2 *Historical and future drivers of long-term care demand*

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2.1 Introduction

This chapter provides an overview of the key drivers of demand for long-term care. Research on this topic has proliferated in the past few decades, and there are good reasons for this. Identifying the drivers of care demand helps in understanding and determining the required distribution of long-term care resources in the population and can aid the detection and minimisation of any potential inequality in care utilisation and social injustice. In the context of global population ageing and a changing pattern of morbidity and disability in later life, the demand for long-term care will continue to rise and become more complex and differentiated across the world. Research on the drivers of care demand sheds light on how demand is likely to change in the future. Equipped with an understanding of the drivers of demand, policy makers and practitioners will be better prepared for any upcoming turbulence and able to make informed decisions about resource allocation. Moreover, people prefer to receive care from different sources such as professionals or family caregivers, which leads to different patterns of long-term care utilisation. A good understanding of the drivers of demand is a crucial step towards the provision of personalised care that caters for the recipients' preferences. Furthermore, understanding what drives demand for care can help guide more effective prevention initiatives and the development of targeted strategies to help contain the foreseen rise in demand.

This chapter describes how declines in infant mortality, fertility and premature death have enabled longer life expectancy in many countries. The numbers and proportion of older persons (65 years and older) are gradually increasing, which is leading to an increase in demand for long-term care in all countries, and proportionally more in countries with a currently younger population. Moreover, we note the prominent increase of older people in need of dementia care, which is

particularly intensive. Such rising demand for long-term care prompts reflection on new, more effective long-term care service mixes. As well as the necessity of an overall increase in expenditure on long-term care, we argue that policy should support the ongoing paradigm shift away from nursing home services and towards de-institutionalisation (that is, support for 'ageing in place' home-based care, provided either formally or informally). We also demonstrate why it is vitally important to raise the awareness of long-term care as a social and human right, and build a robust regulatory framework to continually monitor and improve the quality of care in the system. However, with lower fertility and changes in labour market participation rates, policy interventions are needed to, on the one hand, ensure an adequate supply of informal caregiving and, on the other hand, invest in and develop the long-term care workforce to prevent shortages and maintain acceptable quality levels through training and career structures.

The chapter is organised as follows. Section 2.2 discusses the established theories that aim to explain why people use care or how they choose from different sources of care. These theories provide a useful 'roadmap', which has been tested and refined in empirical research. Sections 2.3–2.6 review the empirical evidence on the key drivers of long-term care demand. The discussion focuses on the extent to which different factors are associated with care demand, how they have changed in the past, and what their impacts on care demand may be in the future. Drawing on empirical data, section 2.7 brings together the individual drivers discussed in sections 2.2–2.6 and presents the results regarding their joint and relative importance. Section 2.8 reviews the existing research on the projections of long-term care demand. Section 2.9 concludes this chapter with a focused discussion on the policy implications.

2.2 Theoretical perspectives

Theories of long-term care utilisation and demand have a long history. Andersen and colleagues (Andersen & Newman, 2005; Andersen et al., 1975) proposed a behavioural model of health care utilisation, which has since been used as a theoretical framework for long-term care research (Bradley et al., 2002; Burnette & Mui, 1995). According to the original behavioural model, the drivers of long-term care utilisation can be divided into three groups: predisposing factors, need factors and

enabling factors. Predisposing factors are the individual-level characteristics, such as age, gender and ethnicity, that affect people's propensity to use long-term care and are in place prior to the onset of care needs. Later, it was argued that psychosocial factors such as the expectation of receiving care, preference for self-independence, and concerns about privacy factors mediate the relationship between the predisposing factors and care utilisation (Bradley et al., 2002; Jacobs et al., 2016).

The concept of care needs takes a central role in the behavioural model as the most immediate reason for using care. Theoretically, there is a distinction between perceived needs and evaluated needs (Andersen, 1995). The former is a social construct based on people's own views and influenced by social status and health beliefs, whereas the latter is largely based on an assessment of people's health conditions by care professionals as well as on eligibility rules embedded in legislation (Brugiavini et al., 2017). A thorough discussion on the alternative concepts of care need, as well as the implementation of policy through eligibility rules, is included in chapter 3 of this volume.

Enabling factors refer to the means and know-how that allow people to access care (Andersen, 1995). These include the availability and proximity of formal and informal care providers (Martikainen et al., 2009; Pickard et al., 2012), and the financial resources such as income and insurance that people can mobilise to purchase care. In the digital era, the internet provides another important channel through which people access information about public services. IT knowledge and skills, as an important form of human capital, are increasingly recognised as another enabling factor for care utilisation (Hu et al., 2020).

A recent development of the behavioural model has been an emphasis on the impact of societal factors on individual behaviour (Andersen and Newman, 2005). It has been pointed out that the propensity to use long-term care is strongly influenced by social norms or values. In countries or regions where family members are expected to take caregiving responsibilities, people attach great stigma to care home admissions because they are considered as the abandonment of care recipients by their family members. As a result, people are not willing to move to a care home even though their care needs can be fully met there, and they can afford the services (Shi and Hu, 2020).

