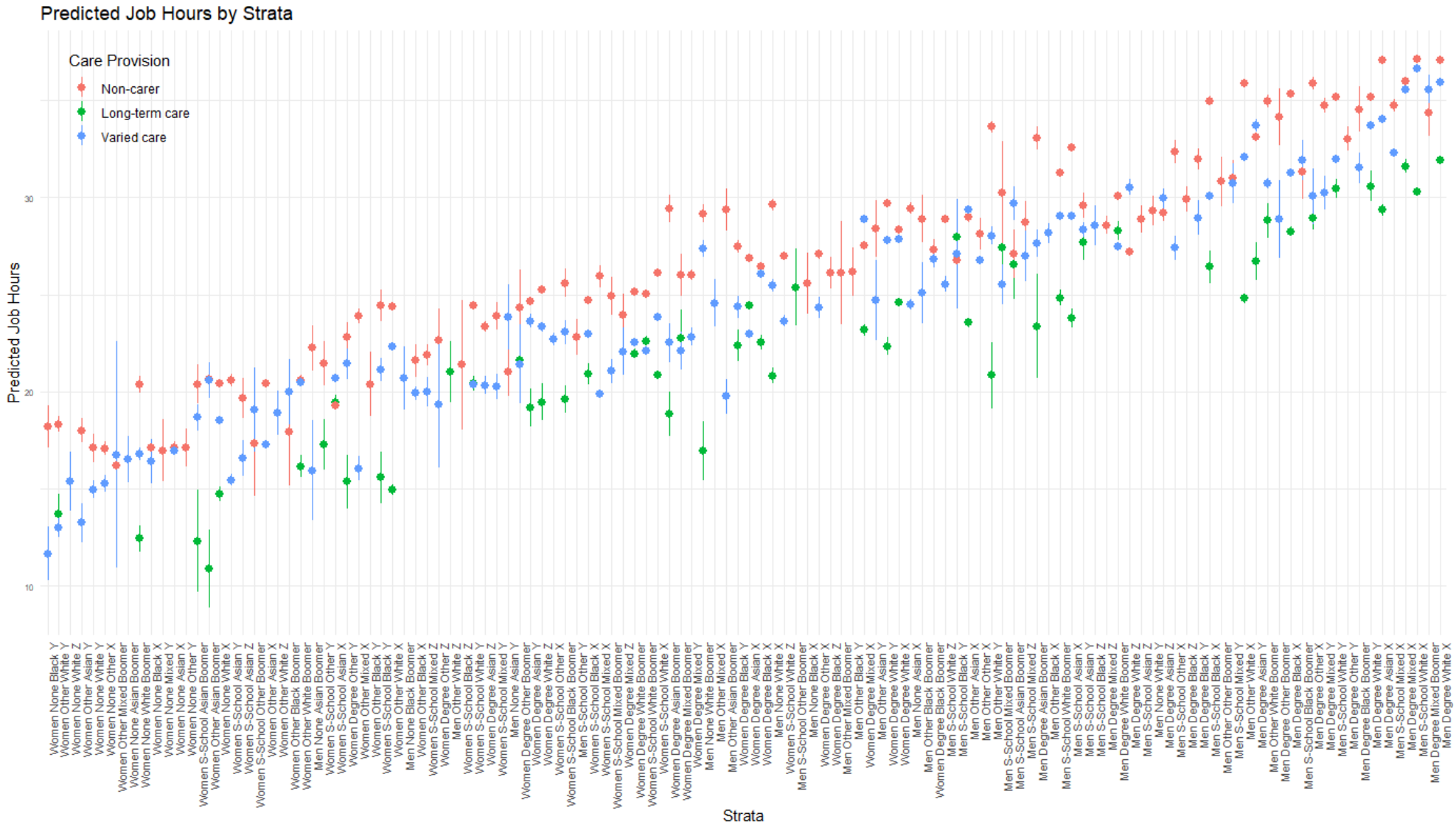

Figure 5.2 Predicted average job hours per week for intersectional strata using 90% confidence intervals, created from model 2.

Can the intersectional variance be explained by controlling for socio-demographic variables and two-way interaction terms?

To answer research question 1c, the strata variance in table 5.3 is analysed to identify how the variance changes once model complexities are added (including controlling for socio-demographic variables and adding two-way interactions between care and socio-demographic variables). Initially, there is evidence of multiplicative (intersecting) effects between the strata variables. In model 1, before the strata variables are controlled for, the strata variance was 46.17. However, when the additional strata variables (care, sex, ethnicity, generation, education) were controlled for in model 2, much of the strata variance was absorbed, reducing to 8.71. The Proportional Change in Variance was calculated to examine whether controlling for socio-demographic variables as fixed effects explains some of the strata level variation using the following formula:

$$PCV = \frac{\sigma^2[model1] - \sigma^2[model3]}{\sigma^2[model1]} = \frac{46.17 - 8.71}{46.17} = 0.8114$$

A PCV value of 0.81135 can be interpreted as approximately 81.14% of the strata variance can be explained by controlling for the main effects of strata variables (care and the additional socio-demographic variables) as fixed effects. This suggests that a large proportion of the variance can be explained by the additive relationship between socio-demographic characteristics, although some evidence of multiplicative effects remains.

The remaining multiplicative effects are visualised in figure 5.3. Of the eleven significant strata that contain long-term carers, eight have lower than average effect ranges in comparison to what you may expect given the fixed effects. This suggests that overall, long-term carers may be more likely to work fewer hours than average, given the fixed effects. The following strata containing long-term carers have negative effect ranges: **'Men Degree White Boomer', 'Women Other White Y', 'Men S-School White Boomer', 'Men None White X', 'Men S-School Asian X', 'Women Other White X', 'Women Other Asian Boomer', 'Men Other White Y'**. Whilst the following strata containing long-term carers have positive effect ranges: **'Women S-School White Boomer', 'Women Degree Asian X', 'Men S-School White Y'**. There is a large amount of diversity between these strata in relation to the socio-demographic characteristics they consist of, suggesting overall there are no clear patterns that emerge.

What is interesting is the instances where the significant strata have different effect ranges across different levels of caring. For example the **'Non-carer Men Other White Y'** strata has a positive effect range (works a greater number of hours) compared to the expected outcome given the fixed effects, whilst the **'Long-term Carer Men Other White Y'** strata has a negative effect range (works fewer hours). Of the **'Men Degree White Boomer'** strata, all care groups have a negative effect range, but this is less negative for long-term carers in comparison to varied/non-carers, suggesting that compared to what you may expect, although all care groups work fewer hours, this is more pronounced for varied carers/non carers.

There are also some key differences between long-term and varied carers who share similar demographic characteristics. The **'Long-term carer Men S-School Asian Boomer'** strata has a negative effect range (works fewer hours) whilst the **'Varied-carer Men S-School Asian Boomer'** strata has a positive effect range (works a greater number of hours). In contrast, the **'Men Degree Other X'** strata has a negative effect range for varied carers and a positive effect range for long-term carers.

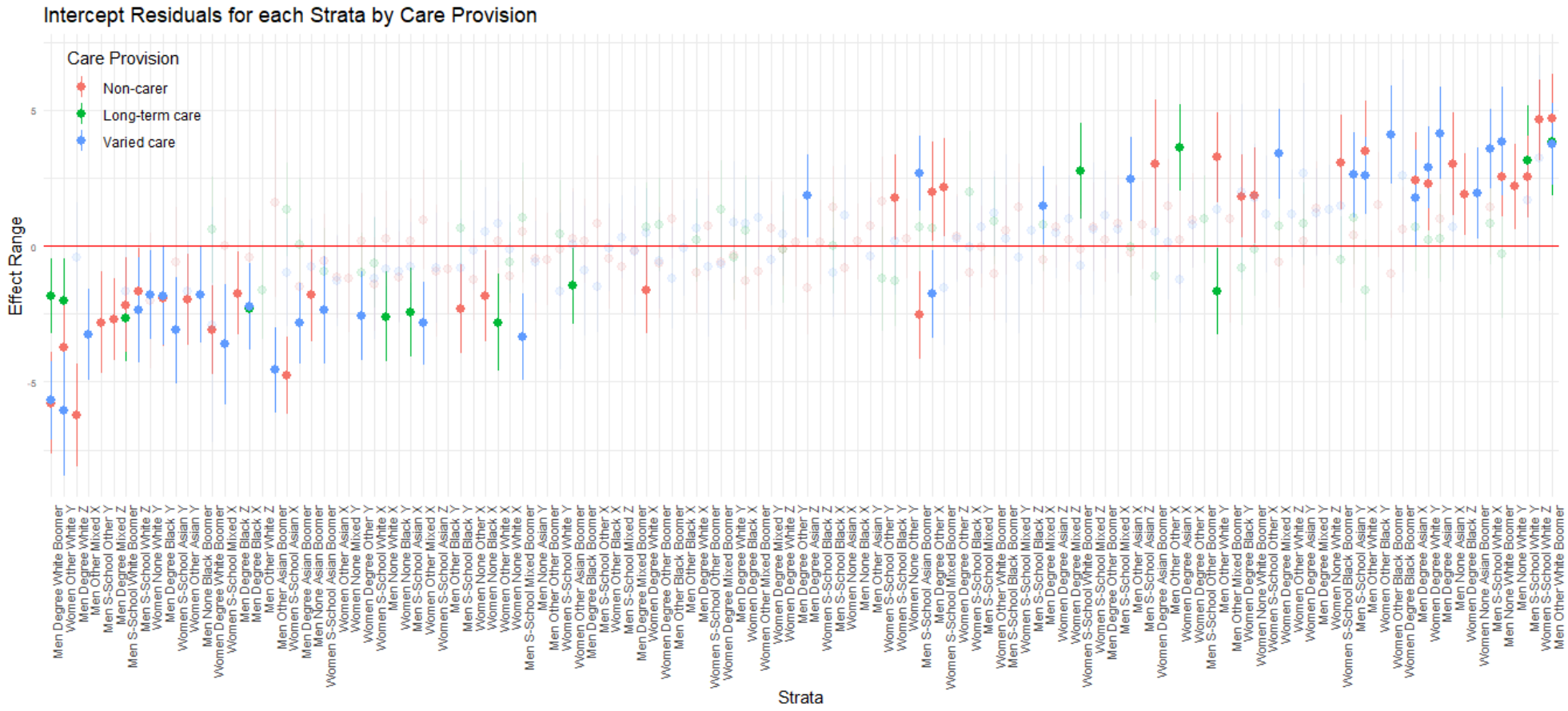

Figure 5.3 Intercept residuals (multiplicative effects) of each strata, coloured by care provision using 95% confidence intervals. Created with model 2.

Interestingly, once interaction terms between care and the additional strata variables were added, despite the AIC decreasing, suggesting a better model fit, the strata variance increased to 9.7 in model e (see appendix table 6) from 8.71 in model 2. This is unusual as you may expect the interaction terms to control for at least a small proportion of the hierarchical variance. Similarly, none of the coefficients were significant in model e (appendix table 6), suggesting that adding these interactions was not beneficial to the model. As a sensitivity test, the same model was run in glmmTMB, where the AIC increased, suggesting that the model may not be a better fit (see appendix table 7).

However, once random slopes on age were added in model 5, some interaction terms become significant, and the AIC decreases, indicating that the model may work best once interactions and random slopes are added simultaneously. Despite this, the level three slope variance also increased very slightly from 0.31 in model 3 to 0.32 once interaction terms were added in model 4. This indicates that there is not enough evidence to suggest that two-way interactions between care and the additional strata variables explains the variance between strata (multiplicative effects). Due to the significant interaction coefficients in model 5 these interactions were not removed from the final model. A more in-depth discussion around the model building process can be found under figure 6 in the appendix.

What do trajectories of employment look like over the life-course between different levels of care provision?

In model 5, the addition of two-way age-strata interactions absorbs a large proportion of the variability in age slopes. The slopes PCV was calculated to find this proportion (Merlo et al., 2016):

$$Slopes\ PCV = \frac{\sigma^2[model4] - \sigma^2[model5]}{\sigma^2[model4]} = \frac{0.32 - 0.06}{0.32} = 0.8125$$

This suggests that 81.25% of the remaining variance between strata is explained by controlling for age-strata interactions. This suggests that the relationship between socio-demographic variables over the life-course accounts for much of the difference in job hours across strata, indicating that only a small amount can be attributed to multiplicative effects (by which, we mean 3+ way interactions involving age and 2 or more strata-defining variables).

To identify the overall employment trajectories across different types of caring over the life-course, model 5 was plotted as shown in figure 5.4. In figure 5.4, the overall employment

trajectories for different levels of caring shows an inverse 'U' shape where employment peaks between 30 to 50 years old. Overall, long-term carers work the fewest hours on average across the life-course, but this is only significant from approximately 30 to 50 years old. This gap then converges as retirement age approaches, where there are again some overlapping confidence intervals. Overall figure 5.3 emphasises that long-term carers are experiencing the largest disparities in job hours, particularly during their prime working years. There are no clear differences observed between non-carers and varied-carers as the confidence intervals consistently overlap.

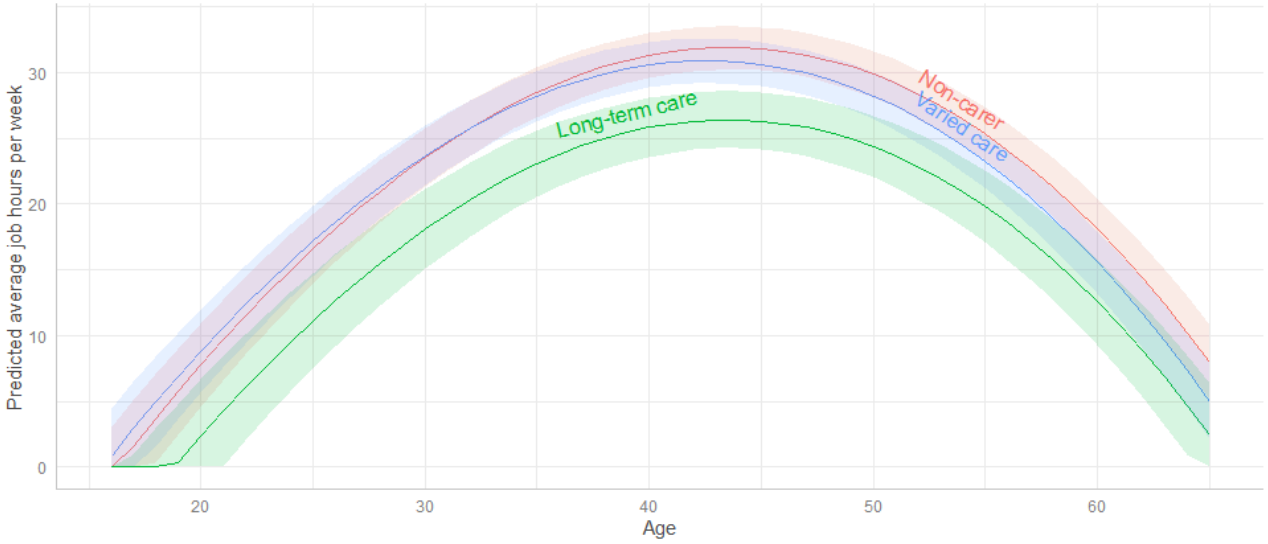

Figure 5.4 Employment trajectories across different levels of caring, once main effects are controlled for. Created from model 5.

Is there intersectional variability in these life-course trajectories of employment?

As identified, there is evidence of multiplicative effects. To identify whether there was variability in life-course employment trajectories across strata, age random slopes and interactions were added into the models. The results from the age random slopes in model 5 revealed some significant differences in life-course employment trajectories between strata, as shown in figures 7 and 8 in the appendix. To visualise these differences, figure 5.5 highlights some of the key strata where trajectories were different for carers compared to non-carers.

For '**Men-Degree-Asian-X**' who are long-term carers the employment trajectory is steeper (tilted upwards) in comparison to non-carers, whose trajectory follows a more downwards tilt. This results in predicted job hours being approximately the same at age 45 for both care types, despite long term carers working fewer hours earlier in the life-course. Long-term carers then go onto work more hours later in the life-course, post age 45 in comparison to non-carers with the same socio-demographic characteristics.

For the '**Women-Degree-Asian-X**' strata, varied carers also have a steeper increase in job hours over the life-course towards the peak in comparison to non-carers. This means that despite working considerably fewer job hours on average earlier in the life-course, varied-carers work similar hours as the other care types at approximately age 50.

For the '**Men-S-School-Asian-Boomer**' strata, varied-carers again follow a steeper trajectory meaning despite varied-carers working fewer hours earlier in the life-course, non-carers work fewer hours later in the life-course (after age 50). However, job hours are not hugely different between care types for this strata, meaning that the differences appear small in figure 5.5.

For the '**Women-Degree-White-Z**' strata, non-carers have a steeper trajectory than long-term carers. Long-term carers also work considerably fewer hours at the beginning of the measured trajectory, meaning the disparity in job hours between long-term carers and job hours likely increases over the life-course up until job hours peak.

For '**Men-Degree-White-Z**' who are non-carers, job hours begin lower than for those who are varied-carers. However non-carers job hours increase more steeply in comparison to varied carers, who although work a greater number of hours earlier in the life-course, show a more gradual increase, meaning that job hours begin to look a lot more similar for both varied-carers and non-carers by mid-twenties.

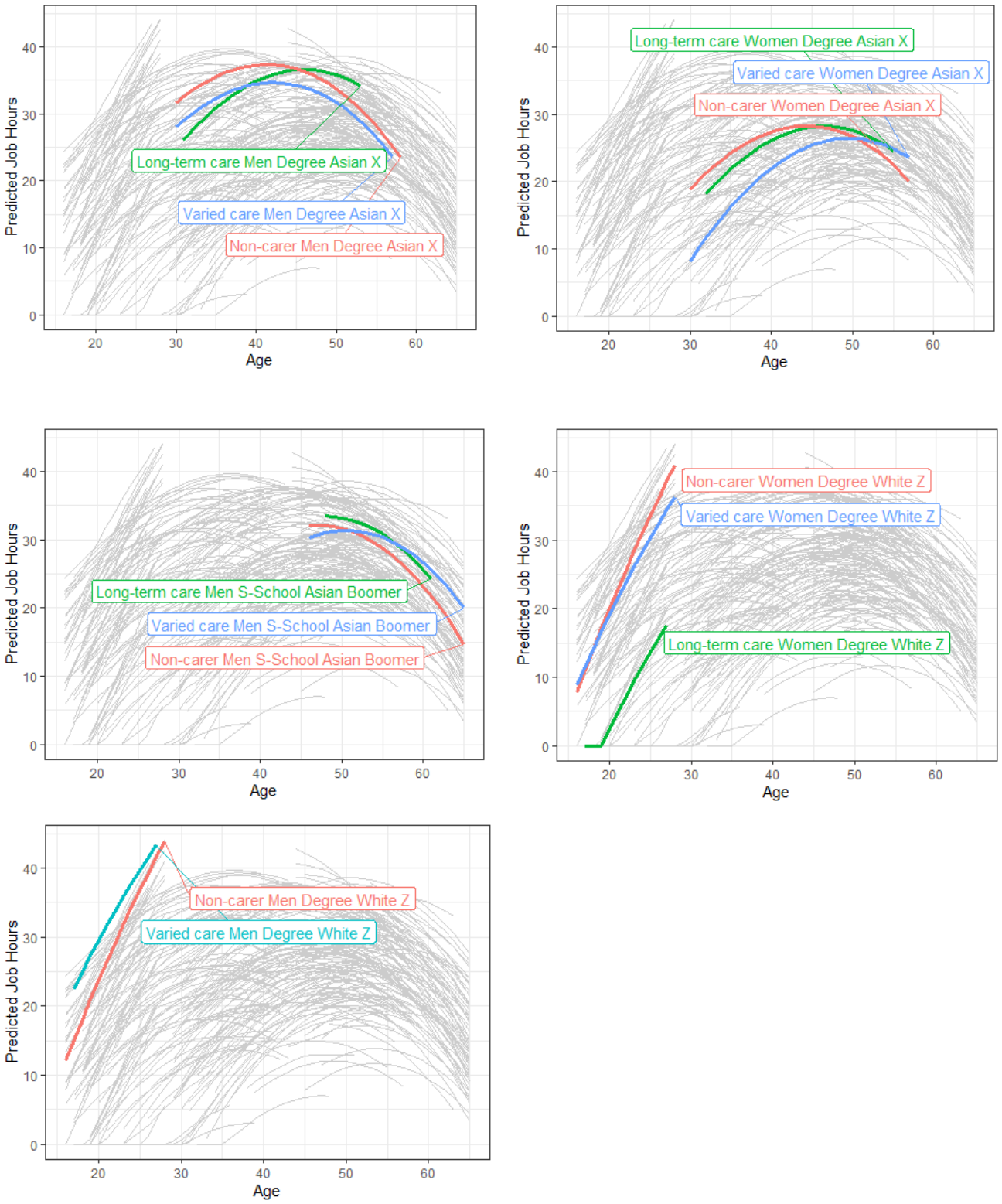

Figure 5.5 Age trajectories for strata where there are large differences between care provision and non-caring.