The economic model of long-term care demand (henceforth 'economic model') builds upon the Grossman model of health demand (Grossman, 1972). In this model, long-term care is conceptualised as

a service that people with care needs consume to maximise their utility subject to income constraints. Demand for long-term care, therefore, is driven by a person's income, the price of services, the price and quality of close substitutes or complementary services, and the person's preferences (Kemper, 1992; Van Houtven & Norton, 2004).

Like the behavioural model, the economic model recognises the important role of care needs. However, there is a subtle difference: the economic model explicitly distinguishes between care need and care demand, with the latter taking account of a person's inherent ability and willingness to purchase services. In other words, demand arises when a person with long-term care needs seeks long-term care and is prepared to pay when the price is right. Despite this difference, there is a great overlap between the behavioural model and the economic perspective in terms of the proposed drivers of long-term care demand. In some cases, this may simply boil down to a 'labelling' issue. For example, predisposing factors in the behavioural model are considered as preference factors in the economic model. Socioeconomic characteristics and service prices, which are captured by care affordability in the economic model, are treated as enabling factors in the behavioural model.

The concept of demand for long-term care has little meaning if there is no or insufficient potential supply, although it is important to recognise that care needs persist irrespective of supply availability. Both the behavioural and economic models recognise that there are multiple sources of supply of long-term care. In many high-income countries, people may choose between formal and informal care. By comparison, formal care systems are underdeveloped in most LMICs, with the result being an overwhelming reliance on informal care. In both cases, spouses, adult children, relatives, neighbours and friends may all be potential caregivers under the umbrella of informal care.

Researchers have devoted a great deal of attention to understanding the factors influencing people's choice of either formal or informal care. Two theories, the hierarchical-compensatory theory (Cantor, 1979; Shanas, 1979) and the task-specific theory (Litwak, 1985; Messeri et al., 1993), have been proposed to explain the selection behaviour. The hierarchical-compensatory theory posits that older people's selection of caregivers follows an ordered preference based on the proximity of the relationships between older people and caregivers. The spouse is often the first choice for caregiving. In the absence of a spouse, older

people will turn to their next of kin such as adult children and other relatives. When family members are unavailable, they will seek help from friends, neighbours or formal caregivers.

The task-specific theory argues that the selection of caregivers is driven by the nature of the tasks. For example, help with personal care tasks such as eating and dressing requires frequent personal contact and a shared lifestyle between caregivers and care recipients, so the spouse is the most suitable caregiver. In comparison, help with domestic tasks such as managing finances or shopping for groceries is needed at longer intervals and can in some cases be provided remotely. Children and other family members may be better positioned to assist with these tasks. By and large, the choice between different sources of care is based on the comparative advantages of caregivers in assisting with different tasks, making care arrangements between caregivers and recipients not a random process but one strongly driven by an efficient division of labour.

Many of the theories reviewed in this section were developed in the very specific situations of a few high-income countries with distinct system characteristics. Although theories are powerful tools to guide long-term care research and inform policy making, there are debates about the extent to which these theories are applicable when our attention turns to long-term care systems outside those countries. In the next few sections, we will provide an overview of the empirical evidence in the literature and discuss the extent to which these theories are supported by the findings reported in different parts of the world.

2.3 Population ageing as a driver of long-term care demand

Older people are the main users of long-term care due to increased rates of morbidity and disability and declines in functionality as people age. A sustained increase in long-term care demand is therefore a direct result of the profound changes in the population structure in recent decades (Brändström et al., 2021; Hu & Ma, 2018; Hu et al., 2022b; Hu et al., 2022c; Kemper, 1992; Murphy et al., 2015; Suanet et al., 2012). Population ageing is a global phenomenon. There has been a continued increase in the number as well as the proportion of older people in developed and developing countries alike. It is projected that the number of older people aged 60 and over will increase by 116 per cent between 2017 and 2050, from 962 million to

2,081 million (United Nations, 2019). The demographic structure within the older population is also changing. As life expectancy continues to rise, especially in developing countries, the proportion of very old people (those aged over 85) increases much faster than the older population in general (United Nations, 2019). People of very old age are also the most intensive users of long-term care (Hu, 2020).

Population ageing is driven by decreasing fertility and mortality rates. A decline in fertility rates takes place in the context of (post-) industrialisation where the pursuit of education, employment and other personal life goals leads people to have fewer children, or to have children later in life. In some cases, government policy also plays a decisive role. For example, the One Child policy pursued by the Chinese government in the late 1970s restricted parents to having a single child, and the fertility rate has stayed low ever since (Feng et al., 2012). Lower fertility rates do not directly affect demand for long-term care but exert an indirect influence through a reduction in the number of younger adults and the availability of caregivers, which affects supply-induced demand. This will be discussed in more detail in section 2.5.

Recent decades have seen an overall decrease in the mortality rate in most parts of the world, driven by improvements in living standards, advancements in medical sciences and improvements in the quality of health care. In addition, a well-designed social insurance or social security system ensures that life-saving health care services are accessible and affordable to most members of society. Reduced mortality rates contribute directly to an increase in life expectancy. As shown in Figure 2.1, the life expectancy of the world population increased from 47 years in 1950 to 72 years in 2020. People in Northern America and Europe have the highest life expectancy, which stood at 79 years and 78 years respectively in 2020. Meanwhile, life expectancy in Africa and Asia has been catching up quickly. Although regional differences in life expectancy remain, those differences have diminished in both relative and absolute terms. In 1950, life expectancy at birth in Northern America was 69, compared to 37 in Africa – almost double. By 2020, the difference in life expectancy had declined to 16 years.