Figures 4.6 to 4.9 show the trajectories of job hours over the life-course, stratified by care provision, for each socio-demographic characteristic defined in the strata variable. The results highlight some varying effects which are outlined below:

Figure 5.6 shows the trajectories of job hours over the life-course, visualised by generations. Overall there do not appear to be any large differences in the employment trajectories for different generations across different levels of caring. For long-term carers, generation Z works fewer hours in comparison to other care groups, however the confidence interval is very large, possibly due to smaller sample size amongst this group making it difficult to say with certainty that there are differences. Amongst long-term carers the older generations also appear to work on average more hours than the younger generations in comparison to other types of carers, but again the confidence intervals are wider.

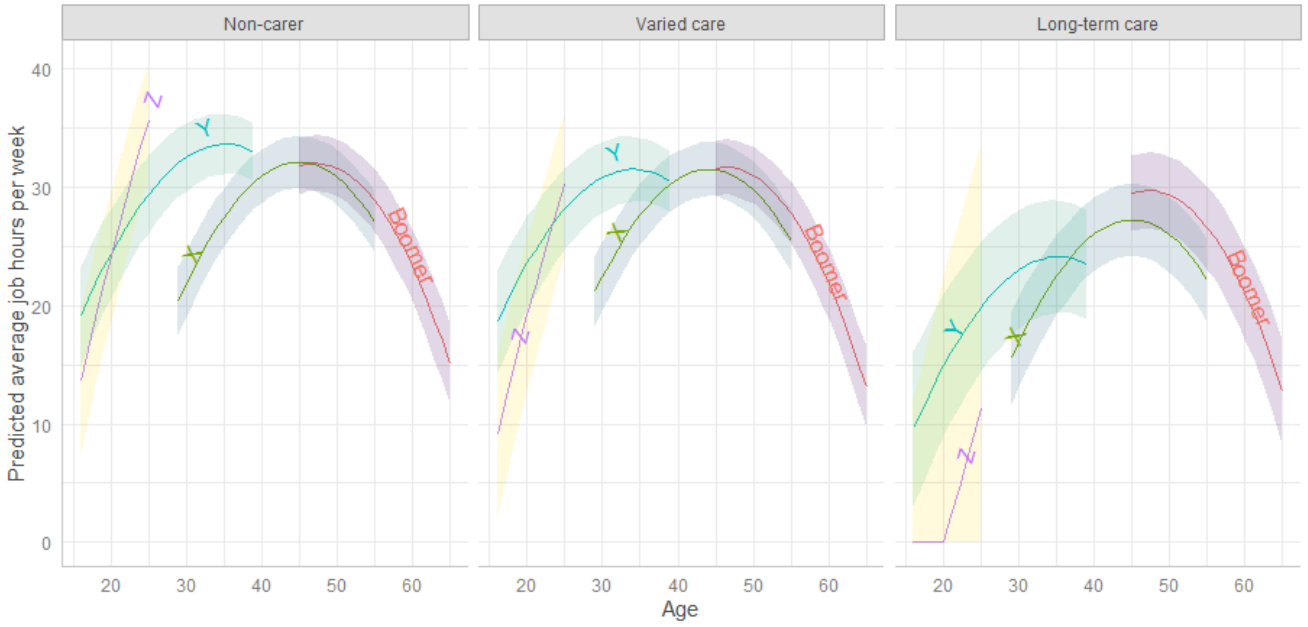

Figure 5.6 Predicted average job hours worked per week over the life-course for different generations, stratified by different levels of caring. Created from model 5.

In figure 5.7, as the results in table 5.3 and figure 5.2 also suggest, the predicted job hours for men are much higher than for women. This is a consistent finding across the life-course for all levels of caring, although the gap decreases later on into the life-course from around 50 years old onwards towards state pension age. Consistently across the life-course, for long-term carers, the predicted job hours for both men and women are fewer than the predicted hours for men and women who consistently provide no care. However, the overall employment trajectory is similar for both men and women across all levels of caring following the inverse "u" shape. Job hours peak for both men and women at approximately 43 years old, but for

long-term and varied carers this peak is reasonably higher than for long-term carers. This indicates that there is limited evidence to suggest that employment trajectories significantly differ over the life-course across types of care.

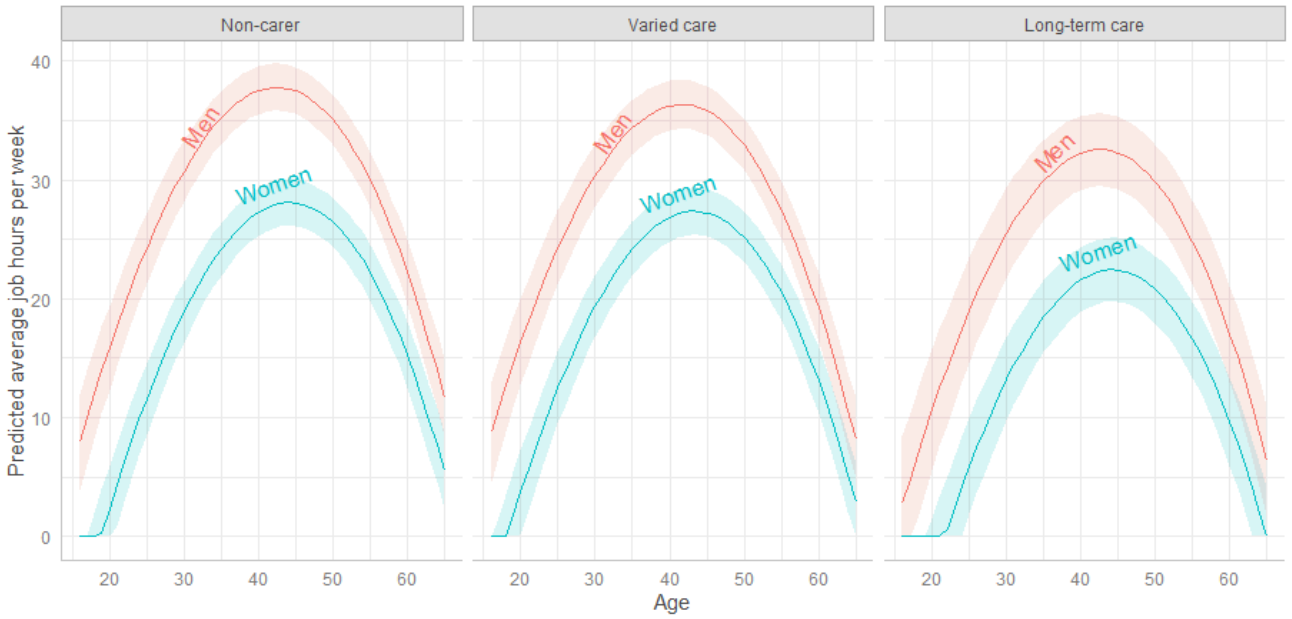

Figure 5.7 Predicted average job hours worked per week over the life-course for men and women, stratified by different levels of caring. Created from model 5.

In figure 5.8, the confidence intervals for most ethnic groups overlap, meaning it is difficult to say with much certainty that there are differences across ethnic groups. Overall, it appears that White individuals are more likely to be working more hours up until mid life across all levels of caring. This disparity appears to be more pronounced for the varied care group, where the gap in job hours is much larger and until later in the life-course, after the age of 50 years old. As retirement age approaches this difference becomes much less pronounced. These findings suggest that inequalities in job hours across ethnic groups become less pronounced later on in the life-course as retirement age approaches.

However, one interesting trend is that for non-carers, the Black ethnic group works on average slightly fewer hours per week in comparison to other ethnic groups up until around the age of 40, where this trend actually begins to reverse; by age 50, the Black ethnic group works on average, the most hours per week. For Black long-term carers, this trend is more pronounced earlier in the life-course. Up to approximately ages 45 to 50, Black long-term carers work considerably fewer hours on average, in comparison to all other ethnic groups. In contrast to non-carers, this trend does not completely reverse, and there are less clear differences between ethnic groups later in the life-course. This interpretation can however, only remain as

speculation due to the large confidence intervals, hence further research will be needed into specific ethnic differences.

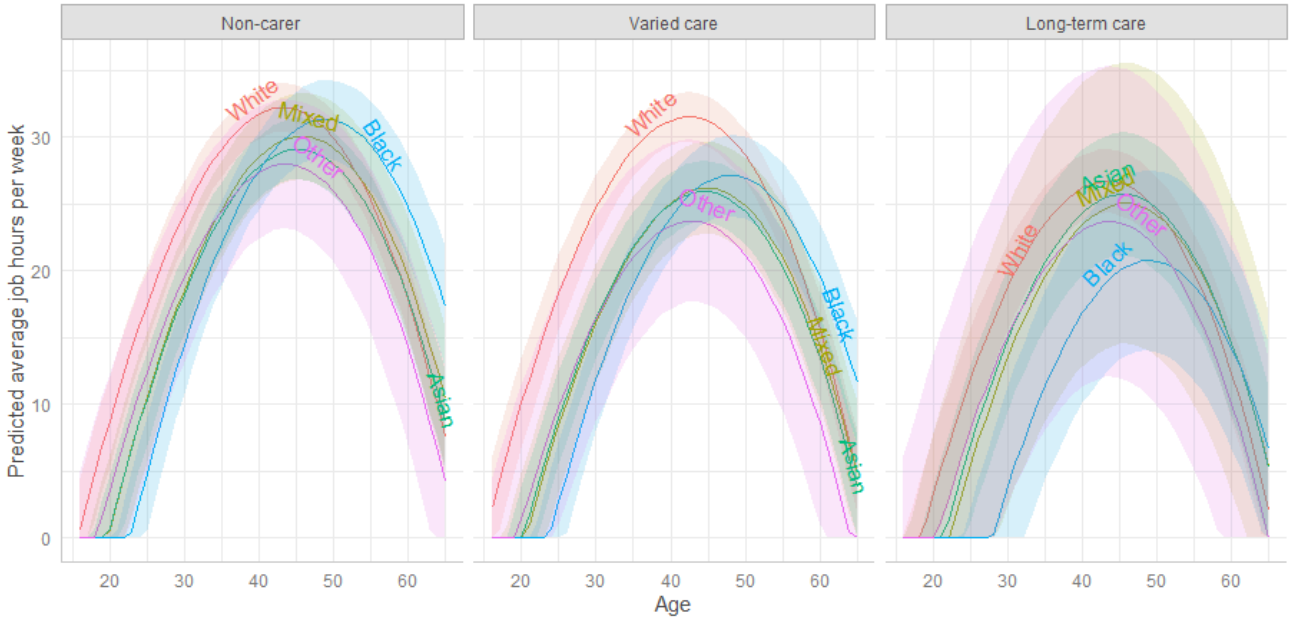

Figure 5.8 Predicted average job hours worked per week over the life-course for different ethnic groups, stratified by different levels of caring. Created from model 5.

In figure 5.9, for long-term carers, the gap in job hours between those with a degree or secondary school education is much wider for long-term carers than it is for varied or long-term non-carers. This suggests that the negative relationship between care and job hours may be the most pronounced for carers with the fewest educational qualifications. This gap is the widest below 50 years old. Although the gap in job hours converges over the life-course after 50 years old towards retirement age, there is still a small difference in job hours between levels of education, particularly for long-term carers with no educational qualifications. This is in contrast to varied and long-term non-carers, where there does not appear to be much difference in job hours later in life. There are no large differences in the trajectories between varied carers and long-term non-carers.

Another interesting finding is that for long-term carers with other or no educational qualifications, the predicted job hours does not exceed 0 until approximately 30 to 35 years old. This suggests that a large proportion of this demographic are not in paid employment, and hence bring the predictions down. This indicates that those of low socioeconomic status who provide long-term care are less likely to join the workforce, particularly at younger ages.

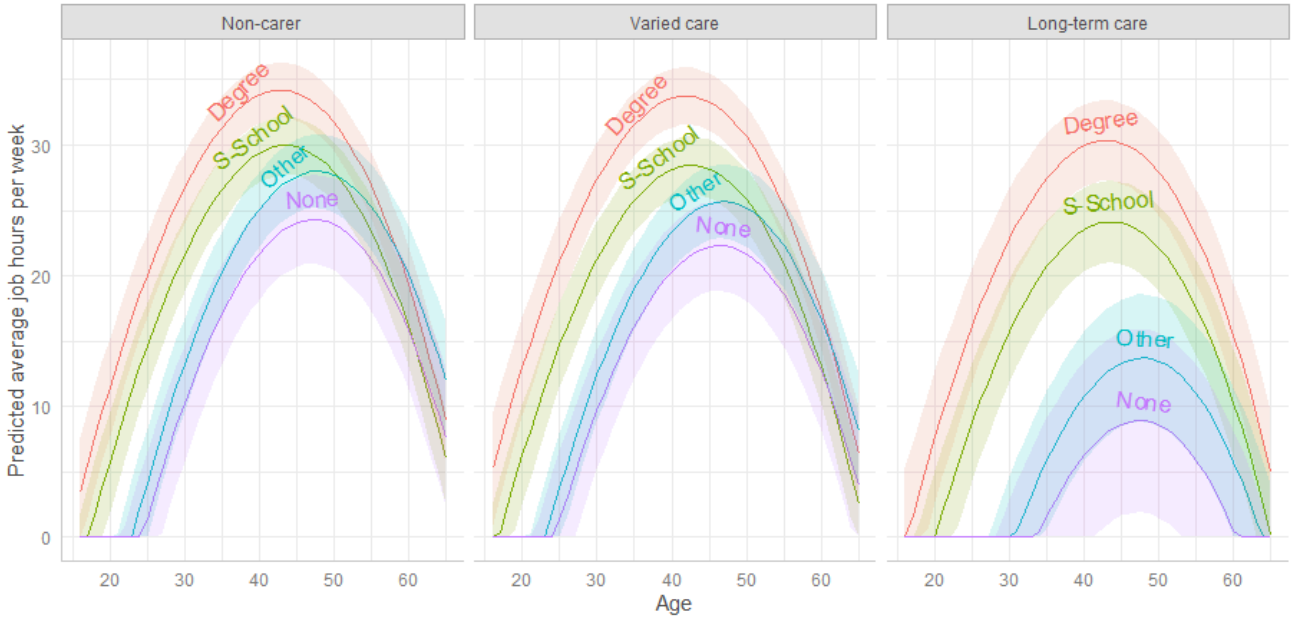

Figure 5.9 Predicted average job hours worked per week over the life-course for different levels of educational attainment, stratified by different levels of caring. Created from model 5.

Discussion

The results for **research question 1a** support findings from the previous work on unpaid care and employment (Chapter three; Chapter four). Providing care, particularly long-term care over the life-course, is associated with working fewer hours per week in comparison to people who consistently do not provide care. This study differs from existing studies in terms of both the conceptualisation and categorisation of care, hence there is limited research to compare these findings directly to. The overall relationship between care and employment, however, is similar to that found in the literature. These findings were therefore unsurprising, as existing studies (Butcher, 2025a and 2025b unpublished; Evandrou and Glaser, 2003; Watkins and Overton, 2024), and campaigns (Carers UK, 2019a) have found that providing care may be negatively related to paid employment, with people reducing hours to provide care, or leaving the workplace entirely. Studies suggest that this is likely due to care and paid employment competing for time, and care for many people takes up a large amount of their time, meaning that full-time employment is incompatible with their caring responsibilities (Henz, 2004; Jacobs et al., 2015; Raiber, Visser and Verbakel, 2022). Care can also be physically and emotionally demanding, which may also make it more difficult to combine it alongside paid employment (Spann et al., 2020).

To address **research question 1b**, the results show that men with degrees are consistently predicted to have higher job hours regardless of care status, however, long-term carers with degrees work on average fewer hours than non-carers with degrees. This is unsurprising, as

this demographic are amongst the most likely to have higher paying jobs (Social Mobility Commission, 2023). This means that the financial cost of reducing working hours would be the highest for this demographic due to the higher loss of income (Carmichael and Charles, 2003; Miller and Sedai, 2022). Similarly, this demographic may have the financial resources to pay for formal care services, and additional support such as equipment, to help with care needs (Floridi, Carrino and Glaser, 2021). In turn, they may therefore have more time available to participate in paid employment, which could explain some of the high predicted job hours. Traditional gender roles may also have a part to play in explaining this relationship. Highly educated males are more likely to have a higher income and therefore may be more likely to take on the role of 'breadwinner' due to the higher cost of reducing paid employment (Miller and Sedai, 2022). Although gender roles and expectations are converging over time (Scott and Clery, 2013), they still play an important role in society (Carr et al., 2018; Pomeroy and Fiori, 2025; Watkins and Overton, 2024). These expectations may mean that men are more likely to work longer hours in order to provide for their family, irrespective of whether or not they also provide care.

Another unsurprising finding is that female carers have amongst the lowest predicted job hours. Existing literature that highlights the disparities between men and women in care provision, with women consistently providing more care than men at all ages except in older age (Office for National Statistics, 2023c). It may be the case that within carer strata, the women are on average, providing more hours of care per week in comparison to men. Although the data used in this study does not allow for this nuance to be identified due to the risk of small counts, it would be interesting to consider how care intensity affects this relationship. Further research on large scale data should investigate this further, through stratifying for care intensity. Amongst female carers, those who have the highest (degree) level of education have the highest predicted hours. This is similar to the results for men, and possibly due to similar reasons related to opportunity costs and financial support as mentioned above.

When addressing **research question 1c**, this analysis indicated that the relationship between socio-demographic characteristics is primarily additive, however there are multiplicative effects present after controlling for socio-demographic variables in model 2. Overall, the majority of significant strata containing long-term carers work fewer hours on average in comparison to what is expected given the fixed effects. This is unsurprising as you may expect to see long-term carers have lower effect ranges due to points made earlier about the negative

relationship between providing care and employment (see page 161). There is also a large amount of variation in the socio-demographic characteristics that make up the strata between these significant strata that have negative effect ranges, making it difficult to explain why these specific strata containing carers who provide long-term care over the life-course have lower effect ranges.