While population ageing is a universal trend, the population of older people increases at markedly different rates between countries and regions. Such variation is illustrated in Table 2.1. It is projected that the numbers of older people in Africa and Latin America and the

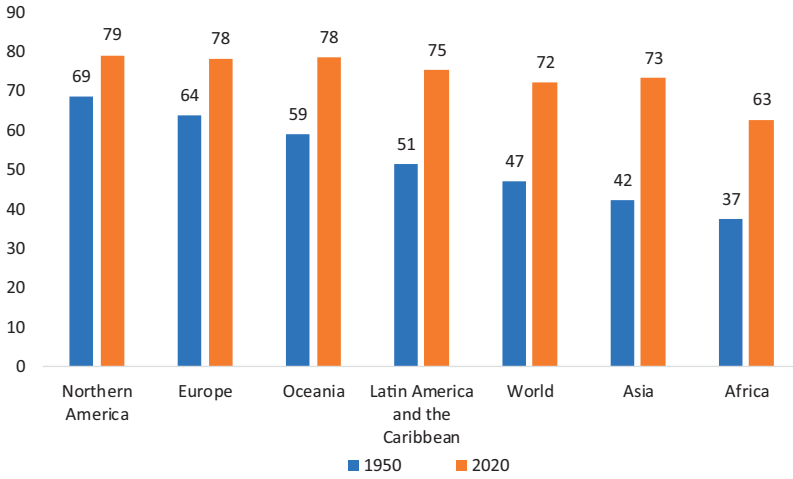

Figure 2.1. Life expectancy at birth across different regions in 1950 and 2020 (years)

Source: United Nations (2019)

Caribbean will increase by 229 per cent and 167 per cent respectively in the next three decades, faster than any other world regions. In comparison, although Europe and Northern America currently have the highest proportion of older people in their populations, this proportion is only projected to increase by 35 per cent and 57 per cent respectively by 2050. There is no doubt that governments in Europe and Northern America are currently facing much higher demand for long-term care than other regions, but it seems that Africa, Latin America and the Caribbean and Asia will be the main driver of a worldwide increase in demand for long-term care in the decades to come.

It is important to note that these population projections are based on specific assumptions about future fertility and mortality rates. There are ongoing debates about what the most appropriate assumptions are, and official statistics released by different countries show that projected numbers of older people are normally sensitive to different assumptions. In the case of the Republic of Korea, for example, in the medium population scenario the number of people aged 65 or over is projected to increase from 8.1 million in 2020 to 17.2 million in 2040 (Table 2.2). By contrast, under the high population scenario (which assumes a higher fertility rate, higher life expectancy at birth and higher net immigration

Table 2.1. *Number of persons aged 60 years or over in 2017 and 2050*

	Number of persons aged 60+ years in 2017 (millions)	Number of persons aged 60+ years in 2050 (millions)	Percentage change between 2017 and 2050	Distribution of persons aged 60+ years in 2017 (percentage)	Distribution of persons aged 60+ years in 2050 (percentage)
World	962.3	2080.5	116.2	100.0	100.0
Africa	68.7	225.8	228.7	7.1	10.9
Asia	549.2	1273.2	131.8	57.1	61.2
Europe	183.0	247.2	35.1	19.0	11.9
Northern America	78.4	122.8	56.6	8.1	5.9
Latin America and the Caribbean	76.0	198.2	160.8	7.9	9.5
Oceania	6.9	13.3	92.8	0.7	0.6

Source: United Nations (2017)

Table 2.2. *Projected number of people aged 65 years or over in Republic of Korea under different demographic assumptions, 2020–2040 (millions)*

	2020	2030	2040	% increase 2020–2040
High population	8.1	13.2	17.8	120%
Medium population	8.1	13.0	17.2	112%
Low population	8.1	12.7	16.6	105%

Source: Statistics Korea (2019)

than in the medium scenario) the projected number of older people in 2040 is 17.8 million. Under the low population scenario (lower fertility, lower life expectancy and lower immigration), the projected number of older people in 2040 is 16.6 million. The uncertainties in future

population projections will affect the precision of our projections for long-term care demand, a topic we will revisit in section 2.8.

2.4 Definition of long-term care needs and demand for long-term care

Long-term care needs arise when people experience a sudden loss of, or a gradual decline in, functional capacity to perform daily tasks. Indeed, the ability to perform activities of daily living (ADL) is one of the most common measures of functional disability and long-term care needs. An important policy question is: how should this capacity and thus the level of need be defined and measured? Historically, the measurement of care needs had a strong focus on personal care. Katz et al. (1970) proposed a six-item scale, which includes eating, bathing, dressing, using the toilet, moving in and out of a bed or a chair, and continence. Meanwhile, Mahoney and Barthel (1965) developed an inventory of ten ADLs. As well as the six items in Katz et al.'s (1970) measure, they included grooming, ambulation and climbing stairs, and controlling bowels and bladder, which were treated as two separate ADLs. Functional capability to perform instrumental activities of daily living (IADL), which focus on domestic tasks, is another common measure of long-term care needs. Spector et al. (1987) pointed out that IADLs include people's ability to adapt to a changing environment. Lawton and Brody (1969) proposed an eight-item scale of IADLs which encompass using the telephone, shopping, food preparation, housekeeping, laundry, using transportation, taking medication and managing finances.

Any discussions of long-term care needs are incomplete without mentioning the environmental settings. Functional capability and environmental requirements define each other. A person can live in a house or a community comfortably and independently only when the functional capability of the person meets the requirements of the physical environment (Lawton, 1983). The extent to which the person has sufficient functional capability depends on the housing characteristics or accessible features in the neighbourhood. A house with assisted living facilities or adaptations (e.g., a lift or accessible rollator) greatly reduces the requirements imposed on older people with ADL limitations so that they can accomplish the tasks necessary for daily living themselves or with some extra help from care workers (Ball et al.,

2004). Otherwise, people living alone and with severe functional disability have no other choice but to move into a nursing home.

In addition to functional ability, it has increasingly been recognised that the onset of mental illness or cognitive impairment may trigger long-term care needs. Measurements such as the Interval Need scale (Isaacs & Neville, 1976; Willis et al., 2019) and Bristol Activities of Daily Living (BADL) scale (Bucks et al., 1996) have been designed to capture these additional dimensions. The Interval Need scale distinguishes between long, short and critical interval needs according to the intervals elapsing between the need for help. Severely mentally disturbed persons who are not responsible for their actions and who may endanger themselves or others are graded as having a critical interval need. Orientation in time and space is a key component of the BADL scale in evaluating the care needs of people living with dementia. The implication is that care professionals and policy makers should turn their attention to different measurement scales according to the specific care needs of the groups that their interventions and policies target. Additionally, as models of care evolve there is a growing recognition of the importance of holistic approaches that consider the whole person, not just their clinical or physical needs. In practice, while clinical needs and ADLs are primary factors in long-term care assessments, some countries also consider factors like social participation to provide a more comprehensive picture of an individual's needs. The policy implications of needs assessments in designing public programmes of long-term care will be explored in chapter 3.

Given the multi-dimensionality of the concept, it is unsurprising that the estimated number of people needing long-term care varies according to the definitions of need. If the definition is confined to functional disabilities in ADL tasks, it is estimated that 20 million community-living older people aged 60 and over in China have long-term care needs (Hu, 2019). Another 40 million will be added to the estimate if functional disabilities in IADL tasks also count towards long-term care needs. Similarly, Kaye et al. (2010) estimated that the older population (aged 65 and over) with long-term care needs in the United States is around 2.5 million using an ADL-based definition. This rises to 5.0–5.4 million if an ADL/IADL-based definition is adopted.

The number of older people with long-term care needs in the future hinges upon two factors. The first is the age composition of the older population. The severity of functional limitations or the level of care

needs is positively correlated with age (Hu et al., 2022a; Singer et al., 2019; Zimmer et al., 2012). Therefore, as the number of older people and the proportion of older people in higher age groups rise, so will the number of people with care needs. The second factor is the age-specific prevalence of care needs. As the world population continue to enjoy added years of life in the future, debates emerge about the possible health profiles of people in those years. The morbidity compression hypothesis posits that the time people spend with diseases will be compressed to a very short period of time at the end of life (Fries, 1980, 1983). In comparison, the morbidity expansion theory argues that technological advances and modern medicine reduce mortality by helping people with poor health survive longer, which implies an increase in the prevalence of morbidity over time (Gruenberg, 1977). The dynamic equilibrium hypothesis provides a more nuanced perspective: delayed disease progression means that people will spend less time in the more severe stages of a disease or disability but more time in the less severe stages (Manton, 1982).

Studies have been conducted to examine how the prevalence of care needs has changed over time. There is evidence that the prevalence of ADL disability in the United States increased steadily and that of IADL disability decreased between 1995 and 2004. Evidence from England shows a reverse pattern: a decrease in ADL disability and an increase in IADL disability between 2002 and 2008 (Chatterji et al., 2015). Jagger et al. (2016) compared the proportion of life free of disability in the older population in England in 1991 and 2011, and identified a dynamic equilibrium: the proportion of years of mild disability increased by 5.6% for men and 9.4% for women, whereas the proportions of moderate or severe disability decreased by 0.2% for men and 0.1% for women. A recent study comparing seventeen countries across the globe between 2004 and 2014 showed a significant increase in the prevalence of ADL disabilities in Belgium, the Czech Republic and Mexico, and a significant decrease in Denmark, England, Greece, the Republic of Korea, Poland and Sweden (Lee et al., 2020).