Amongst the significant long-term carer strata with more positive effect ranges, there is also a fair amount of variation in the socio-demographic characteristics. Of these strata, one similarity is the higher level of education (secondary school or higher). This could relate to having higher paying jobs and therefore a higher opportunity cost of reducing employment to provide care (Carmichael and Charles, 2003; Carmichael, Charles and Hulme, 2010; Miller and Sedai, 2022). However, it is difficult to make claims such as these with much certainty, particularly as there are also strata with lower effect ranges that consist of higher levels of education, adding complexity to the discussion. More research is therefore needed into the intersectional relationship of socio-demographic characteristics that may impact care and employment.

Interestingly, the **'Non-carer Men Other White Y'** strata work on average fewer hours per week compared to what you may expect, given the fixed effects, whilst the 'Long-term carer Men Other White Y' strata work a greater number of hours. This suggests that the effect of providing long-term care over the life-course may be particularly great for this demographic of White men who hold some level of education and are part of generation Y. This is perhaps unsurprising, as this demographic are in their prime working years being generation Y, but perhaps not at their full earning potential as they may be in older generations. They also do not hold degrees, which means on average they may not have the highest income. This may mean that the opportunity cost of leaving employment may not be as great as some other groups, which could explain the lower effect range when providing long-term care. This demographic, being White males of working age, typically have high levels of employment (UK Government, 2023), which could explain the high effect range for non-carers, who do not have additional care responsibilities that may disrupt employment over the life-course, explaining the disparity between these two groups.

The '**Long-term carer Men S-School Asian Boomer'** strata work fewer hours on average compared to what you may expect, whilst the **'Varied-carer Men S-school Asian Boomer'**

strata work a greater number of hours. Again, this finding highlights that the effect of providing long-term care may be more negative for this demographic in comparison to providing intermittent or shorter periods of care over the life-course. This demographic is the eldest in the analysis and therefore may be approaching state pension age, where providing care, especially when consistent or of high intensity, often results in early retirement (Civil Service Pensions, 2022, The Eurocare Team, 2024), which could partly explain this result.

In contrast, of the **'Men Degree Other X'** strata, those who provide long-term care over the life-course work on average a greater number of hours than you may expect given the fixed effects, whilst those who provide intermittent or shorter periods of care work fewer hours. It is not clear however, why this may be the case for this demographic. The variation within the varied-carer category (in terms of length of care episodes and intensity of care) means it is difficult to determine why certain strata may have different job hours, and this discussion aims not to overinterpret results, but to provide a general and descriptive discussion around some of the key trends.

To address **research question 2a**, the employment trajectories over the life-course were mapped for different levels of caring. The inverse U shape trajectory of employment is unsurprising, as it follows traditional patterns of employment. At younger ages, individuals may be at a transition period of their life (Robison, Inglis and Egan, 2020; Xue et al., 2023), just entering the labour market, and may be more likely to be working part time, for example, alongside further education. Hours tend to increase during prime employment years, when an individual has the most job experience and often works in higher positions. This is also the age when an individual is most likely to be earning the most (Francis-Devine, 2024). Job hours naturally begin to decline once an individual approaches state pension age.

There are lower levels of employment amongst younger long-term carers in comparison to varied carers and non-carers. This could reflect the impact caring early in the life-course can have for entering the labour market. For example, caring at a young age may make it more difficult to start a job, particularly if they are still in school, college or university, due to the multiple roles being both demanding in terms of time (Henz, 2004; Jacobs et al., 2015; Raiber, Visser and Verbakel, 2022), as well as physically and emotionally demanding (Spann et al., 2020). Caring can in some cases be disruptive to education, and could make the decision to carry on in higher education more difficult (Brimblecombe et al., 2020; Robison, Inglis and

Egan, 2020; Xue et al., 2023). This could lead to long-term carers having fewer qualifications or less job experience, which could make it more difficult to enter the labour market, or enter a specific career further on in the life-course, particularly if care responsibilities are still present. This may explain why long-term carers experience a persistent gap in job hours in comparison to non-carers across the life-course, particularly from 16 to mid-life.

The disparities between long-term carers and non-carers decrease as state pension age approaches, where the difference in job hours decreases. This is unsurprising, as job hours naturally decrease closer to state pension age, as individuals are more likely to retire. However, there is still a considerable gap in job hours between long-term carers and non-carers later in life. This could indicate that providing long-term care may increase the likelihood of working part-time later in life, or retiring early (Civil Service Pensions, 2022, The Eurocare Team, 2024), due to the competing nature of work and care (Ansari-Thomas, 2024; Verbakel and Boot, 2024).

The gap between varied carers and non-carers is less pronounced, with varied carers working similar hours on average to non-carers up until 40 years old onwards. These results should, however, be approached with caution. The 'varied carer' group consists of a wide range of care patterns due to needing to maintain a sufficient sample size for analysis (Evans et al., 2024b). This means that there may be a large number of carers with shorter spells of caring occurring at different times across the life-course, that could not be picked up in this analysis. This could make it more difficult to detect differences between varied carers and non-carers if many varied carers also have long periods of not caring. However, there does appear to be a slight gap in job hours between varied carers and non-carers in later life, which could suggest that intermittent caring could have a negative impact on job hours around mid-life, when an individual is in their peak working years. This could lead to negative financial impacts as the loss of earnings is likely to be greatest at this stage in the life-course (Francis-Devine, 2024).

To address research question 2b, when analysing the different life-course employment trajectories across strata, two strata stand out as highlighting key differences between non-carers and varied carers. For the 'Long-term carers-Men-Degree-Asian-X' strata, job hours are much fewer earlier in the life course in comparison to the 'Non-carers-Men-Degree-Asian-X' strata, but this reverses post age 45 where long-term carers begin to work more hours on average. This could reflect long-term carers becoming more able to combine care with

employment later in the life-course due to having more experience providing care, as well as possibly having more time to put support in place (Sacco et al., 2023).

However, this demographic of non-carers beginning to work fewer hours than long-term carers later in the life-course could also reflect this demographic being more able to take early retirement; having a degree (possibly equating to higher earnings) and working greater number of hours earlier in the life-course may equate to having more saving and also a larger pension contribution (Cribb et al., 2024). This may not be the case for long-term carers hence they work more hours later in life.

For the 'Long-term Carers-Women-Degree-White-Z' strata, job hours are considerably lower than those of non-carers, and this increases over the life-course towards mid-life as shown in the plot. This is interesting as you may expect having a degree would increase job hours even for long-term carers, resulting in a more similar employment trajectory to non-carers. However, the impact of having a degree may not be as visible amongst strata of generation Z as most would have only recently received their degree, being the youngest generation included in the analysis.

This finding might be linked to the life stage of an individual, as being in generation Z and providing long-term care might indicate that these carers have been providing care since childhood, which usually means caring for a close relative such as a parent or sibling (NHS, 2024). This type of care may be particularly emotionally demanding, and demanding in terms of time, and being a young carer has been found to be disruptive to employment and future income (Letelier et al., 2024).

The employment trajectory for the ‘Women-Degree-Asian-X’ strata who are varied carers is steeper than for non-carers. This could represent the convergence in job hours as state pension age approaches; non-carers with degrees may be able to retire early due to having worked more hours over the life-course, and potentially having greater savings and pension contributions (Cribb et al., 2024).

For the 'Men-Degree-White-Z' strata, varied carers' job hours increase more steeply over the life-course than non-carers. This could again be related to points made previously about the life-course stage, where caring at a younger age may be more disruptive to employment due to the type of care being provided.

Although the discussion presents some possible explanations for the results, more research will be needed to explore intersectional differences in order to make confident claims that explain the findings. However, the findings still highlight some interesting policy considerations. Overall, the clearest trend from these results is that trajectories for carers (both long-term and varied) appear to be steeper (tilted upwards) than non-carers. This finding indicates that the disparities in job hours tend to be largest earlier in the life-course, suggesting that policy should focus on supporting carers at younger ages, earlier on into their experience of providing care. This may include education and promotion surrounding what support is available, as carers may not always be aware of what support they can receive (Carers UK, 2022c; Carers UK, 2023), particularly earlier on into recognising themselves as a carer.

When analysing the interactions, the effect of providing consistent care on trajectories of job hours over the life-course appears to be roughly the same for men and women. However, women work on average fewer job hours at the baseline level, meaning that on average, female carers work amongst the fewest hours in paid employment. This is consistent with societal trends that show women to be more likely to be out of the labour market as they are caring for the family and the home, and more likely to be working part-time roles in comparison to men (UK Women's Budget Group, 2021). This is also consistent with existing literature that finds female carers to be more likely to be working fewer hours (Carmichael and Charles, 2003; Evandrou and Glaser, 2003).

This is unsurprising, as women are more likely to be taking on higher intensity care roles (Petrillo, Bennett and Pryce, 2022), or combining care with other domestic tasks such as looking after children, earlier defined as being a part of the 'sandwich generation' (Ansari-Thomas, 2024; Pomeroy and Fiori, 2025). This may explain why in figure 5.5, the difference between job hours between men and women starts to increase around age 30 up until around age 45, as this could indicate a time in the life-course when women are having children who also require care. These factors compete for time (Sacco et al., 2023), leaving less time available for paid employment (Royal Economic Society, n.d.), explaining why female carers are amongst the demographic working the fewest hours. This may also mean that female carers are at the highest risk of financial insecurity through reduced income from paid employment. This is therefore important from a policy perspective as targeting policy measures effectively and providing more financial support for carers could help reduce gender inequalities related to income.

When investigating the interaction between care and ethnicity, the findings suggest that although there are not many obvious differences between ethnic groups due to the overlapping confidence intervals, there are some possible key differences. Within the 'varied' carers category, the White ethnic group appear to work significantly more hours on average than all other ethnic groups up until mid-life. This trend is also evident in the other care categories, but less pronounced and the confidence intervals have more overlap. It is difficult to say with certainty why this may be, as the varied category likely has a lot of variation within it. For example, it could be that White varied carers are providing fewer hours of care than other ethnic groups, hence making it easier to combine care with employment. Further research into ethnic differences that also takes into account care intensity will therefore be important.

Another interesting finding is that amongst long-term carers, the White ethnic group work the most hours per week until mid-life to state pension age where the differences between ethnic groups become minimal. The gap is particularly pronounced for Black long-term carers. This is important as it suggests there may be inequalities between ethnic groups in the relationship between care and employment throughout a large portion of the life-course. As these disparities are primarily during prime working years, and reduce as state pension age approaches, the loss of earnings through paid employment may be the highest during this period. According to these results, Black carers may therefore be at the highest risk of experiencing a reduction in earnings through reduced participation in paid employment during their prime working years. However, these results should be approached with caution as some overlapping confidence intervals make these findings difficult to analyse with certainty.

There may be multiple explanations for this finding. For example, some evidence suggests that some ethnic groups may have different cultural expectations (Carers UK, 2025b), for example, South Asian and Black Caribbean (Wells et al., 2025) particularly surrounding gender (Banks, 2022). If there are care needs in a family, it may be more normal in certain cultures to take on these caring responsibilities over paid employment, particularly for women. Additional care responsibilities may be more prevalent during the ages of 16 to 50, but particularly from late 20s onwards due to this being the ages that many individuals have dependent children who often live in the same household (Office for National Statistics, 2025). These competing demands may make it difficult to participate in as many hours of paid employment, explaining why Black long-term carers may work amongst the fewest hours up until mid-life. However, it

is perhaps surprising that this trend does not continue past approximately 55 years old, as many people in this age bracket have additional caring responsibilities for elderly parents, as well as potentially still having dependent children at home (Ansari-Thomas, 2024; Pomeroy and Fiori, 2025). It may be that there are more similarities between carers who are approaching state pension age, as they may be less likely to have dependent children living at home, or that job hours naturally decline as state pension age approaches for most demographics. This reinforces the influence that family characteristics may have on patterns of caring (Di Gessa and Deindl, 2024).

There is also evidence to suggest that ethnic minority carers in the UK, including Black carers, face greater barriers in accessing support services (Wells et al., 2025), for example respite care and benefits such as Carers' Allowance. This could be for a variety of reasons including language barriers making it difficult for some groups to access support if English is not their first language (Banks, 2022; Carers UK, 2025b; Greenwood et al., 2015; Wells et al., 2025), as well as lack of education on what support is available meaning some groups are not aware of what they are entitled to (Carers UK, 2023). This may make it more difficult for carers to work as many hours in paid employment, due to not having the same levels of support as other carers during their prime working years. Past prime working age, these factors may play less of a role, as job hours may decline after this stage in the life-course for a larger number of reasons that may be related to or un-related to care.

We therefore argue that more needs to be done to support carers from ethnic minorities, particularly during prime working years. Involving carers from minority groups in the co-production of services and support will be important in ensuring services are effective (Carers UK, 2023). Additional considerations should be made with ethnic minorities in mind, for example, ensuring documents, paperwork and information can be shared in a variety of languages, as well as having people available to help people navigate online web-pages and forms who are able to support people whose first language is not English (Banks, 2022; Carers UK, 2023; Carers UK, 2025b; Greenwood et al., 2015). More funding should be put into increasing cultural awareness, and improving the inclusivity of care services to achieve this. This will allow more carers from ethnic minority groups to access the support they need, which could in turn make it easier to combine care with employment, meaning they are not at a greater financial disadvantage during their prime working years.

We recognise that there are likely differences within the ethnic group categorisation used in this paper, meaning detail may have been missed (Race Disparity Unit and Race Equality Unit, 2020). For example, there are many different cultures, religions and experiences within categories such as 'Asian', that may all relate differently with caring. For example, some research suggests that the 'South Asian' and 'Black Caribbean' ethnic groups may put more of an emphasis on the expectation of familial caring (Wells et al., 2025). However, due to sample size issues, it was not possible to use smaller categories of ethnicity. Using smaller categories would have meant too large a proportion of strata would have been left empty, resulting in a lack of meaningful findings when conducting statistical analysis (Evans et al., 2024b). Further research could benefit from exploring ethnic and cultural differences in greater detail, for example, through qualitative studies.

Due to the large differences in types and lengths of care episodes within the varied carer group, it is difficult to make any claims about the reason behind White varied carers having higher predicted job hours up until mid-life. It may be that the White ethnic group consists of individuals with shorter, or less intensive caring episodes, which could put less strain on employment. It could also be that ethnicity intersects with other socio-demographic characteristics, with more individuals in this group having higher levels of education, and therefore more likely to be in higher paying roles that would hold a higher opportunity cost of reducing hours to care (Carmichael and Charles, 2003; Carmichael, Charles and Hulme, 2010; Miller and Sedai, 2022). However, this difference in job hours for White varied carers is not as pronounced for other levels of caring, making it difficult to determine whether this could be true.

When investigating the interaction between care and highest educational qualification (used as a measure of socioeconomic status), the findings suggest that having fewer educational qualifications has a greater negative relationship with job hours amongst long-term carers than for varied carers or long-term non carers, particularly below mid-life. Earlier in the life-course, there is evidence that many long-term carers with other or no qualifications are not in paid employment, particularly up until 30-35 years old. This indicates that long-term carers with a lower socioeconomic status are more likely to work the fewest hours in paid employment consistently across the life-course, but particularly during their prime working years and earlier in the life-course.

One explanation for this could be related to the opportunity cost of care and employment. For example, those of a lower socioeconomic status are less likely to be in higher management or leadership roles (Chartered Management Institute, 2022), roles that are often higher paid with less flexibility. Instead they may be more likely to be in more precarious employment, that is less well paid (Macmillan and Shanahan, 2021). As a result, the financial cost of giving up paid employment may not be as high as someone in a higher paid job (Carmichael and Charles, 2003; Carmichael, Charles and Hulme, 2010; Miller and Sedai, 2022). Similarly, financial support such as CA may be accessible to carers who have a lower income, due to a carer having to earn less than £196 to qualify for the benefit (Carers UK, 2025a). These factors may make the decision to leave paid employment or work fewer hours in order to provide care easier for some individuals, explaining why carers with no educational qualification work amongst the fewest hours consistently across the life-course.

The high number of long-term carers of low socioeconomic status who are out of the labour market up until 30-35 years old suggest that there may be a delay in entering paid employment for this group. Having fewer qualifications may make it more difficult to find a higher paying job, with many of the job options available being more precarious or less stable (Macmillan and Shanahan, 2021), which may make the decision to provide care over participating in paid employment easier if the foregone earnings would be less (Carmichael and Charles, 2003; Carmichael, Charles and Hulme, 2010; Miller and Sedai, 2022). Similarly, this group may have fewer financial resources to pay for additional support such as formal care services (Carers UK, 2019b; Watkins and Overton, 2024). This might mean that they have to take on most of the care responsibilities themselves, which could be emotionally and physically demanding, and leave them with less time available to participate in paid employment (Henz, 2004; Jacobs et al., 2015; Raiber, Visser and Verbakel, 2022; Sacco et al., 2023), particularly at younger ages when they may have less money saved up to pay for additional support, and less work experience to provide them with skills and experiences that could help them combine care and employment.

Overall this points to the need for greater support for younger carers, who are perhaps going through a transitional period in the life-course from childhood to adulthood where entering the labour market for the first time can be daunting for many people, let alone with additional care responsibilities (Robison, Inglis and Egan, 2020; Xue et al., 2023). Educating employers on how to support carers, and carers on knowing what support is available, such as unpaid leave (Carers UK, 2024a, 2024d; Hamblin, Heyes and Allard, 2024) and flexible working arrangements

(Legislation.gov.uk, n.d.), could help younger carers enter the workforce with more confidence and security. This could in turn increase their financial stability and provide them with work experience and skills that could help their employment pathways improve over the course of their life.

Conclusion

Key findings

There are several interesting findings from this research. Firstly, this research finds that unpaid care is negatively associated with paid employment, and that this is most pronounced for long-term carers, who work on average just over 7 fewer hours per week in comparison to non-carers. Secondly, the results show differences in average job hours across intersectional strata, and despite much of this variation being explained by fixed effects and two-way interactions between age and socio-demographic characteristics, some multiplicative effects remain.

More research is needed into explaining the intersectional relationship between socio-demographic characteristics including care, and its impact on job hours over the life-course. However, several strata with significant differences between similar socio-demographic characteristics but different levels of caring highlighted that long-term care tended to have a steeper (tilted upwards trajectory) where they worked fewer hours on average earlier in the life-course than non-carers but a greater number of hours later in the life-course.

The results reveal that the trajectories of job hours are similar for male and female carers, however, females have a lower baseline level of job hours, meaning female carers work on average the fewest hours. This reflects societal trends on gender roles (Carr et al., 2018; Pomeroy and Fiori, 2025; Watkins and Overton, 2024) and the gendered nature of caring and domestic labour (Carr et al., 2018; Pomeroy and Fiori, 2025; Watkins and Overton, 2024). Overall, there were no large differences between ethnic groups, however, up to around mid-life, Black long-term carers work amongst the fewest hours. This could be partly explained by cultural expectations or issues around accessing support services (Banks, 2022; Carers UK, 2025b; Greenwood et al., 2015; Wells et al., 2025). The results also find that carers with the fewest qualifications work the fewest hours consistently across the life-course, but particularly before mid-life, suggesting that low socioeconomic status is associated with reduced labour market participation. This could be explained by the opportunity costs of employment versus

care (Carmichael and Charles, 2003; Miller and Sedai, 2022), type of employment and workplace flexibility (Watkins and Overton, 2024), as well as access to benefits such as CA (Carers UK, 2025a). Overall, the disparities in job hours between socio-demographic groups diminish from mid-life to state pension age.