The evidence suggests divergent trends in the prevalence of long-term care needs across countries. The evidence from some countries supports the disability expansion theory, while in others it supports the dynamic equilibrium theory. To policy makers and researchers, the implication is

that there are great uncertainties regarding the age and gender-specific prevalence of care needs in the future. Under the assumption of an unchanged age and gender-specific prevalence of care needs, Wittenberg et al. (2018) projected that the number of older people with ADL limitations in England will increase from 1.75 million in 2015 to 2.95 million in 2040. In comparison, the number will increase to 3.33 million in 2040 if an annual increase of 0.5% in age-specific prevalence is assumed, and to 2.62 million in 2040 with an annual decrease of 0.5% (see Figure 2.2). As mentioned before, the exact measures of care needs matter. Using interval needs as the measurement, Kingston et al. (2018) projected that the number of older people in the United Kingdom with care needs will increase by 32 per cent, from 4.2 million in 2015 to 5.5 million in 2035. In most cases, it is highly debatable what the most appropriate assumption about future prevalence of care needs should be. One possible approach to addressing these uncertainties is for policy makers and researchers to consider a wider range of plausible assumptions and look at a range of estimates, rather than sticking to a particular set of assumptions.

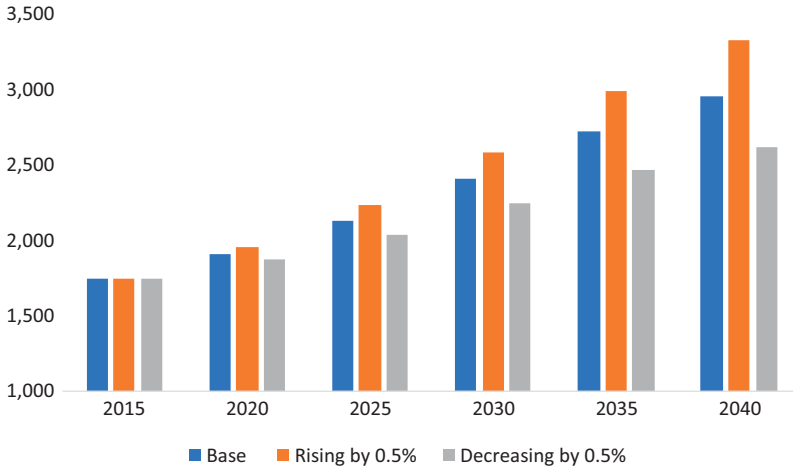

Figure 2.2. Projected number of ADL-disabled older people in England 2015–2040 under different assumptions of prevalence of disability in England (in thousand persons)

Source: Wittenberg et al. (2018)

2.5 The availability of caregivers affects the demand for long-term care

Demand for long-term care is preconditioned by the availability of caregivers. Long-term care demand is a latent construct that often cannot be observed directly. What can be observed is the utilisation of long-term care, which represents a state of equilibrium where demand matches supply. Serious policy concerns regarding unmet needs will arise where the supply of care cannot keep up with the demand. Recent policy debates on inadequate care provision have pointed to the possible consequences for care poverty (Hu & Chou, 2022; Kröger, 2022; Kröger et al., 2019).

It is useful to make a conceptual distinction between two types of caregivers: unpaid (or informal) caregivers and professional (or formal) caregivers. Unpaid caregivers such as family members, friends and neighbours assume the majority of the care responsibilities for older people in a country. Spouses are often the main caregivers of older people with care needs and play a crucial role in maintaining older people's wellbeing. This is most common among people with personal care needs (see section 2.2). Yet access to spouse care is a gendered issue. It has been widely observed that females have a higher life expectancy on average than males (Van Oyen et al., 2010). This implies that females are more likely than males to lose access to spousal care and to seek alternative care arrangements. This is especially the case for people in very old age (aged over 85). The good news is that this gender imbalance is changing. Recent evidence suggests that the gap in life expectancy between men and women has been decreasing, which is partly attributable to changed life habits and consequently a reduction in preventable deaths among males (Pattison et al., 2012). One example is the reduction in the prevalence of lung cancer as increasing numbers of men stop smoking. Improved availability of care provided by husbands is likely to boost the demand as well as the receipt of long-term care by older females.

Adult children are also important caregivers. Older people living with their children are more likely to receive care or more hours of care than those living away from their children because the costs and time associated with caregiving increase in the latter case, sometimes significantly. In LMICs, economic development has a profound impact on family structure and household composition. For example,

traditional values in China such as filial piety have been weakened as a result of rapid industrialisation and urbanisation, and nuclear families are increasingly common (Hu & Ma, 2018). As a consequence, the average household size and the proportion of older people living with their children have been declining (Zeng et al., 2008). This poses a serious threat to older people's access to care provided by their children.

Meanwhile, it should be stressed that the impact of economic development on living arrangements and care access may not fully offset those associated with culture and social norms. In the Republic of Korea, which is a high-income economy, 14 per cent of older people (aged over 65) are estimated to be single and living alone (Jang & Kawachi, 2019). This is far below the level in England, which is 34 per cent. In addition, it has been reported that 54 per cent of older people in Taiwan, China would prefer to live with their children or children's families, but only 34 per cent actually do so (Ministry of Health and Welfare, 2017). The key message is that the cultural context and informal institutions still play a visible role in shaping preferences in care arrangements, which should be duly accounted for when governments set out to design or reform long-term care systems.

Family bonds are an important but often overlooked factor in the quality of care. While marital status and living arrangements indicate the availability of an older person's support network, family bonds reflect the quality of the network. A study conducted by Silverstein et al. (1995) shows that adult daughters who feel close to their older parents and communicate well with them are more likely to provide care. Hu and Wei (2021) found that older people who are satisfied with their relationships with their spouses and children are more likely to receive adequate care and less likely to have unmet care needs.