Policy suggestions

The findings of this analysis allude to there being insufficient support in place to allow carers to combine employment with care, particularly for certain demographic groups including women, certain ethnic groups, and those of a lower socioeconomic status, and particularly earlier in the life-course upon entry to the workforce and in prime working ages. This can result in widening social inequalities for already marginalised groups, through lack of income through paid employment. Insufficient support early in the life-course could also shape future pathways and trajectories of employment that could have knock-on effects to well-being later in life (Carers UK, 2019b). Policy therefore needs to address this, and should be co-produced alongside carers with lived experiences to have the most positive effect.

Firstly, we argue for carers to be able to access paid leave for up to ten days each year for reasons related to their caring responsibilities. This is in support of Carers UK who advocate for paid leave for carers, as an improvement to the Carers Leave Bill 2024 (Carers UK, 2024a, 2024d). The current Carers Leave allowance permits up to a week of unpaid leave (Hamblin, Heyes and Allard, 2024), whilst an important milestone in improving rights for carers, this is not satisfactory in its current state due to it being unpaid. Unpaid carers leave may exclude certain demographics from being able to access it. For example, those of low socio-economic status who rely on their income from paid employment may be financially disadvantaged by missing out on this income. This means that there are likely to be inequalities in being able to take leave, which may reinforce some of the inequalities already highlighted within this research. Increasing the reach and allowance of Carers Leave will help to mitigate some of these inequalities, and could subsequently make it easier for many carers to remain in paid employment whilst providing care, through allowing carers some additional flexibility within paid employment.

Whilst this could benefit carers at any stage in the life-course, it could particularly benefit younger carers, who are perhaps newly entering the workforce, as it could provide some reassurance that employment can be flexible around care responsibilities without there being

a risk of foregone earnings. It is also more accessible to younger carers of low socioeconomic status, who may have fewer savings or feel they have less job security. This policy would also continue to support carers throughout their prime working years. This could in turn reduce the number of carers who feel they have to leave the labour market or reduce their working hours in order to care, which could improve their long-term financial situation and allow them to have more choice over their career pathways over the course of their life (Alonso-Perez et al., 2024; Carmichael and Ercolani, 2016), which can in turn improve their quality of life as they enter the later stages of the life-course.

Secondly, improved access to respite services. Respite care can provide carers with a break from their caring responsibilities (Moultrie, Mallion and Taylor-Page, 2024; Samsi et al., 2022). These breaks from caring are important in taking some of the pressures of carers, which can in turn help to manage their mental and physical well being (NHS England, n.d.). Currently, the costs of respite care can be covered by a carers local council, following a needs and carer's assessment, or from a charity (NHS England, n.d.). We argue that respite services should be more accessible, through Carers' assessments being more generous in their eligibility criteria. We also suggest that there should be more education provided to ensure carers understand what they may be entitled to. This will allow more carers to access the services they need, including respite care. In turn we hope that this will support carers' well-being, making it easier for them to combine care and employment, and therefore not be at a financial disadvantage.

Increasing education surrounding support such as respite care could support carers who lack knowledge on what support is available, for many reasons including language and cultural barriers mentioned earlier (Banks, 2022; Carers UK, 2025b; Greenwood et al., 2015; Wells et al., 2025). This could help support minority carers enter the workforce earlier in the life-course, as well as provide the support and flexibility they might need to remain in the workforce across their prime working years. Again, this provides minority carers with more autonomy and choice over their employment trajectories due to having that additional support that could alleviate some of the time and well-being pressures they may face from combining multiple roles (Carers UK, 2019a; Hlebec, Monarres and Šadl, 2024; Verbakel and Boot, 2024).

Whilst this research focuses primarily on working carers, we do also recognise the value of care (Petrillo, Zhang and Bennett, 2024), and highlight that not all carers will be able to

combine work and care, or may not wish to do so. Since the results reinforce previous findings that carers work on average fewer hours in paid employment, and are therefore at financial disadvantage (Watkins and Overton, 2024), we also argue that financial support for carers who are unable to work should be improved. Improved access to Carer's Allowance would be a good start to reducing financial inequalities experienced by carers. We support the recent review of CA under the Labour government in 2025, that aims to increase CA to £83.30 from £81.90, with an increased weekly earning limit of £196 from £151, making it more accessible to more carers. However, the increase is small and not satisfactory in meeting the needs of carers (Carers UK, 2024c; Carers UK, 2025c). CA should continue to be reassessed in line with social and economic changes, to ensure it meets the needs of carers.

Improving financial support will ensure that carers who are unable to participate in paid employment will not be at a disadvantage either in their prime working years or later in the life-course. Increased financial support will alleviate immediate financial pressures faced by carers who may face additional costs (Watkins and Overton, 2024) whilst being unable to earn a sufficient income through paid employment. It will also ensure that carers who have not been able to contribute to their personal pension or save for later life (Carers UK, 2019b) as much as others who have been able to work consistently throughout the life-course, will not be financially disadvantaged in the later stages of the life-course. This ensures that carers in all stages of the life-course are considered and well supported, allowing for carers to have better health and well-being throughout their life.

Limitations

This study is not without limitations. Firstly, key detail may be missed in the re-categorisation of care into three, wide categories. Ultimately this was done as considering the nuances within care categories, such as care intensity (measured in the average hours of care provided per week), would have left insufficient numbers of individuals within each strata group. This would have resulted in it being difficult for the model to pick up on trends, resulting in a lack of findings (Evans et al., 2024b). It was therefore decided that this categorisation was suitable for this particular analysis, but we recognise nuances may be overlooked.

Secondly, MAIHDA is inherently descriptive and aimed at uncovering more general trends (Bell et al., 2024). Although this paper does not claim to be able to do any more than this, it is recognised that there are likely differences within strata that are unable to be captured in this

context. Finding a balance between sample size and also capturing key details is important in MAIHDA, and whilst this balance has been carefully considered, some key detail is likely missed.

Suggestions for future research

MAIHDA, and particularly longitudinal MAIHDA, are relatively new and unexplored methodologies in the field of adult social care. Future research could therefore benefit from developing these methodologies, and using them across this field. It would be interesting to see how findings compare transnationally, using other large panel studies.

This analysis has a small focus, looking at care only in terms of long-term or varied care. It would be interesting to explore care in greater depth, for example, considering care intensity in terms of hours of care provided per week. Additionally, treating time as time varying, rather than time invariant as this study does, would allow for an exploration of how different lengths of care episodes impact employment trajectories. This would allow us to gain a wider understanding of the relationship between care and employment from an intersectional perspective.

Finally, this paper incorporates care as a strata defining variable, and as fixed effects in the model. Future research could include care as random slopes at the higher levels of the model, rather than as a strata defining variable. This would allow the job hours of each intersectional strata to vary according to care. This would make an interesting methodological comparison to this study.

Chapter Six: Conclusion

This thesis has made a significant contribution to the field of adult social care research, specifically in the context of quantitative statistical methods. This final chapter presents a summary of the three key contributions: Firstly, the empirical contribution, where the findings of the analysis are summarised in relation to the existing literature and more nuanced findings are offered; secondly, the methodological contribution, where I discuss the use of a novel methodology and its strengths; finally, the contribution made through analysis of up-to-date data, where the importance of this is emphasised. The chapter concludes by suggesting recommendations for future research.

Empirical findings

Overall care-employment relationship (reinforcing findings from previous research)

Whilst many of the findings, particularly on the fixed effects, mirror findings reported in the previous literature (as referenced throughout chapters three to five), these are still significant contributions to the field as they show that issues highlighted over the past two decades and beyond remain important, despite changes in policy and legislation. The results presented in the thesis show that providing care (particularly when care is intensive, or continues for a substantial part of the life-course) is associated with working fewer hours in comparison with not being involved in caring. Carers, it seems, are still often unable to work full-time, despite policy developments introduced over the past two decades (as discussed in chapter four) to support and enable carers to work flexibly.

It is unclear why this is, and it has not been an aim of the thesis to explain this. In the UK, there is insufficient evidence on the impact of relevant policies or on up-take of relevant entitlements to determine how effective these policy changes have been. What is evident, however, is that more support is needed to enable carers to combine work and care.

Nuances in the care-employment relationship (new contributions)

The thesis highlights some novel findings, beyond the overall relationship noted above. In chapter three, whilst, overall, the models did not highlight any clear distinctions between strata groups as a result of multiplicative, higher order interaction effects, some interesting results emerged from the addition of two-way interaction terms (as they also do in chapter five). A key finding was that in generations X and Y high-intensity carers (providing 20+ hours

of care per week) worked on average significantly fewer hours than those providing less than 20 hours of care per week. This indicates that high intensity carers in their prime working years (late twenties to fifties) may be missing out on income derived from employment in years that are usually regarded as important for earning income, contributing to pension schemes and progressing in careers. This finding is further supported by the findings presented in chapter five, where the largest disparity in job hours was seen between ages 30-55. These findings may perhaps be expected as, overall, people are more likely to be in employment in these 'prime working years', hence a greater disparity between carers and non-carers (or carers caring at a lower intensity). Despite this, the findings highlight some of the difficulties carers may face, in terms of the financial implications of reducing work as a result of caring responsibilities.

A second key finding in chapter three is that high intensity carers with secondary school (GCSE or A-Level) or other educational qualifications work on average significantly fewer hours than others with the same qualifications who provide less care. There were some similarities in the analysis presented in chapter five, where overall, long-term carers with 'other' or no qualifications worked considerably fewer hours across the life-course than 'varied' or non-carers. Overall, this indicates that policy may need to focus on supporting carers who do not have a degree level qualification who may also be more at risk financially due to having fewer resources, such as savings, to fall back on.

In-line with existing research and wider understandings of care, the relationship between caring and employment was also found to be gendered, with high intensity female carers working on average fewer hours than any other group. Despite this, in the analysis presented in chapter three, the effect of caring on employment was greater for men , although this was not similarly evident in the findings discussed in chapter five.

Findings for ethnicity were considered in all chapters; these were unclear in parts, especially in the data discussed in chapter three. In chapter five, however, the data presented show that, compared to other ethnic groups, the White ethnic group worked on average more hours up to around age 50, a finding that applied particularly to the 'varied carer' group. The large variation in the length of care episodes and in the intensity of care provided in this group that was not measured in this analysis made it difficult to identify reasons for this. Compared to 'non-carers', 'varied' carers, and 'long-term' carers, carers in the Black ethnic group worked on

average fewer hours than all other ethnic groups up to around age 50. This indicates that there may be some disparities between ethnic groups that require policy attention.

Multiplicative effects were present in chapter five. This chapter highlights that there may be intersectional differences in the care-employment relationship, although the large amount of variation between the characteristics of these strata groups made it difficult to explain this variation, emphasising the need for further research. There was also evidence that employment trajectories differed across intersectional strata, with some strata differing significantly across differing levels of caring. Of the significant differences across caring, the disparities in job hours appeared to be greatest earlier in the life-course, suggesting that support should be focused on supporting carers earlier into the onset of caring. Whilst this thesis does not aim to explain the mechanisms behind these differences, it provides an important descriptive analysis of possible disparities in employment outcomes, which alongside further research (such as in-depth qualitative studies) can help gain a deeper understanding of how carers can best be supported.

Methodological contribution

A main contribution of the thesis is its use of emerging methodology. MAIHDA models specifically are an emerging method in adult social care research, with very few studies using MAIHDA in the field previously (Alonso-Perez et al., 2024; Pomeroy and Fiori, 2025). This study makes a notable methodological contribution in applying multilevel (longitudinal and MAIHDA) models to explore the care and employment relationship for the first time.

Longitudinal analysis

In chapter four the longitudinal multilevel approach marked a significant contribution through the use of 14 waves of data to highlight the care-employment relationship over time. This was the first analysis of its kind to use data from 2009/10 to 2022/23 to look at this relationship, allowing for new insight into an increasingly important aspect of UK society over the last decade and a half. The analysis is particularly interesting and important as this was a significant period of economic, social and political change in the UK. It is also useful from a policy perspective, as the findings provide further evidence of the persistent inequalities experienced by carers over a long period, making them an especially important group to consider how to better support. This will only be possible by gaining a better understanding of how policy has been useful (or not) to carers, as I discuss later in this chapter.

Use of random slopes

The use of random slopes with MAIHDA in chapters three and five is particularly novel. Using random slopes for care intensity (in which the strength of the relationship between care and employment is allowed to vary across different intensities of care for each strata) had not previously been done in the field of social care. Indeed, at the time chapter three was written, random slopes in MAIHDA had been used in only very few studies across all disciplines (e.g. Bell et al., 2024; Evans et al 2023). This research therefore sets an example of the sort of techniques that can be applied in adult social care and social science research more generally. It would be of interest, in future research, to examine whether using random slopes on a large dataset such as the Census of Population (Office for National Statistics) would make a difference to some of the findings, as the smaller size of the dataset used for high intensity care may have impacted the model's ability to run effectively or to subdivide variables such as ethnicity as much as would be ideal.

Use of new data

Another important contribution of this thesis is the use of up-to-date data to study the relationship between caring and employment, as much previous research was becoming somewhat dated. To my knowledge, the thesis is the only piece of work to include data from the most recent wave of the Understanding Society dataset to study the relationship between caring and employment. The most recent wave of data comes from 2022/23, allowing us to build on much previous work that used older sources, prior to much of the social, political and economic change seen in the UK in recent years (as discussed in chapter four).

Continued research in this field is important as the UK has seen much change and uncertainty in the past two decades. As highlighted throughout the thesis, but particularly in chapter four, events such as the global financial crisis, Brexit, the COVID-19 pandemic and more general political and economic uncertainty have had major societal impacts. Alongside this, we have seen change from the perspective of knowledge and information on the provision of unpaid care. Caring became the focus of a new question in the Census of Population in 2001 (Office for National Statistics, 2023b), allowing for a wider understanding of carers across regular data points.

Policy has also been implemented that may have had a direct or indirect impact on carers, including changes in employment law and practice regarding flexible working, workers' rights

and changes driven by responses to the Covid pandemic, as well as commitments made to improve the social care system, much of it set out in the Care Act 2014 which has subsequently been only partially implemented. The large scale changes and developments during the period of data collection and analysis in the thesis, makes the contribution made in it by using recent data to understand the nature of the caring and employment relationship, both currently and throughout the period, especially important.

Suggestions

Future research

Future research on this and related topics could benefit from adopting frameworks similar to those used in this thesis. In contemporary society, with statistical methods and technology more advanced than ever, research capabilities are broadening. In future, researchers will be able to use these advancements to improve and extend knowledge by applying techniques such as, and including, MAIHDA and longitudinal models in the field of social care. This will enable the study of more sophisticated and nuanced research questions and exploration of inequalities from new dimensions, including how the relationship between caring and factors such as participation in paid employment change over time and differ intersectionally.

Improving data

To fully exploit contemporary methodological developments, better data on carers is needed. The need for improved data has two main aspects: quality and quantity. To improve data quality, more questions about carers need to be asked in more datasets. This is something that has improved due to the campaigns that led to the Office for National Statistics adding a question about whether someone is an unpaid carer into the Census in 2001 (Office for National Statistics, 2023b). This vastly improved understanding of caring in the UK and allowed for many subsequent studies to explore questions about the experiences and characteristics of carers using large scale data for the first time. Continued campaigning for the inclusion of carers and additional questions on care in the UK's main datasets will be important in ensuring research on carers can reach its full potential. As one example, a question on carer-care recipient relationships could be added to datasets such as the Census, as this is an important topic that warrants further research.

However, even with more questions about carers, certain analysis will not be as impactful unless a larger number of carers are included in the data. Sample size in the datasets used will therefore be important and should be a key focus of data collection over the next decade.

Throughout the analysis used for this thesis it became evident that some questions in which I was initially interested could not be examined with enough certainty or depth as I had initially hoped. Upon running preliminary descriptive analysis, it was evident the small sample size (and number of empty strata), particularly for certain categories of care and ethnicity, would make it difficult for the models to detect differences (should they be present) between these groups.

This issue was particularly salient in chapter five, where the models were the most complex. There were a total of 210 empty strata in this chapter, leaving many groups excluded from analysis. Whilst this was preferred to collapsing groups into overly reductive categories, it is recognised that important information could consequently not be analysed. Larger datasets with a larger number of carers, from a range of socio-demographic groups, would enable these questions about these crucial nuanced differences to be more easily addressed. With large enough datasets, it may even be possible to expand the number of categories of variables such as ethnicity, as the five-category model used throughout this thesis has been criticised for failing to capture key differences within categories (Race Disparity Unit and Race Equality Unit, 2020). This will be important from a policy perspective as it allows inequalities to be identified so measures can be targeted effectively to minimise these.

Conducting similar analyses on large datasets, such as the Office for National Statistics Census (the most recent of which was not available at the time this thesis was written) will therefore be important. At the time of thesis submission, the Longitudinal Study (LS), derived from the Census, is due to be made available for analysis. This presents an opportunity for longitudinal research to be conducted on a dataset with a larger sample size, making it appropriate for examining trends over time and conducting MAIHDA analysis on. The main drawback of using the LS over Understanding Society is the ten year gap between data points, whereas Understanding Society has annual data points. Nevertheless, up-to-date analysis on such a powerful dataset will be key for future research.

Improving our understanding of policy effectiveness

This thesis has made some general policy recommendations throughout, including calling for improved access to respite care, flexible working arrangements, paid leave and improved Carer's Allowance (CA). These recommendations stem from a need to support those carers who work fewer hours (as evidenced in the results) and who are thus at a risk of loss of income likely to result in financial hardship. Some targeted measures were also suggested, such as co-production of support services with groups of carers who are the most likely to be working the fewest hours, or on whom care has a greater impact, such as women and certain ethnic minority groups. Providing better information and education through a range of mechanisms, such as through schools, workplaces and other institutions, and ensuring this is provided in a range of formats including in a variety of languages, are some of the measures that may help. However, based on the scope of this thesis it is difficult to go further than providing general recommendations, given that knowledge about policy outcomes is limited.

I argue that the government needs to commission a review of the successfulness of recently implemented policies. For example, finding out how much knowledge of what support is available (such as respite care, right to request flexible working and unpaid leave, as well as financial support) carers have, and whether carers take up this support. This will allow for a greater understanding of what carers have found helpful, and where policy has fallen short. Findings from research will then be more informative, as they can be situated in the context of the changing policy landscape allowing for more specific recommendations to be made. Policy can therefore be developed using this information, which will ultimately be more effective in supporting carers.

Not only should this improve carers' experiences, it could also have a positive side effect on economic productivity, in turn benefitting UK society as a whole. If carers were better supported to combine caring with employment, job hours would likely increase. This would in turn allow carers to experience better career opportunities and progression throughout their life-course. This would also mean an increase in tax contributions which would benefit society by allowing more money to be spent on public services. Similarly, if Carer's Allowance restrictions were changed, to allow people to work a greater number of hours but still claim the benefit, a smaller number of carers might leave employment or reduce working hours in order to qualify for Carer's Allowance. Carer's Allowance is important in helping to cover the additional costs of caring, and improving its access could not only prevent carers from

struggling financially, but ensure carers are still able to participate in paid employment. Overall this highlights the ways in which changes that benefit carers can also benefit the UK economy.

Concluding remarks

This chapter has evidenced the key contributions to knowledge that this thesis has made. The empirical contributions have allowed for comparisons to be made with findings in existing literature, highlighting that the same issues of care being, for many and especially those with the heaviest caring roles, incompatible with employment; such findings have been presented repeatedly over the last two decades and, as this thesis has shown still persist. I argue that by improving policy effectiveness, we can gain a better understanding as to whether policies that are implemented are utilised by carers and have a positive impact. This will allow policy recommendations to be made with greater certainty. The methodological contributions have paved the way for future research to follow. With better data, advanced techniques such as longitudinal and MAIHDA modelling should be applied in the field of adult social care to uncover inequalities experienced by carers. This will allow a more nuanced understanding of care and what shapes carers' experiences. The use of new data allowed for an up-to-date analysis to be conducted. Not only does this allow for comparisons to be made with existing research, it also allows for future research. Continued research on this topic will always be important, as it helps indicate whether changes have occurred over time, and how we can better support carers going forward to ensure they are not at a financial disadvantage due to their caring responsibilities impacting their capacity to work.

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Appendix

Chapter three figures and tables

Table 1 Model 3 results, using Understanding Society waves 14 (U Essex, 2024).

	Null		**Model 1**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
Predictors	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*
(Intercept)	22.18 ***	0.80	22.92 ***	0.78	29.72 ***	1.29	29.92 ***	1.24	29.41 ***	1.29	29.59 ***	1.32
Care intensity (ref: 0 hours)												
> 20 hours			-1.03 **	0.32	-1.05 **	0.32	-0.87 *	0.39	-0.94	0.48	-2.32 *	0.94
20+ hours			-9.75 ***	0.49	-9.69 ***	0.49	-9.43 ***	0.85	-9.58 ***	0.59	-6.93 ***	1.51
Sex (ref: Male)												
Female					-6.49 ***	0.85	-6.51 ***	0.82	-6.26 ***	0.84	-6.84 ***	0.87
Generation (ref: Boomer)												
X					7.75 ***	1.19	7.71 ***	1.12	7.69 ***	1.18	8.09 ***	1.22
Y					6.20 ***	1.22	5.97 ***	1.16	6.09 ***	1.21	6.65 ***	1.25
Z					3.28 **	1.27	3.09 *	1.23	3.17 *	1.26	3.63 **	1.30
Ethnicity (ref: White)												
Mixed					-0.44	1.35	-0.19	1.34	-0.10	1.36	-0.81	1.40
Asian					-5.01 ***	1.08	-4.66 ***	1.04	-4.60 ***	1.07	-5.53 ***	1.11
Black					-0.68	1.26	-0.51	1.23	-0.44	1.26	-0.47	1.31
Other					-5.64 **	2.15	-5.62 **	2.13	-5.41 *	2.15	-5.69 *	2.30
Highest educational attainment (ref: Degree)												
s-school					-5.33 ***	1.03	-6.10 ***	0.97	-5.42 ***	1.02	-5.12 ***	1.05
Other					-7.80 ***	1.30	-8.21 ***	1.25	-7.80 ***	1.29	-7.44 ***	1.34
None					-15.68***	1.34	-15.68 ***	1.29	-15.41***	1.34	-16.20***	1.39
Interactions between care and strata variables (ref: non-carer, for strata defining variables see above)												
> 20 hours * female											1.71 *	0.78
20+ hours * female											3.07 **	1.14
> 20 hours * gen x											-0.60	0.94
20+ hours * gen x											-3.15 *	1.34

> 20 hours * gen y					-0.64	1.11
20+ hours * gen y					-4.14 **	1.46
> 20 hours * gen z					-1.17	1.43
20+ hours * gen z					-1.90	2.31
> 20 hours * Mixed					2.41	2.61
20+ hours * Mixed					2.87	3.62
> 20 hours * Asian					3.01 *	1.24
20+ hours * Asian					3.73 *	1.68
> 20 hours * Black					0.02	2.17
20+ hours * Black					-1.72	2.51
> 20 hours * Other					1.01	6.21
20+ hours * Other					-3.68	6.30
> 20 hours * s-school					0.67	0.81
20+ hours * s-school					-5.04 ***	1.16
> 20 hours * Other					-0.06	1.63
20+ hours * Other					-4.51 *	1.95
> 20 hours * None					2.88	2.31
20+ hours * None					1.13	2.15
Random Effects						
L1 var (individual)	204.34	199.69	199.65	198.91	199.27	199.05
L2 var (strata intercept)	68.52 strata	64.43 strata	13.21 strata	14.17	14.19 strata	13.83 strata
L2 var (slope: care)				1.41 1-19 hours 19.07 20+ hours	3.48 Carer	0.84 Carer
Corr. random effects				-0.08 -0.56	-0.40 strata	-0.29 strata
ICC	0.25	0.24	0.06	0.07		
N	142 strata	142 strata	142 strata	142 strata	142 strata	142 strata
Observations	19065	18956	18956	18956	18956	18956
Marginal R^2 / Conditional R^2	0.000 / 0.251	0.016 / 0.256	0.164 / 0.216	0.168 / 0.224	0.159 / 0.215	0.168 / 0.222
AIC	155846.111	154517.622	154360.280	154336.242	154352.215	154274.928

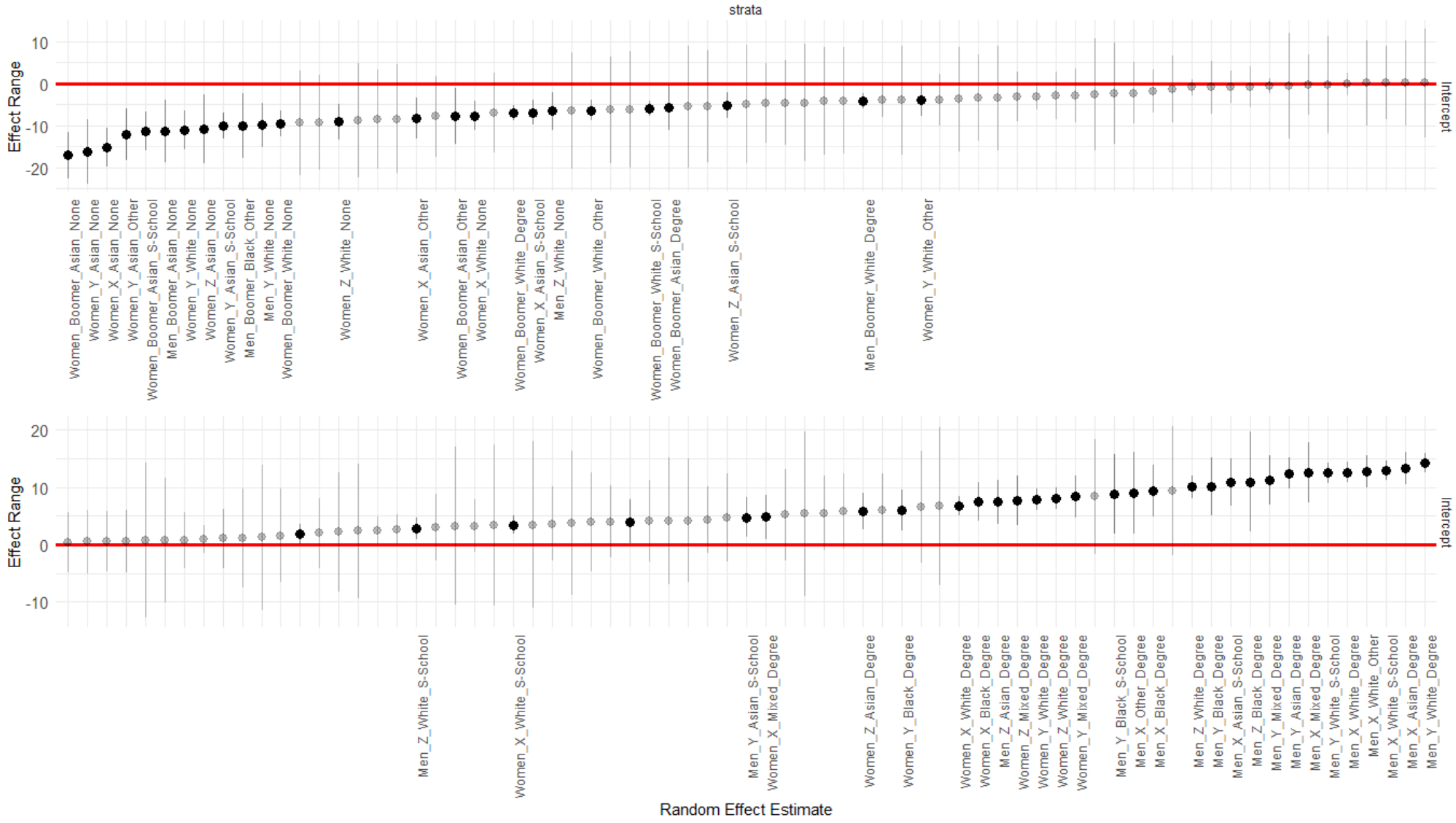

Figure 1 Random effect estimates (multiplicative and additive effects combined) by intersectional strata, model 1. Understanding Society wave 14 (U Essex, 2024).

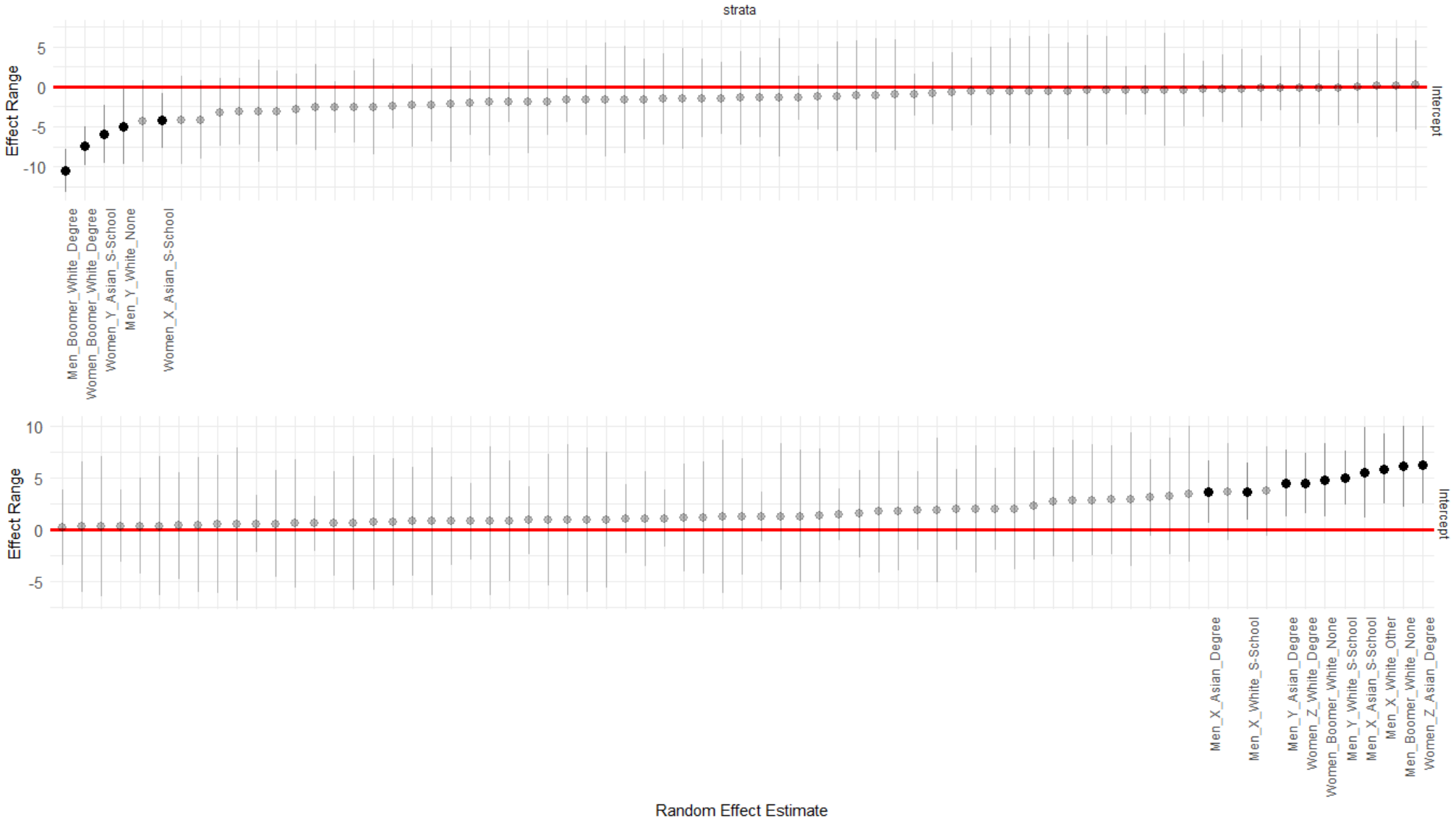

Figure 2 Random effect estimates (multiplicative effects net of additive effects) by intersectional strata, model 2. Understanding Society wave 14 (U Essex, 2024).

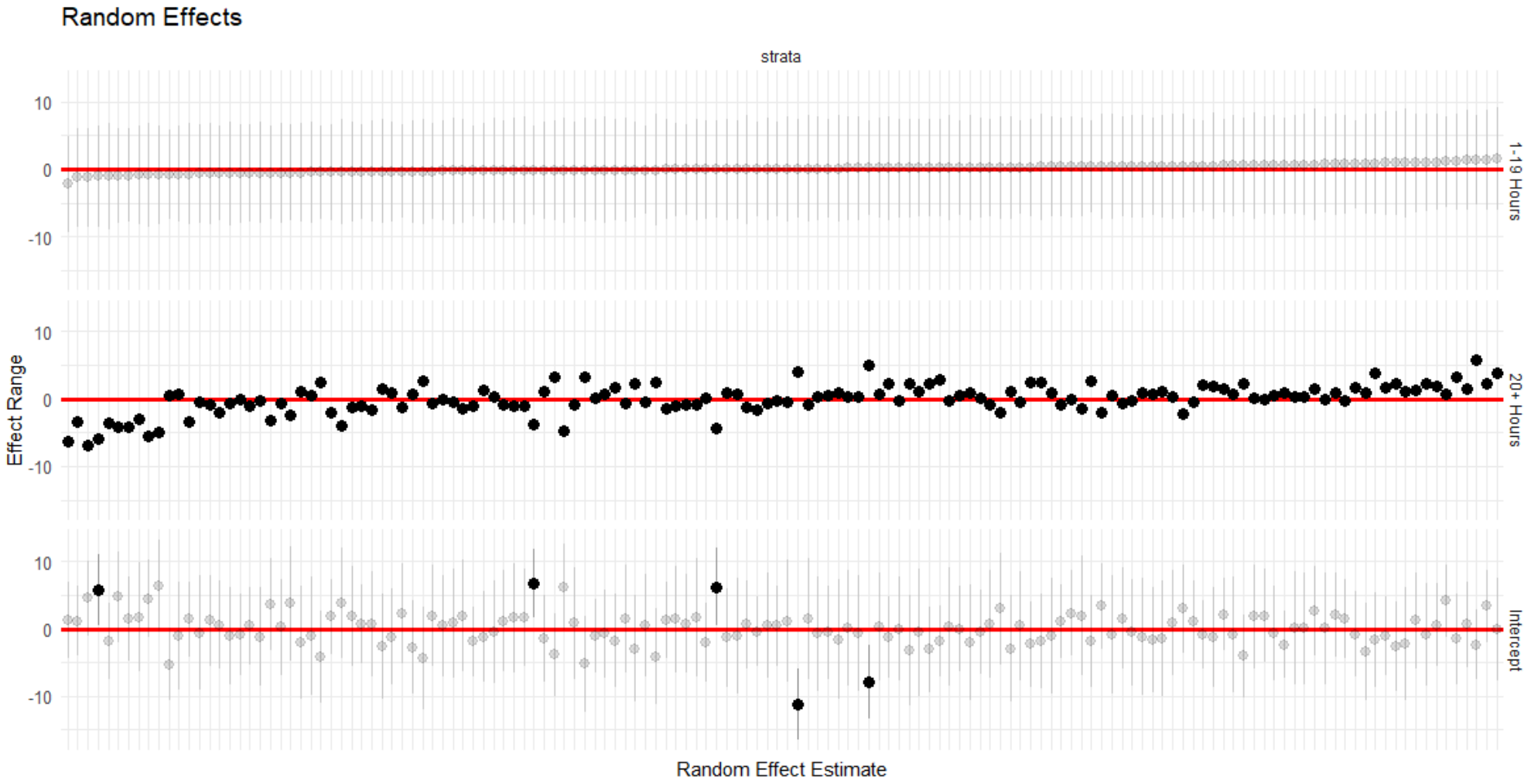

Figure 3 Random effect estimates by intersectional strata, model 3. For random intercepts, these are net of additive effects; for random slopes, these include both additive and multiplicative components. Understanding Society waves 1-14 (U Essex, 2024). Note that the model was unable to predict confidence intervals due to the small size of the effects /samples on high intensity carers.

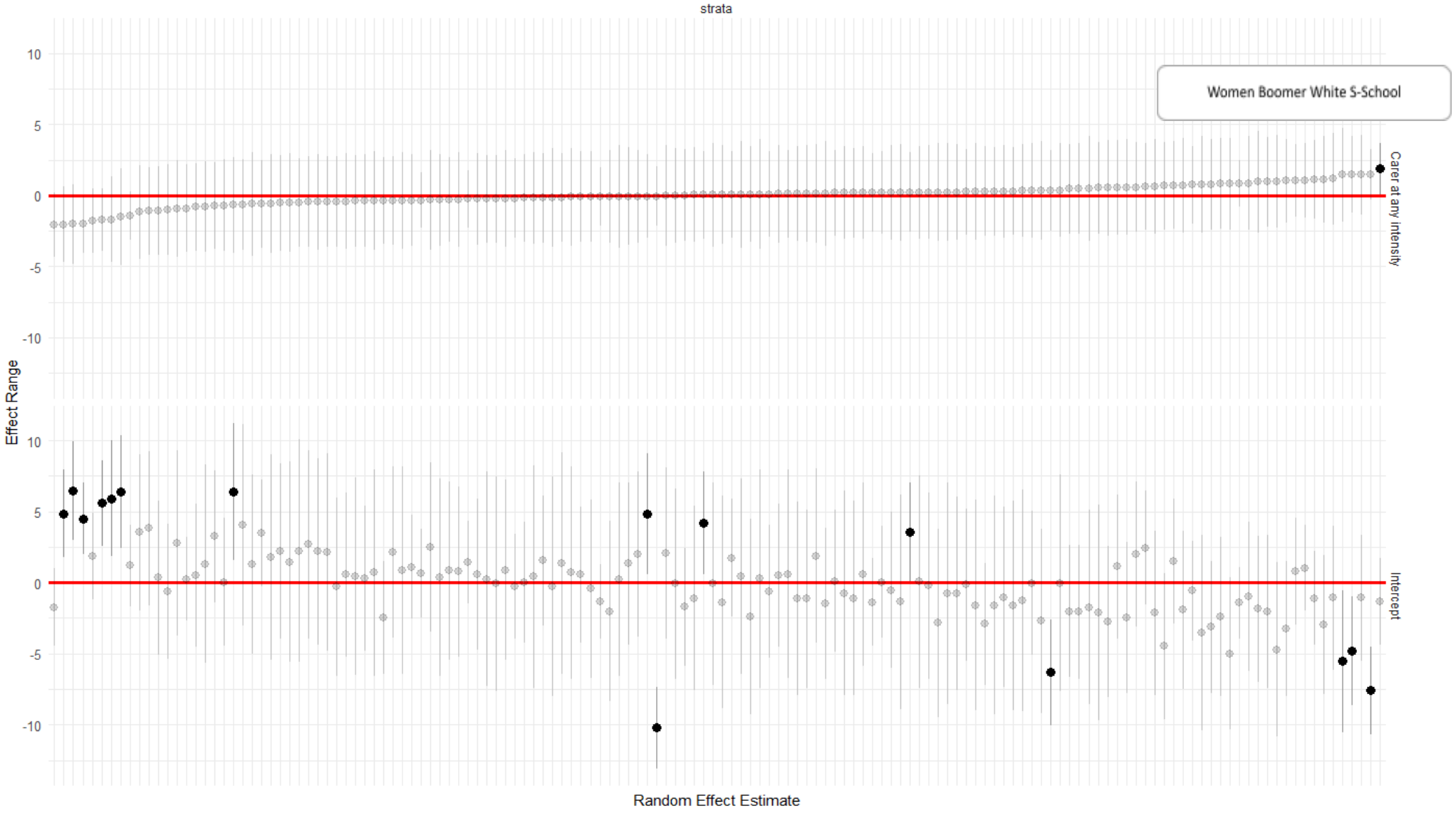

Figure 4 Random effect estimates by intersectional strata, model 4. For random intercepts, these are net of additive effects; for random slopes, these include both additive and multiplicative components. Understanding Society wave 14 (U Essex, 2024).