Formal care provided by professional caregivers is an integral part of the long-term care system in many high-income countries. There is a sustained debate in the literature about the relationships between formal and informal (or unpaid) care. On the one hand, ample evidence suggests that there is a substitutive relationship between informal and formal care. A number of studies conducted in the United States and Europe show that the availability of informal care alleviates the demand for formal care (Bolin et al., 2008; Bonsang, 2009; Gannon & Davin, 2010; Van Houtven & Norton, 2004). There is also emerging evidence that the availability of formal care reduces the demand for

informal care (Hollingsworth et al., 2017; Kim & Lim, 2015). On the other hand, subgroup analysis reveals that the level of substitution between these two types of care may vary. Carrino et al. (2018) have shown how an increase in the public provision of formal care to older people with unmet needs would also lead to an increase in the utilisation of informal care. Bonsang (2009) reported that the substitutive relationships between formal and informal care disappear in older European people with a higher level of care needs. Bolin et al. (2008) found that the substitution effect is stronger in South Europe than in Central and North Europe. The relationship between formal and informal care becomes less clear-cut once we shift our lens of investigation to particular groups of older people.

2.6 Socioeconomic status as driver of long-term care demand

Socioeconomic status is an especially important driver of long-term care demand in countries with a well-developed formal care sector. Formal care is often not free-of-charge at the point of use but may require substantial user contributions towards care costs. In the United Kingdom, for example, financial support from the government is only available to older people with eligible care needs, and the receipt of formal care is subject to means testing which the government uses to decide on the level of user contribution. Therefore, the affordability of formal care depends on the financial resources of the person with care needs and the generosity of government support. A study conducted in the United States showed that people living in states with more generous Medicaid home care programmes are less likely to have unmet personal care needs (defined as not receiving any help with ADL tasks in the presence of ADL care needs (Kemper et al., 2008)). In contrast, evidence from China suggests that where the formal sector is still under development and not widely available to the older population, preferences and demand for formal care may be less sensitive to financial indicators such as income than to other factors (Shi & Hu, 2020).

That socioeconomic status is at the centre of academic debate is also due to its close connection to social equality and distributive fairness. There is a growing body of literature investigating the distribution of long-term care resources among older people with varying levels of income and wealth. The studies conducted in Europe all confirm that the distribution of formal and informal care is more concentrated in

older people with a lower level of income or wealth (Carrieri et al., 2017; García-Gómez et al., 2015; Ilinca et al., 2017; Rodrigues & Glendinning, 2015; Tenand et al., 2020). This is largely because older people with a lower level of income or wealth are more likely to have a higher level of long-term care needs and demand. However, when it comes to long-term care inequity, namely the distribution of care resources for people with similar levels of need for care, great variations across countries start to emerge. After controlling for care needs, paid domestic help and home-based nursing are found to be more concentrated among the rich in Southern and Continental Europe, whereas countries in Northern Europe do not demonstrate significant care inequity (Carrieri et al., 2017). These findings largely resonate with the clustering of welfare states by researchers studying the typology of welfare state regimes. Nordic countries, which typify 'social democratic' regimes, are characterised by more state involvement in welfare provision and more progress in the reduction of inequity than countries with 'conservative' regimes (Aspalter, 2017). Provision of long-term care under different welfare state regimes will be discussed further in section 3.3.

2.7 The joint and relative importance of demand drivers: an empirical application

As well as investigating each driver of care demand separately, it is equally useful to understand the joint importance of all drivers or the relative importance of one driver against another. Their joint importance indicates whether all of the main drivers of care demand have been considered or whether any important drivers are still missed out in the analysis. This is a crucial step that needs to be taken before we can make any reliable projections and forecasts of long-term care demand. Their relative importance helps researchers identify the structure and hierarchy of long-term care drivers. This is especially useful to policy makers and practitioners who have limited resources and thus want to prioritise their interventions for a selected number of the most important drivers. There are different approaches to quantifying the joint and relative importance of a group of drivers. One approach is by looking at whether they can accurately predict the outcome of interest. This involves using the drivers of interest and adopting the machine learning approach to build a prediction model (see Box 2.1) and then comparing the predicted outcomes with the actual outcomes shown in the data.

Box 2.1. Machine learning methods for prediction models

Machine learning is considered a branch of artificial intelligence research where algorithms are used to enable computers to learn from data and make predictions (Casanova et al., 2020; Qin et al., 2020). Machine learning has strong connections with, but is different from, mathematical statistics. It is increasingly popular due to its capability to uncover complex patterns in data and make accurate predictions. Compared with linear or logistic regression models, machine learning models can automatically capture the non-linear relationships between variables, which provides a time-efficient way to improve prediction accuracy (Hu, 2020). The commonly used machine learning models or algorithms include: random forests, XGBoost, support vector machine (SVM), Naïve Bayes, and artificial neural networks (ANN). The deep learning algorithm, which is highly effective in processing unstructured data such as text, images and videos, is a subset of the ANN where there are multiple layers of network representations (Collet & Allaire, 2018).