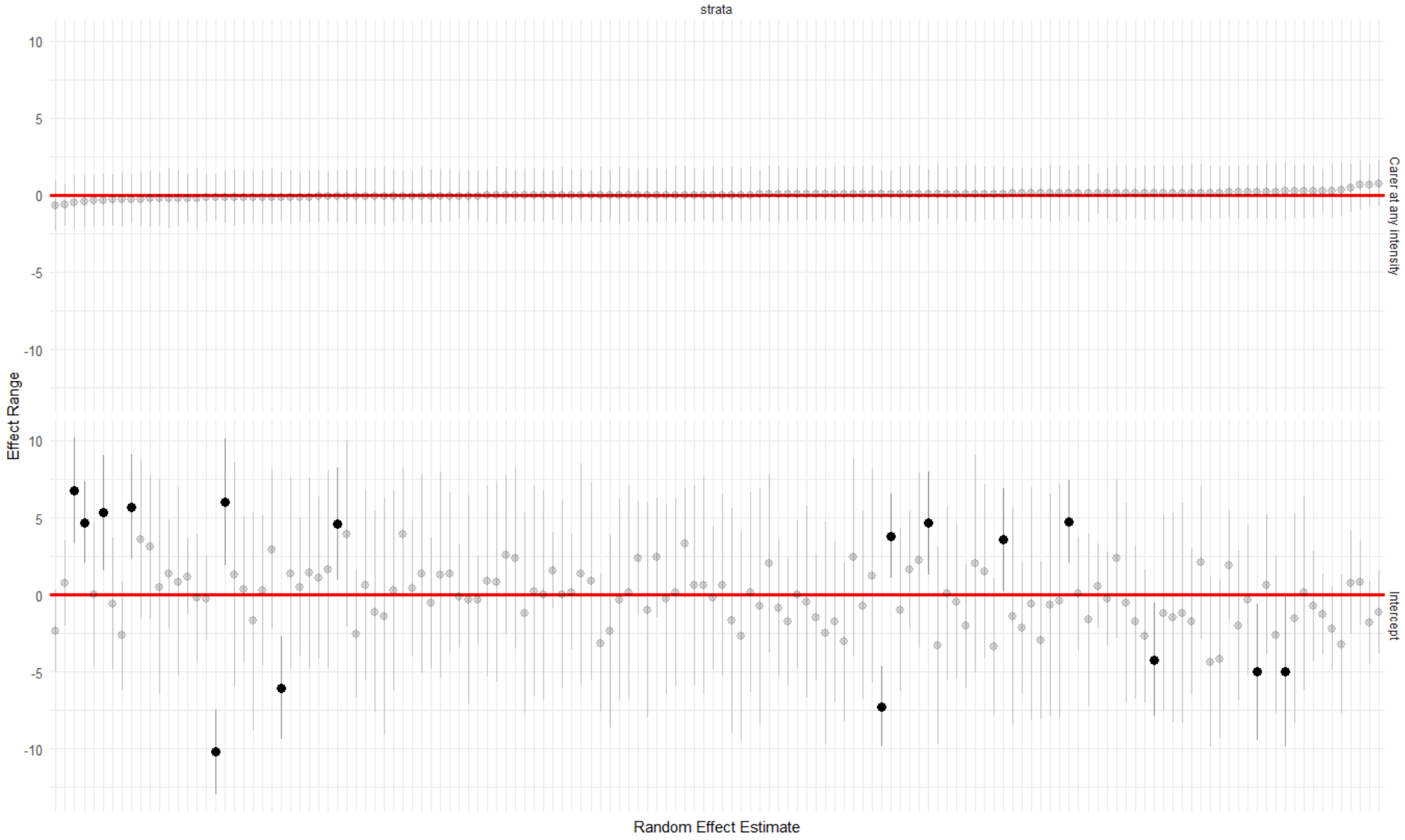

Figure 5 Random effect estimates (multiplicative effects net of fixed effects) by intersectional strata, model 5. Understanding Society wave 14 (U Essex, 2024).

Chapter four figures and tables

Table 2 Variables used in this research project. Full information can be found through the Understanding Society variable search: https://www.understandingsociety.ac.uk/documentation/mainstage/variables/ (U Essex, 2024).

Variable metadata			
Code	**Original label**	**New code**	**New label**
jbhrs: No. of hours normally worked per week. "How many hours, excluding overtime and meal breaks, are you expected to work in a normal week?"			
jbhrs	No. of hours normally worked per week	jbhrs	No. of hours normally worked per week
jbstat: Current labour force status			
-2	refusal	NA	NA
-1	don't know	NA	NA
1	self-employed	NA	NA
2	Paid employment(ft/pt)	1	In the labour market
3	Unemployed	0	Out of the labour market
4	Retired	0	Out of the labour market
5	On maternity leave	NA	NA
6	Family care or home	0	Out of the labour market
7	Full-time student	NA	NA
8	LT sick or disabled	NA	NA
9	Govt training scheme	NA	NA
10	Unpaid, family business	NA	NA
11	On apprenticeship	NA	NA
12	On furlough	NA	NA
13	Temporarily laid off/short term working	NA	NA
14	On shared parental leave	NA	NA
97	Doing something else	NA	NA
Aidhrs: hours per week spent caring			
-8	Inapplicable	0	Provides no care
-7	Proxy	NA	NA
-2	Refusal	NA	NA
-1	Don't know	NA	NA
1	0 - 4 hours per week	1	1-9 hours per week
2	5-9 hours per week	1	1-9 hours per week
3	10-19 hours per week	2	10-19 hours per week
4	20-34 hours per week	3	20+ hours per week
5	35-49 hours per week	3	20+ hours per week
6	50-99 hours per week	3	20+ hours per week
7	100 + hours per week/continuous	3	20+ hours per week
8	Varies under 20 hours	NA	NA
9	Varies over 20 hours	NA	NA

97	Other	NA	NA
Sex: Sex, derived			
-9	Missing	NA	NA
0	Inconsistent	NA	NA
1	Male	1	Male
2	Female	2	Female
Ethn_dv: Ethnic group (derived from multiple sources)			
-9	Missing	NA	NA
1	British/english/scottish/welsh/Ni	1	White
2	Irish	1	White
3	Gypsy or irish traveller	1	White
4	Any other white background	1	White
5	White and black caribbean	2	Mixed
6	White and black african	2	Mixed
7	White and asian	2	Mixed
8	Any other mixed background	2	Mixed
9	Indian	3	Asian
10	Pakistani	3	Asian
11	Bangladeshi	3	Asian
12	Chinese	3	Asian
13	Any other asian background	3	Asian
14	Caribbean	4	Black
15	African	4	Black
16	Any other black background	4	Black
17	Arab	5	Other
97	any other ethnic group	5	Other
Hhtype: household composition			
1	1 male, aged 65+, no children	1	Single adult, no children
2	1 female, age 60+, no children	1	Single adult, no children
3	1 adult under pensionable age, no children	1	Single adult, no children
4	1 adult, 1 child	2	Single adult & children
5	1 adult, 2 or more children	2	Single adult with children
6	Couple both under pensionable age, no children	3	Two adults, no children
8	Couple 1 or more over pensionable age, no children	3	Two adults, no children
16	2 adults, not a couple, both under pensionable age, no children	3	Two adults, no children
17	2 adults, not a couple, one or more over pensionable age, no children	3	Two adults, no children
10	Couple with 1 child	4	Two adults & children
11	Couple with 2 children	4	Two adults & children
12	Couple with 3 or more children	4	Two adults & children
18	2 adults, not a couple, 1 or more children	4	Two adults & children
19	3 or more adults, no children, excluding any couples	5	Three+ adults no children
22	3 or more adults, no children, excluding any couples	5	Three+ adults no children
20	3 or more adults, 1-2 children, including at least one couple	6	Three+ adults & children

21	3 or more adults, more than 2 children, including at least one couple	6	Three+ adults & children
23	3 or more adults, 1 or more children, excluding any couples	6	Three+ adults & children
Hiqual: Highest qualification, UKHLS & BHPS samples			
-9	Missing	NA	NA
-8	Inapplicable	NA	NA
1	Degree	1	Degree
2	Other higher degree	2	Other higher degree
3	A-level etc	3	A-level etc
4	GCSE etc	4	GCSE etc
5	Other qualification	5	Other qualification
9	No qualification	6	No qualification
Age: Age, in completed years, at the time of interview. Calculated from the date of birth held in the sample administration database and the interview date.			
Age	Age at the time of interview.	Agec	Age at the time of interview, centred.
Pidp: Personal identifier			
Unique identifier code for individuals.		Unique identifier code for individuals.	

Table 3 Full regression results table: men

	m1m		**m2m**		**m4m**		**m3m**		**m5m**	
Predictors	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*
(Intercept)	29.76***	0.09	29.15***	0.13	37.94***	0.23	28.96***	0.14	37.85***	0.24
Care provision (ref: 0 hours)										
1-9 hours	-0.43 **	0.13	-0.44 ***	0.13	-0.45 ***	0.13	1.13 **	0.40	0.20	0.38
10-19 hours	-1.71 ***	0.28	-1.75 ***	0.28	-1.88 ***	0.27	-0.99	0.92	-1.91 *	0.88
[20+ hours]	-5.20 ***	0.27	-5.28 ***	0.27	-5.51 ***	0.26	-3.59 ***	0.78	-4.57 ***	0.75
Wave (ref: wave 1)										
wave [w2]			0.06	0.14	0.06	0.13	0.05	0.15	0.04	0.14
wave [w3]			0.14	0.14	0.10	0.14	0.23	0.16	0.16	0.15
wave [w4]			0.25	0.15	0.21	0.14	0.33 *	0.16	0.23	0.15
wave [w5]			0.68 ***	0.15	0.58 ***	0.15	0.81 ***	0.16	0.64 ***	0.16
wave [w6]			0.85 ***	0.16	0.78 ***	0.15	1.02 ***	0.17	0.88 ***	0.16
wave [w7]			0.97 ***	0.15	0.90 ***	0.15	1.13 ***	0.16	0.97 ***	0.16
wave [w8]			1.05 ***	0.16	0.98 ***	0.16	1.23 ***	0.17	1.04 ***	0.17
wave [w9]			0.99 ***	0.16	0.91 ***	0.16	1.28 ***	0.17	1.06 ***	0.17
wave [w10]			1.18 ***	0.17	1.01 ***	0.17	1.38 ***	0.18	1.05 ***	0.18
wave [w11]			0.70 ***	0.17	0.54 **	0.17	1.03 ***	0.18	0.68 ***	0.18
wave [w12]			0.76 ***	0.17	0.52 **	0.18	1.17 ***	0.19	0.70 ***	0.19
wave [w13]			0.93 ***	0.18	0.66 ***	0.19	1.30 ***	0.19	0.78 ***	0.20
wave [w14]			1.83 ***	0.18	1.22 ***	0.18	2.23 ***	0.19	1.36 ***	0.19
Ethnicity (ref: White)										
ethn [Mixed]					-4.19 ***	0.57			-4.17 ***	0.57
ethn [Asian]					-4.00 ***	0.25			-3.99 ***	0.25
ethn [Black]					-6.13 ***	0.39			-6.11 ***	0.39
ethn [Other]					-5.08 ***	0.75			-5.06 ***	0.75
Household composition (ref: 1 adult, no children)										
1 adult					-7.03 ***	0.40			-7.05 ***	0.40
2 adults no child					1.25 ***	0.16			1.25 ***	0.16
2 adults & children					-0.88 ***	0.17			-0.88 ***	0.17
3+ adults, no child					1.49 ***	0.18			1.49 ***	0.18
3+ adults & children					-0.02	0.19			-0.02	0.19
Highest educational qualification (ref: Degree)										
[Other degree]					-0.29	0.29			-0.29	0.29
[A-levels]					-0.79 ***	0.23			-0.79 ***	0.23
[GCSEs]					-2.79 ***	0.24			-2.80 ***	0.24
[Other]					-4.35 ***	0.35			-4.36 ***	0.35
[None]					-11.87 ***	0.39			-11.87 ***	0.39
Age										
Age					0.17 ***	0.01			0.17 ***	0.01
Age squared					-0.03 ***	0.00			-0.03 ***	0.00
Interactions between care provision and wave (ref: 0 hours, w1)										
1-9 hours:w2							0.56	0.52	0.64	0.50
10-19 hours:w2							-1.75	1.22	-1.75	1.17
20+ hours:w2							-0.70	1.01	-0.54	0.97
1-9 hours:w3							-0.88	0.52	-0.57	0.50
10-19 hours:w3							-0.42	1.22	-0.17	1.17
20+ hours:w3							-1.17	1.01	-0.89	0.97
1-9 hours:w4							-0.68	0.54	-0.23	0.52
10-19 hours:w4							-0.31	1.28	0.23	1.23

20+ hours:[w4				-1.11	1.04	-0.82	1.00
1-9 hours:w5				-1.45 **	0.54	-0.72	0.52
10-19 hours:w5				0.34	1.28	0.93	1.23
20+ hours:w5				-1.29	1.09	-0.86	1.05
1-9 hours:w6				-1.48 **	0.55	-0.72	0.53
10-19 hours:w6				-0.72	1.28	-0.07	1.23
20+ hours:w6				-1.93	1.11	-1.48	1.07
1-9 hours:w7				-1.41 *	0.57	-0.67	0.56
10-19 hours:w7				-0.69	1.33	-0.24	1.28
20+ hours:w7				-1.33	1.09	-0.57	1.06
1-9 hours:w8				-1.63 **	0.58	-0.54	0.56
10-19 hours:w8				-0.26	1.27	0.64	1.23
20+ hours:w8				-2.08	1.10	-1.31	1.07
1-9 hours:w9				-2.63 ***	0.59	-1.31 *	0.57
10-19 hours:w9				-1.63	1.43	-0.54	1.38
20+ hours:w9				-2.52 *	1.17	-1.70	1.13
1-9 hours:w10				-1.98 **	0.61	-0.51	0.59
10-19 hours:w10				-0.87	1.36	0.62	1.31
20+ hours:w10				-1.49	1.14	-0.53	1.10
1-9 hours:w11				-3.29 ***	0.62	-1.62 **	0.60
10-19 hours:w11				-0.73	1.44	0.70	1.40
20+ hours:w11				-2.31 *	1.16	-0.95	1.12
1-9 hours:w12				-3.80 ***	0.62	-1.91 **	0.60
10-19 hours:w12				-3.26 *	1.52	-1.14	1.47
20+ hours:w12				-1.74	1.23	-0.24	1.20
1-9 hours:w13				-3.69 ***	0.67	-1.36 *	0.65
10-19 hours:w13				-0.03	1.54	2.09	1.49
20+ hours:w13				-3.79 **	1.25	-2.17	1.21
1-9 hours:w14				-3.65 ***	0.65	-1.25 *	0.63
10-19 hours:w14				-1.09	1.55	0.29	1.50
20+ hours:w14				-3.62 **	1.16	-1.74	1.12
Random Effects							
L1 var (observations)	92.07	91.88	86.33	91.75		86.32	
L2 var (individual)	178.78 $_{pidp}$	178.79 $_{pidp}$	140.19	179.09 $_{pidp}$		140.22	
Intraclass corr.	0.66	0.66	0.62	0.66		0.62	
No. observations	26243 $_{pidp}$	26243 $_{pidp}$	25695 $_{pidp}$	26243 $_{pidp}$		25695 $_{pidp}$	
Observations	115832	115832	114660	115832		114660	
Marginal R^2 / Conditional R^2	0.002 / 0.661	0.003 / 0.662	0.140 / 0.672	0.004 / 0.663		0.139 / 0.672	
AIC	903893.476	903748.399	883490.958	903632.462		883467.226	

** p<0.05 ** p<0.01 *** p<0.001*

Table 4 Full regression results table: Female

	m1w		**m2w**		**m4w**		**m3w**		**m5w**	
Predictors	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*
(Intercept)	21.81 ***	0.08	20.96 ***	0.11	35.10 ***	0.20	20.92 ***	0.11	35.11 ***	0.20
Care provision (ref: 0 hours)										
1-9 hours	-0.52 ***	0.09	-0.57 ***	0.09	-0.61 ***	0.09	-0.00	0.28	-0.56 *	0.27
10-19 hours	-1.83 ***	0.17	-1.91 ***	0.17	-1.87 ***	0.17	-1.93 ***	0.55	-2.32 ***	0.53
[20+ hours]	-4.31 ***	0.16	-4.54 ***	0.16	-4.34 ***	0.15	-4.99 ***	0.42	-4.73 ***	0.40
Wave (ref: wave 1)										
wave [w2]			-0.01	0.11			-0.09	0.12	-0.17	0.11
wave [w3]			-0.05	0.11			-0.07	0.12	-0.18	0.12
wave [w4]			0.13	0.11			0.09	0.13	-0.09	0.12
wave [w5]			0.54 ***	0.12			0.52 ***	0.13	0.29 *	0.12
wave [w6]			0.79 ***	0.12			0.72 ***	0.13	0.40 **	0.13
wave [w7]			0.91 ***	0.12			0.95 ***	0.13	0.66 ***	0.13
wave [w8]			1.33 ***	0.12			1.39 ***	0.13	1.00 ***	0.13
wave [w9]			1.46 ***	0.12			1.58 ***	0.14	1.12 ***	0.14
wave [w10]			1.68 ***	0.13			1.82 ***	0.14	1.31 ***	0.14
wave [w11]			1.83 ***	0.13			1.98 ***	0.14	1.35 ***	0.15
wave [w12]			1.89 ***	0.14			2.05 ***	0.15	1.31 ***	0.15
wave [w13]			2.14 ***	0.14			2.27 ***	0.15	1.40 ***	0.16
wave [w14]			3.04 ***	0.14			3.23 ***	0.15	2.03 ***	0.15
Ethnicity (ref: White)										
ethn [Mixed]									-1.40 **	0.44
ethn [Asian]									-6.26 ***	0.21
ethn [Black]									-1.24 ***	0.30
ethn [Other]									-5.10 ***	0.62
Household composition (ref: 1 adult, no children)										
1 adult									-9.71 ***	0.18
2 adults no child									-0.43 **	0.14
2 adults & children									-8.49 ***	0.15
3+ adults, no child									-1.76 ***	0.15
3+ adults & children									-4.98 ***	0.16
Highest educational qualification (ref: Degree)										
[Other degree]									-2.32 ***	0.23
[A-levels]									-3.25 ***	0.19
[GCSEs]									-7.01 ***	0.19
[Other]									-9.42 ***	0.30
[None]									-15.53***	0.30
Age										
Age					0.03 ***	0.01			0.03 ***	0.01
Age squared					-0.02 ***	0.00			-0.02 ***	0.00
Interactions between care provision and wave (ref: 0 hours, w1)										
1-9 hours:w2							0.65	0.36	0.76 *	0.35
10-19 hours:w2							0.34	0.72	0.41	0.69
20+ hours:w2							0.08	0.54	-0.19	0.52
1-9 hours:w3							-0.15	0.36	-0.02	0.35
10-19 hours:w3							-0.11	0.72	-0.18	0.69
20+ hours:w3							0.88	0.57	0.53	0.54