In this section, we present the results of a prediction analysis and report on the joint and relative importance of the demand drivers for long-term care utilisation in the older population in England. Our data came from the English Longitudinal Survey of Ageing (ELSA), which collected ageing and health-related information from a nationally representative sample of individuals aged over 50 in England (NatCen Social Research, 2020). We used data from the pooled sample for community-dwelling older people aged 65 and over in waves 6–9, covering the period from 2012 – 2019 (N=22,054).

We used the Extreme Gradient Boosting (XGBoost) algorithm to build the prediction models. The XGBoost algorithm, an efficient variant of the gradient boosting machine algorithm, is increasingly used in predictive analytics and machine learning research (Chen & He, 2016). Apart from automatically capturing non-linear relationships between the predictors and the outcome variable, it has repeatedly outperformed other machine learning algorithms such as logistic regression and support vector machines in terms of prediction accuracy

The targets of our prediction were three binary outcome variables: (1) using informal care vs no care; (2) using formal care vs no care; and

(3) using informal care vs formal care. This meant a total of three prediction models. We examined the following demand drivers: age, gender, marital status, whether or not living with children, the number of functional limitations, living with dementia, education, housing tenure, and equivalised income. The relative importance of one predictor against another was derived by calculating their contribution to the prediction accuracy, which was normalised on a scale from 0 (least important) to 100 (most important). The cross-validation technique was applied: we built the prediction model using the randomly selected training set (70 per cent of the sample) and tested the model performance using the validation set (30 per cent of the sample). This was to detect and avoid overfitting of the prediction models.

The prediction performance of our models is presented in Figure 2.3. Our model has a prediction accuracy of 0.90 for informal care vs no care. This means that the drivers correctly predict the use of informal care or no care for 90 per cent of cases. Functional capability is the most important driver. Indeed, it has such a predominant position in terms of its contribution to prediction accuracy that the importance of the other predictors looks relatively trivial. The prediction model for formal care vs no care has a prediction accuracy of 95 per cent. Functional capability is still the predominant predictor, but the contributions of the other drivers in the formal care model, especially age, are comparably larger than those in the informal care model. The policy implication is that intervention or prevention measures that focus on delaying the onset or progression of functional limitations should be very effective in alleviating the demand for formal or informal care – and arguably more effective than many other policy measures. We will discuss this point in more detail in section 2.9.

Our last model predicts whether a person will use informal or formal care. This model has a prediction accuracy of 75 per cent. The relative importance of the drivers in this model is more balanced than in the other two models. It is notable that marital status is the most important predictor, which points to the central role of spousal care when people choose between informal and formal care. Functional capability is still an important predictor, but it is only half as important as marital status. Income, living with children and level of education all have a non-trivial contribution to the prediction accuracy.

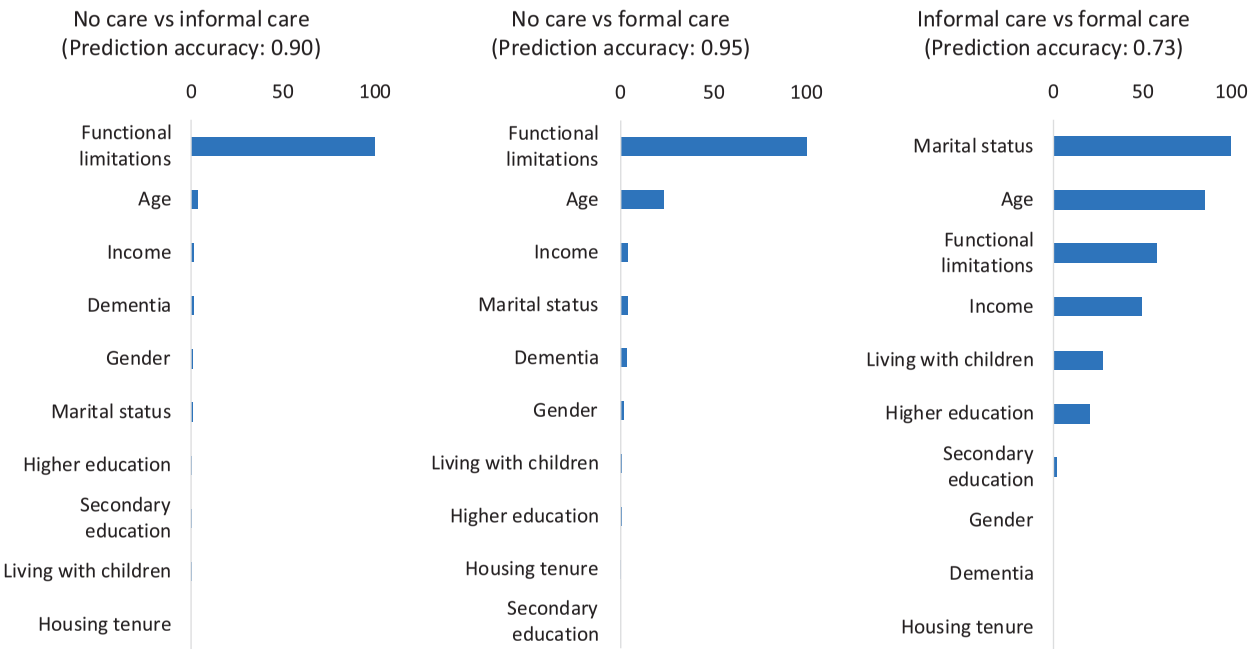

Figure 2.3. Relative importance of drivers of long-term care demand

Guided by the relative importance of the drivers shown in Figure 2.3, we next used the ELSA data to look at the utilisation of formal or informal care in a selection of groups of older people, defined as follows:

- Group 1: 1–2 functional limitations, aged below 75, married;
- Group 2: 3–7 functional limitations, aged between 75 and 85, married;
- Group 3: eight or more functional limitations, aged between 75 and 85, single, living with children;
- Group 4: eight or more functional limitations, aged over 85, single, living alone, above median income;
- Group 5: group 4, living with dementia.