1-9 hours:w4				-0.19	0.38	0.12	0.36
10-19 hours:w4				0.55	0.73	0.73	0.70
20+ hours:[w4				0.96	0.58	0.62	0.56
1-9 hours:w5				-0.52	0.38	-0.21	0.37
10-19 hours:w5				0.42	0.76	0.77	0.73
20+ hours:w5				1.26 *	0.58	0.98	0.56
1-9 hours:w6				-0.24	0.39	0.17	0.37
10-19 hours:w6				1.03	0.75	1.25	0.72
20+ hours:w6				1.24 *	0.60	0.97	0.58
1-9 hours:w7				-0.63	0.40	-0.17	0.38
10-19 hours:w7				0.02	0.79	0.30	0.76
20+ hours:w7				0.69	0.60	0.46	0.58
1-9 hours:w8				-0.73	0.41	-0.17	0.39
10-19 hours:w8				-0.11	0.79	0.44	0.76
20+ hours:w8				0.25	0.60	0.10	0.58
1-9 hours:w9				-0.94 *	0.41	-0.31	0.40
10-19 hours:w9				-0.91	0.83	-0.19	0.80
20+ hours:w9				0.10	0.62	-0.00	0.60
1-9 hours:w10				-1.18 **	0.43	-0.35	0.41
10-19 hours:w10				-0.86	0.85	0.01	0.82
20+ hours:w10				-0.00	0.62	-0.02	0.60
1-9 hours:w11				-1.51 ***	0.43	-0.49	0.42
10-19 hours:w11				-0.49	0.88	0.37	0.85
20+ hours:w11				0.45	0.64	0.66	0.62
1-9 hours:w12				-1.65 ***	0.44	-0.50	0.43
10-19 hours:w12				-0.09	0.95	1.03	0.92
20+ hours:w12				0.33	0.67	0.65	0.65
1-9 hours:w13				-1.46 **	0.47	-0.10	0.45
10-19 hours:w13				0.14	0.96	1.07	0.93
20+ hours:w13				0.53	0.70	1.05	0.68
1-9 hours:w14				-1.53 ***	0.46	-0.09	0.44
10-19 hours:w14				-0.44	0.92	0.70	0.88
20+ hours:w14				-0.43	0.64	0.10	0.62
Random Effects							
L1 var (observations)	80.06	79.56	74.75	79.53		74.76	
L2 var (individual)	169.71 $_{pidp}$	168.50 $_{pidp}$	124.01	168.48 $_{pidp}$		123.96	
Intraclass corr.	0.68	0.68	0.62	0.68		0.62	
No. observations	33368 $_{pidp}$	33368 $_{pidp}$	32571	33368 $_{pidp}$		32571	
Observations	162849	162849	160934	162849		160934	
Marginal R^2 / Conditional R^2	0.003 / 0.681	0.007 / 0.682	0.178 / 0.691	0.007 / 0.682		0.178 / 0.691	
AIC	1246653.019	1245663.491	1214022.699	1245641.391		1214050.324	

** p<0.05 ** p<0.01 *** p<0.001*

Chapter five tables and figures

Figure 6 [1] Full model building process (where numbers represent models included in the main analysis).

Model a is a null model, where job hours is the outcome variable, there are no control variables in the fixed part, with individual random effects. Where: β0 = the intercept, u_{0j}= j represents level 2 (individual) random effects, ε_{ij}= the error for repeated observations over time nested in individuals.

$$JobHours_{ijk} = \beta 0 + (u_{0j} + \varepsilon_{ij})$$

Model b is a null model, where job hours is the outcome variable. Again there are no control variables in the fixed part, with individual and strata random effects. This allows us to identify the initial variation in job hours across intersectional strata. Where: v_{0k}= k is the level 3 (strata) random effects and ε_{ijl}= the error for repeated observations over time, nested in individual, nested in strata.

$$JobHours_{ijk} = \beta 0 + (u_{0jk} + v_{0k} + \varepsilon_{ijk})$$

Model c adds age and age squared into the fixed part of the model. This is done to account for differences in job hours related to age, and to account for the fact that the age variable is non-linear.

$$JobHours_{ijk} = \beta 0 + \beta 3 Age_{ijk} + \beta 4 Age^{2}_{ijk} + (u_{0jk} + v_{0k} + \varepsilon_{ijk})$$

Model 1 adds age cubed into the fixed part of the model. This is done to identify whether adding this term improves the model fit, in order to identify whether the overall age trajectory takes a cubic (or potentially higher order) polynomial form.

$$JobHours_{ijk} = \beta 0 + \beta 1 Age_{ijk} + \beta 2 Age^{2}_{ijk} + \beta 3 Age^{3}_{ijk} + (u_{0jk} + v_{0k} + \varepsilon_{ijk})$$

Model d adds care into the fixed part of the model to account for differences in job hours related to propensity for providing care over the life-course.

$$JobHours_{ijk} = \beta 0 + \beta 1 CareConst_{k} + \beta 2 CareVaries_{k} + \beta 3 Age_{ijk} + \beta 4 Age^{2}_{ijk} + \beta 5 Age^{3}_{ijk} + (u_{0jk} + v_{0k} + \varepsilon_{ijk})$$

Model 2 adds the remaining strata variables as main effects into the fixed part of the model. This is done to identify how much of the relationship between care and job hours can be

explained by socio-demographic variables. Where $\beta_m X_{ijmk}$ represents the strata defining variables, including care, generation, sex, ethnicity and highest educational qualification (*note that care is now represented in the X term).

$$JobHours_{ijk} = \beta 0 + \beta 1 Age_{ijk} + \beta 2 Age^2_{ijk} + \beta 3 Age^3_{ijk} + \sum_{m=1}^{M} A_m X_{mk} + (u_{0jk} + v_{0k} + \varepsilon_{ijk})$$

Model e adds two-way interactions between care and the other strata variables. This was done to explore the multiplicative nature of the variables in more depth. This allows us to see how much of the variation between strata is explained by two-way interactions between care and socio-demographic variables (whether the relationship between the strata variables is additive or multiplicative), helping to answer research question 1c. Here, ϑ represents the two-way interaction effects between X_{jk} and providing consistent care, and φ represents the two-way interaction effects between X_{jk} and providing on and off care, where X includes sex, generation, ethnicity and highest educational qualification.

$$JobHours_{ijk} = \beta 0 + \beta 1 Age_{ijk} + \beta 2 Age^2_{ijk} + \beta 3 Age^3_{ijk} + \sum_{m=1}^{M} A_m X_{mk}$$
$$+ \sum_{m=1}^{M-2} \vartheta_m (X_{mk} CareConst_k) + \sum_{m=1}^{M-2} \varphi_m (X_{mk} CareVaries_k) + (u_{0jk} + v_{0k} + \varepsilon_{ijk})$$

Model f adds random slopes for the linear age component to the strata level only. This allows the relationship between care and job hours across intersectional strata to vary across age. Where: $u_{1l} Age_{il}$ represents the random slopes for the linear age component at the strata level. Interactions are removed in this model.

$$JobHours_{ijk} = \beta 0 + \beta 1 Age_{ijk} + \beta 2 Age^2_{ijk} + \beta 3 Age^3_{ijk} + \sum_{m=1}^{M} A_m X_{mk}$$
$$+ (u_{0jk} + v_{0k} + v_{1k} Age_{ijk} + \varepsilon_{ijk})$$

Model 3 adds random slopes for the linear age component to the strata and individual level. This allows the relationship between care and job hours across individuals to vary for age. Interactions are removed in this model.

$$JobHours_{ijk} = \beta 0 + \beta 1 Age_{ijk} + \beta 2 Age^2_{ijk} + \beta 3 Age^3_{ijk} + \sum_{m=1}^{M} A_m X_{mk}$$
$$+ (u_{0jk} + u_{1j} Age_{ijk} + v_{0k} + v_{1k} Age_{ijk} + \varepsilon_{ijk})$$

Model 4 adds two-way interactions between care and the other strata variables back into the model. This allows the proportion of the strata variance that is explained by care-strata interactions to be calculated using the slopes PCV.

$$JobHours_{ijk} = \beta 0 + \beta 1 Age_{ijk} + \beta 2 Age^{2}_{ijk} + \beta 3 Age^{3}_{ijk} + \sum_{m=1}^{M} A_m X_{mk}$$
$$+ \sum_{m=1}^{M-2} \vartheta_m (X_{mk} CareConst_k) + \sum_{m=1}^{M-2} \varphi_m (X_{mk} CareVaries_k)$$
$$+ (u_{0jk} + u_{1j} Age_{ijk} + v_{0k} + v_{1k} Age_{ijk} + \varepsilon_{ijk})$$

Model 5 adds two-way age interactions for the strata variables. This allows us to identify whether socio-demographic characteristics interact with age. Here, ω represents the two-way interaction effects between X_{jk} and Age, where X includes sex, generation, ethnicity and highest educational qualification. Here, ω represents the two-way interaction effects between X_{mk} and Age, where X includes all the strata defining variables.

$$JobHours_{ijk} = \beta 0 + \beta 1 Age_{ijk} + \beta 2 Age^{2}_{ijk} + \beta 3 Age^{3}_{ijk} + \sum_{m=1}^{M} A_m X_{mk}$$
$$+ \sum_{m=1}^{M-2} \vartheta_m (X_{mk} CareConst_k) + \sum_{m=1}^{M-2} \varphi_m (X_{mk} CareVaries_k) + \sum_{n=1}^{M} \omega_m (X_{mk} Age_{ijk})$$
$$+ (u_{0jk} + u_{1j} Age_{ijk} + v_{0k} + v_{1k} Age_{ijk} + \varepsilon_{ijk})$$

Model g: Three-way interactions between age-care-additional strata variables were added however the AIC score increased indicating that adding three-way interactions did not improve model fit. The trajectories were also plotted using this model and they looked much the same as those plotted with model 6, hence the inclusion of three-way interactions was not deemed justifiable.

---

[1] Confusion arises where care is included in the models as its own model terms whilst simultaneously a strata defining variable. Care is added to the models in model d whereas the rest of the strata variables (sex, ethnicity, socio-economic status and generation) are added in model 2. To avoid the confusion of having separate terms for care and the rest of the strata variables, the care variable has been included in the 'X_{mk}' term in model 2, hence it is no longer represented as '$\beta 1 CareConst_k + \beta 2 CareVaries_k$ ' as it was in model d.

In model e, 4 and 5, interactions between care (ϑ and φ) the additional strata defining variables (X, which includes sex, generation, ethnicity and highest educational qualification) were added. To get around the difficulty of care being included in the X term, '$M - 2$' is used in the following terms: $\sum_{m=1}^{M-2} \vartheta_m (X_{mk} CareConst_k)$ and $\sum_{m=1}^{M-2} \varphi_m (X_{mk} CareVaries_k)$. This is done to express that X in these terms now represents only sex, generation, ethnicity and highest educational qualification, with the '-2' representing the removal of the two care terms (CareConst and CareVaries) from X.

Commentary on model building process:

From model three onwards, the models experience some convergence issues. The 'lmer' package in R is however, sensitive to convergence issues, particularly when models become complex and contain a large number of parameters, so this is maybe expected. The issue surrounding the increasing variance once care*strata interactions are added (as mentioned in chapter five page 153) does not appear to be related to the convergence issues, since model e (where care*strata interactions are first introduced) does converge. The convergence issues appear to be related to the addition of random slopes, which is perhaps unsurprising as this adds complexity to the model. As a result, it was decided that the care*strata interactions were a valuable addition to model 5 as they meant plots 4.6-4.9 were able to be created. The change in variance was also much smaller between model 4 and model 5, and the introduction of some statistically significant coefficients for the interaction terms meant that the concerns surrounding the care*strata interaction were not as significant in model 5 as in model e, hence the inclusion of model 5 in the main results table.

It is recognised, however, that there may be some issues with these models in terms of the specific details and outcomes. Despite this, the overall patterns and story remains important, and the results overall look as you may expect, which reduces concern surrounding these issues addressed in this section. It may be (as is pointed out in chapter six), that better data is needed to conduct analysis of this kind for the 'lmer' package to work more effectively. Running similar analyses on larger datasets would also act as a good comparison for these results, to see whether the outcomes remain similar.

I do want to emphasise that this discussion around concerns with the models does not take away from the importance of the analysis and its findings. It is, however, important to be aware of the fact that no statistical model will be perfect, and this research is no exception. The decision making process in this chapter has been done carefully to ensure all decisions made had meaning and added value to the analysis, in order to best answer the research questions.

Table 5 Regression results with interaction terms included.

	Model 1		Model 2		Model 3		Model 4		Model 5	
Predictors	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*
(Intercept)	30.16 ***	0.50	41.74 ***	0.71	48.75 ***	1.06	47.96 ***	1.39	46.80 ***	1.30
Age, centred										
Age	-0.05 ***	0.01	-0.05 ***	0.01	0.05	0.05	0.05	0.05	-0.27 ***	0.07
Age squared	-0.04 ***	0.00	-0.04 ***	0.00	-0.05 ***	0.00	-0.05 ***	0.00	-0.05 ***	0.00
Age cubed	-0.00 ***	0.00	-0.00 ***	0.00	-0.00 ***	0.00	-0.00 ***	0.00	-0.00 ***	0.00
Care provision: ref = Continuous non-carer										
Long-term care			-6.08 ***	0.88	-7.06 ***	1.20	-8.74 *	3.78	-8.43 *	3.62
Varied care			-2.62 ***	0.61	-2.78 **	0.86	-2.66	2.05	-2.50	1.89
Ethnicity: ref = White										
Mixed			-1.82	1.00	-3.88 **	1.41	-2.76	2.01	-2.01	1.88
Asian			-3.24 ***	0.72	-3.94 ***	1.01	-3.20 *	1.51	-2.95 *	1.39
Black			-2.11 *	0.89	-4.42 ***	1.24	-2.59	1.81	-1.46	1.67
Other			-3.83 **	1.48	-5.55 **	2.02	-3.92	2.77	-4.18	2.65
Generation: ref = Boomer										
X			1.41	0.79	15.15 ***	1.40	18.36 ***	1.82	19.29 ***	1.88
Y			3.25 ***	0.66	12.01 ***	1.10	13.21 ***	1.49	15.96 ***	1.48
Z			-0.97	0.55	5.40 ***	0.80	5.82 ***	1.13	8.58 ***	1.08
Highest educational attainment: ref = Degree										
S-School			-2.43 ***	0.65	-5.48 ***	0.92	-4.54 **	1.41	-4.14 **	1.30
Other			-5.73 ***	0.87	-10.03 ***	1.20	-7.62 ***	1.81	-6.38 ***	1.67
None			-8.74 ***	1.03	-13.17 ***	1.42	-11.22 ***	2.08	-9.98 ***	1.93
Sex: ref = Men										
Women			-8.05 ***	0.56	-9.94 ***	0.79	-10.10 ***	1.18	-9.43 ***	1.09
Interactions between care and strata variables, ref = as above										
Carer*Women							-0.53	2.36	-0.40	2.18
Varies*Women							0.98	1.72	0.87	1.58
Carer*Mixed							-0.10	6.08	0.50	5.83
Varies*Mixed							-2.41	2.92	-2.95	2.71
Carer*Asian							2.53	3.17	2.13	2.98
Varies*Asian							-2.60	2.17	-2.30	1.98
Carer*Black							-4.91	4.24	-5.07	4.01
Varies*Black							-2.83	2.62	-3.01	2.42
Carer*Other							0.54	6.80	1.22	6.61
Varies*Other							-4.08	4.35	-3.49	4.16
Carer*gen x							-17.20 *	8.12	-15.86 *	7.92
Varies*gen x							-5.80 *	2.87	-5.18	2.70
Carer*gen y							-7.40	6.25	-6.13	6.07
Varies*gen y							-2.36	2.35	-1.83	2.18

Carer*gen z				-2.30	3.44	-1.83	3.31
Varies*gen z				-0.45	1.72	0.04	1.60
Carer*S-School				-2.18	2.69	-1.96	2.49
Varies*S-School				-1.17	2.02	-1.00	1.85
Carer*Other				-10.98 **	3.63	-10.41 **	3.36
Varies*Other				-1.15	2.59	-1.42	2.39
Carer*None				-11.36 *	4.71	-11.50 **	4.36
Varies*None				-0.78	3.02	-1.13	2.79
Interactions between age and strata variables, ref = as above							
Age*Carer						-0.00	0.09
Age*Varies						-0.09	0.06
Age * Mixed						0.25 *	0.10
Age*Asian						0.21 **	0.07
Age*Black						0.56 ***	0.09
Age*Other						0.04	0.16
Age*gen x						-0.09	0.10
Age * gen y						0.76 ***	0.07
Age*gen z						0.65 ***	0.05
Age*S-School						0.06	0.06
Age*Other						0.48 ***	0.08
Age*None						0.43 ***	0.11
Age*Women						0.16 **	0.05
Random Effects							
L1 Var: wave	88.38	88.38		66.42		66.42		66.41	
L2 Var: ind	93.41 pidp:stratacoh	93.57 pidp:stratacoh		123.73 pidp		123.70 pidp		123.54 pidp	
L3 Var: Strat	46.17 stratacoh	8.71 stratacoh		20.96 stratacoh		19.55 stratacoh		13.44 stratacoh	
L2 Slope var				0.89 pidp.agec		0.89 pidp.agec		0.89 pidp.agec	
L3 Slope var				0.31 stratacoh.agec		0.32 stratacoh.agec		0.06 stratacoh.agec	
Correlation of random effects (individual)				-0.03 pidp		-0.03 pidp		-0.03 pidp	
Correlation of random effects (strata)				0.45 stratacoh		0.39 stratacoh		0.08 stratacoh	
ICC	0.61	0.54		0.82		0.82		0.80	
No. strata	13859 pidp	13859 pidp		270 stratacoh		270 stratacoh		270 stratacoh	
No. individuals	270 stratacoh	270 stratacoh		13859 pidp		13859 pidp		13859 pidp	
Observations	146033	146033		146033		146033		146033	
Marginal R^2 / Conditional R^2	0.077 / 0.642	0.165 / 0.613		0.183 / 0.852		0.175 / 0.851		0.132 / 0.825	
AIC	1103250.819	1103022.191		1086676.400		1086603.974		1086467.173	

** p<0.05 ** p<0.01 *** p<0.001*

Table 6 Additional regression model outputs not included in analysis but included in the model building process.

	Model a		**Model b**		**Model c**		**Model d**		**Model e**		**Model f**	
Predictors	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*
(Intercept)	28.03 ***	0.10	25.33 ***	0.48	29.88 ***	0.51	32.55 ***	0.73	40.95 ***	0.99	48.99 ***	1.00
Age, centred												
Age					-0.24 ***	0.01	-0.05 ***	0.01	-0.05 ***	0.01	0.09 *	0.04
Age squared					-0.03 ***	0.00	-0.04 ***	0.00	-0.04 ***	0.00	-0.04 ***	0.00
Age cubed							-6.22 ***	1.37	-7.21 **	2.40	-6.96 ***	1.12
Care provision: ref = Continuous non-carer												
Long-term care							-3.27 **	1.05	-0.74	1.45	-2.92 ***	0.81
Varied care							-0.00 ***	0.00	-0.00 ***	0.00	-0.00 ***	0.00
Ethnicity: ref = White												
Mixed									-1.02	1.45	-3.77 **	1.30
Asian									-3.42 **	1.10	-4.03 ***	0.95
Black									-1.86	1.32	-4.04 ***	1.15
Other									-2.13	2.01	-5.37 **	1.80
Generation: ref = Boomer												
X									0.84	1.10	15.17 ***	1.35
Y									2.79 **	0.95	12.38 ***	1.05
Z									-1.30	0.82	5.58 ***	0.76
Highest educational attainment: ref = Degree												
S-School									-1.55	1.02	-4.93 ***	0.87
Other									-4.00 **	1.36	-9.15 ***	1.12
None									-8.38 ***	1.57	-12.53 ***	1.31
Sex: ref = Men												
Women									-8.19 ***	0.86	-9.89 ***	0.74
Interactions between care and strata variables, ref = as above												
Carer*Women									0.89	1.78		
Varies*Women									0.10	1.26		
Carer*Mixed									7.10	4.86		
Varies*Mixed									-2.22	2.13		
Carer*Asian									1.02	2.42		
Varies*Asian									0.04	1.58		
Carer*Black									-2.44	3.32		
Varies*Black									-0.08	1.94		
Carer*Other									-0.97	5.26		
Varies*Other									-4.73	3.29		
Carer*gen x									-4.79	4.53		
Varies*gen x									2.33	1.67		
Carer*gen y									-1.92	3.57		
Varies*gen y									1.46	1.44		
Carer*gen z									-0.88	2.20		
Varies*gen z									1.19	1.21		
Carer*S-School									-0.27	2.04		
Varies*S-School									-1.89	1.47		
Carer*Other									-4.86	2.73		
Varies*Other									-2.48	1.95		
Carer*None									-4.32	3.54		
Varies*None									0.15	2.27		
Random Effects												
L1 Var: wave	95.92		95.97		88.87		88.38		88.38		85.97	
L2 Var: ind	126.59 $_{pidp}$		96.49 $_{pidp:stratacoh}$		94.37 $_{pidp:stratacoh}$		93.42 $_{pidp:stratacoh}$		93.50 $_{pidp:stratacoh}$		92.43 $_{pidp}$	
L3 Var: Strat			40.20 $_{stratacoh}$		47.61 $_{stratacoh}$		41.04 $_{stratacoh}$		9.70 $_{stratacoh}$		17.45 $_{stratacoh}$	
L3 Slope var											0.35 $_{stratacoh.agec}$	
Correlation of random effects (strata)											0.31 $_{stratacoh}$	
ICC	0.57		0.59		0.62		0.60		0.54		0.64	
No. strata	13859 $_{pidp}$		13859 $_{pidp}$		13859 $_{pidp}$		13859 $_{pidp}$		13859 $_{pidp}$		270 $_{stratacoh}$	
No. individuals			270 $_{stratacoh}$		270 $_{stratacoh}$		270 $_{stratacoh}$		270 $_{stratacoh}$		13859 $_{pidp}$	
Observations	146033		146033		146033		146033		146033		146033	
Marginal R^2 / Conditional R^2	0.000 / 0.569		0.000 / 0.588		0.078 / 0.645		0.093 / 0.640		0.164 / 0.614		0.226 / 0.724	
AIC	1117497.499		1114591.248		1104096.580		1103228.361		1102972.892		1099811.322	

** p<0.05 ** p<0.01 *** p<0.001*

Table 7 Regression models run in glmmTMB instead of lmer as a sensitivity test.

	Model 1		**Model 2**		**Model e**	
Predictors	*Estimates*	*std. Error*	*Estimates*	*std. Error*	*Estimates*	*std. Error*
(Intercept)	30.16 ***	0.50	41.70 ***	0.68	40.88 ***	0.86
Age	-0.05 ***	0.01	-0.05 ***	0.01	-0.05 ***	0.01
Age squared	-0.04 ***	0.00	-0.04 ***	0.00	-0.04 ***	0.00
Age cubed	-0.00 ***	0.00	-0.00 ***	0.00	-0.00 ***	0.00
Long-term care			-6.03 ***	0.84	-7.24 **	2.24
Varied care			-2.59 ***	0.58	-0.65	1.26
Mixed			-1.81	0.96	-0.96	1.31
Asian			-3.24 ***	0.68	-3.33 ***	0.97
Black			-2.06 *	0.86	-1.76	1.19
Other			-3.78 **	1.45	-2.05	1.89
X			1.45	0.76	0.98	0.99
Y			3.19 ***	0.64	2.71 **	0.85
Z			-1.00	0.52	-1.38	0.72
S-School			-2.42 ***	0.62	-1.54	0.90
Other			-5.62 ***	0.84	-3.84 **	1.21
None			-8.62 ***	1.00	-8.08 ***	1.43
Women			-8.07 ***	0.54	-8.21 ***	0.76
Carer*Women					1.02	1.61
Varies*Women					-0.05	1.12
Carer*Mixed					7.16	4.69
Varies*Mixed					-2.22	1.94
Carer*Asian					1.05	2.25
Varies*Asian					-0.05	1.40
Carer*Black					-2.41	3.15
Varies*Black					-0.06	1.75
Carer*Other					-0.99	5.13
Varies*Other					-4.69	3.14
Carer*gen x					-4.74	4.39
Varies*gen x					2.20	1.51
Carer*gen y					-1.98	3.44
Varies*gen y					1.32	1.30
Carer*gen z					-0.92	2.08
Varies*gen z					1.14	1.07
Carer*S-School					-0.31	1.82
Varies*S-School					-1.84	1.29
Carer*Other					-4.69	2.48
Varies*Other					-2.38	1.73
Carer*None					-4.31	3.26
Varies*None					0.08	2.04
Random Effects						
L1 Var: wave	88.37		88.37		88.38	
L2 Var: ind	93.41 $_{\text{pidp:stratacoh}}$		93.59 $_{\text{pidp:stratacoh}}$		93.52 $_{\text{pidp:stratacoh}}$	
L3 Var: Strat	45.86 $_{\text{stratacoh}}$		7.43 $_{\text{stratacoh}}$		6.60 $_{\text{stratacoh}}$	
ICC	0.61		0.53		0.53	
No. strata	13859 $_{\text{pidp}}$		13859 $_{\text{pidp}}$		13859 $_{\text{pidp}}$	
No. individuals	270 $_{\text{stratacoh}}$		270 $_{\text{stratacoh}}$		270 $_{\text{stratacoh}}$	
Observations	146033		146033		146033	
Marginal R^2 / Conditional R^2	0.077 / 0.642		0.165 / 0.611		0.166 / 0.609	
AIC	1103208.726		1102994.869		1103017.136	

** p<0.05 ** p<0.01 *** p<0.001*

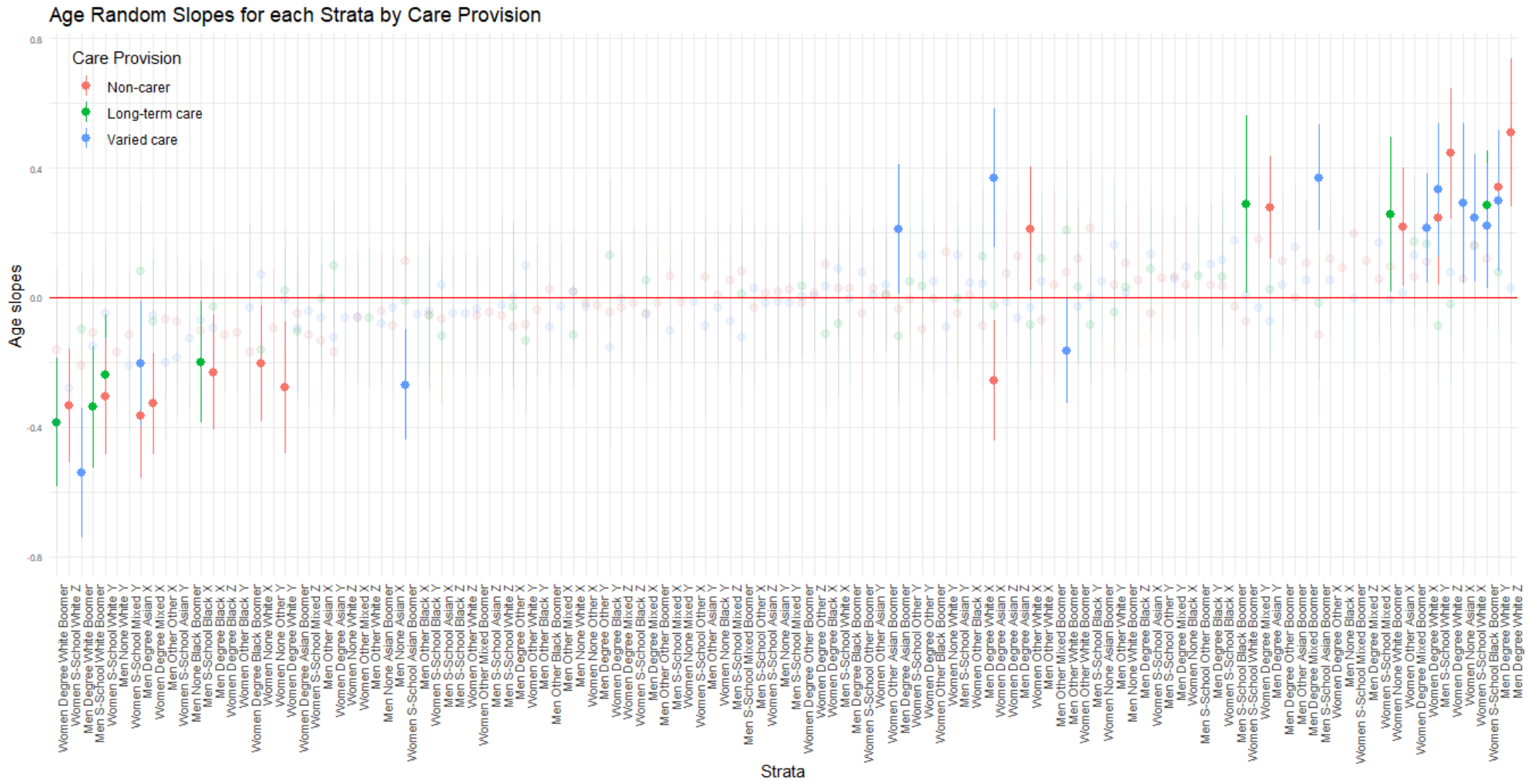

Figure 7 Age slopes for intersectional strata using 90% confidence intervals, highlighting statistically significant strata in relation to 0. Created from model 5.

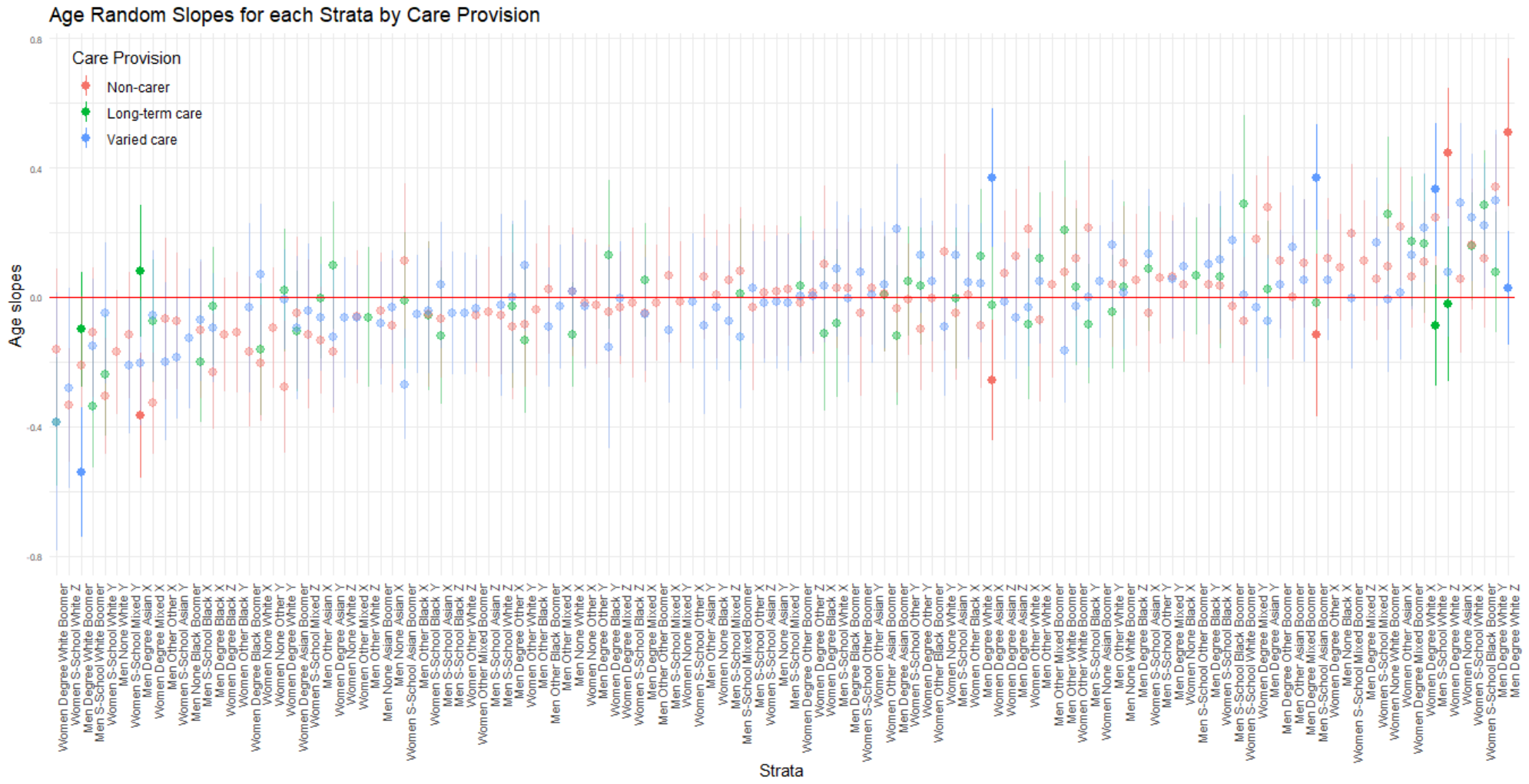

Figure 8 Age slopes for intersectional strata using 90% confidence intervals, highlighting groups with the largest differences in slopes. Created from model 5.

Table 8 Variables used in this research project. Full information can be found through the Understanding Society variable search: https://www.understandingsociety.ac.uk/documentation/mainstage/variables/ (U Essex, 2024).

Variable metadata			
Original code	**Original label**	**New code**	**New label**
jbhrs: No. of hours normally worked per week. "How many hours, excluding overtime and meal breaks, are you expected to work in a normal week?"			
jbhrs	No. of hours normally worked per week	jbhrs	No. of hours normally worked per week
jbstat: Current labour force status			
-2	refusal	NA	NA
-1	don't know	NA	NA
1	self-employed	NA	NA
2	Paid employment(ft/pt)	1	In the labour market
3	Unemployed	0	Out of the labour market
4	Retired	0	Out of the labour market
5	On maternity leave	NA	NA
6	Family care or home	0	Out of the labour market
7	Full-time student	NA	NA
8	LT sick or disabled	NA	NA
9	Govt training scheme	NA	NA
10	Unpaid, family business	NA	NA
11	On apprenticeship	NA	NA
12	On furlough	NA	NA
13	Temporarily laid off/short term working	NA	NA
14	On shared parental leave	NA	NA
97	Doing something else	NA	NA
Aidhrs: hours per week spent caring			
-8	Inapplicable	0	Non-carer (at cross-section)
-7	Proxy	NA	NA
-2	Refusal	NA	NA
-1	Don't know	NA	NA
1	0 - 4 hours per week	1	Carers (at cross-section)
2	5-9 hours per week	1	Carers (at cross-section)
3	10-19 hours per week	1	Carers (at cross-section)
4	20-34 hours per week	1	Carers (at cross-section)

5	35-49 hours per week	1	Carers (at cross-section)
6	50-99 hours per week	1	Carers (at cross-section)
7	100 + hours per week/continuous	1	Carers (at cross-section)
8	Varies under 20 hours	1	Carers (at cross-section)
9	Varies over 20 hours	1	Carers (at cross-section)
97	Other	1	Carers (at cross-section)
Sex: Sex, derived			
-9	Missing	NA	NA
0	Inconsistent	NA	NA
1	Male	1	Male
2	Female	2	Female
Ethn_dv: Ethnic group (derived from multiple sources)			
-9	Missing	NA	NA
1	British/english/scottish/welsh/Ni	1	White
2	Irish	1	White
3	Gypsy or irish traveller	1	White
4	Any other white background	1	White
5	White and black caribbean	2	Mixed
6	White and black african	2	Mixed
7	White and asian	2	Mixed
8	Any other mixed background	2	Mixed
9	Indian	3	Asian
10	Pakistani	3	Asian
11	Bangladeshi	3	Asian
12	Chinese	3	Asian
13	Any other asian background	3	Asian
14	Caribbean	4	Black
15	African	4	Black
16	Any other black background	4	Black
17	Arab	5	Other
97	any other ethnic group	5	Other
Hiqual: Highest qualification, UKHLS & BHPS samples			
-9	Missing	NA	NA
-8	Inapplicable	NA	NA
1	Degree	1	Degree
2	Other higher degree	2	Other higher degree
3	A-level etc	3	A-level etc

4	GCSE etc	4	GCSE etc
5	Other qualification	5	Other qualification
9	No qualification	6	No qualification
Age: Age, in completed years, at the time of interview. Calculated from the date of birth held in the sample administration database and the interview date.			
Age	Age at the time of interview.	Agec	Age at the time of interview, centred.
Birthy: Year of birth			
<0		NA	NA
1900:1945		0	Silent generation
1946:1964		1	Boomer generation
1965:1979		2	Generation X
1978:1994		3	Generation Y
1995:2006		4	Generation Z
>2006		NA	NA
Pidp: Personal identifier			
Unique identifier code for individuals.		Unique identifier code for individuals.	