This provides another angle to understand how different factors combine to drive long-term care demand. As shown in Figure 2.4, there are wide inter-group variations in terms of care utilisation. Eighty-five per cent of those in the first group did not use any care, 13 per cent used informal care and 2 per cent used formal care. This stands in

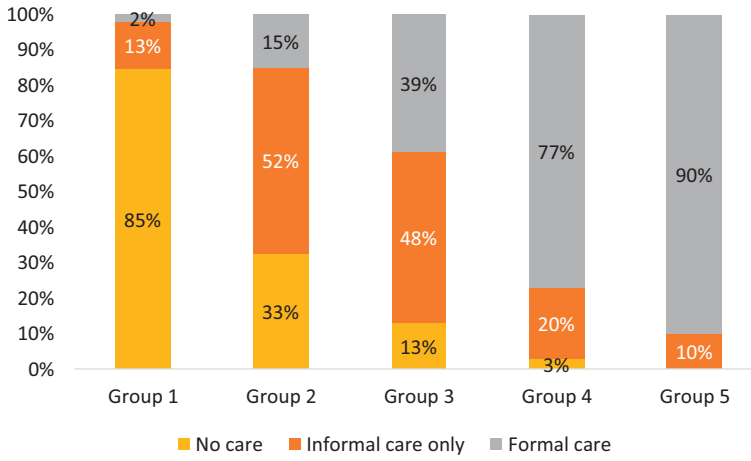

Figure 2.4. Variations in the proportions of older people using informal or formal care

Notes: Group 1: 1–2 functional limitations, aged below 75, married; Group 2: 3–7 functional limitations, aged between 75 and 85, married; Group 3: 8 or more functional limitations, aged between 75 and 85, single, living with children; Group 4: 8 or more functional limitations, aged over 85, single, living alone, above median income; Group 5: group 4, living with dementia

marked contrast to those in group five. They were all care users: 10 per cent used informal care and 90 per cent used formal care. It should be pointed out that the results presented in this section are based on data collected in England. The relative and joint importance of the demand drivers are likely to differ in other contexts.

2.8 Projecting future demand for long-term care

Projections of demand for long-term care and associated expenditure are valuable for budgeting and planning services at the local level and for developing policies at the national and local levels. They have been produced to guide reforms of long-term care systems and to assess the sustainability of current or proposed systems. The Brookings Institution produced projections for the United States when reforms were under consideration there (Wiener et al., 1994). In 1998, the London School of Economics and Political Science (LSE) produced projections for the United Kingdom when a Royal Commission was preparing proposals for reforming long-term care in the United Kingdom (Wittenberg et al., 1998). In 2006, updated projections were produced for the United Kingdom and new projections were produced for three other European countries – Germany, Spain and Italy (Comas-Herrera et al., 2006). Projections have also recently been produced for Hong Kong (Chung et al., 2009) and mainland China (Xu & Chen, 2019). The European Union Economic Policy Committee's Ageing Working Group regularly produces economic and budgetary projections for member states, which include long-term care as well as other services affected by population ageing (European Commission, 2018). What all these projections have in common is a marked increase in needs and demand for care, even under conservative assumptions.

These projections need to be distinguished from forecasts. They comprise estimates of future demand for long-term care on the basis of a set of assumptions about trends in the drivers of demand and about future patterns of care. Projecting the numbers of people needing care involves assumptions about future mortality rates and disability rates by age and gender. These may be drawn from demographic and epidemiological modelling by government statistical offices or research centres. Projections of numbers of service users require analyses or assumptions about trends in socioeconomic drivers of demand such as income and household composition. They also require assumptions

about whether the balance between unpaid care, community-based services and residential care will change or remain constant over time. Finally, if expenditure is projected, an assumption is needed regarding the future wages of social care staff. These factors are likely to be affected by government policies. Projections have generally been produced on the basis of unchanged policies and specified changes in policy that governments may be considering.

It has been projected that the number of older people receiving formal long-term care in England will rise from 0.66 million in 2015 to 1.18 million in 2040. Public expenditure on social services for this group has been projected to rise from around 0.45% of gross domestic product (GDP) in 2015 to 0.75% of GDP in 2040 (Wittenberg et al., 2018). Older people with dementia are among the most intensive users of long-term care. The costs of formal care for older people with dementia in England have been projected to rise by 300 per cent, from £9.8 million in 2015 to £39.2 million in 2040 (Wittenberg et al., 2020). It is worth noting that these projections are sensitive to assumptions about future trends in mortality and disability rates and in the real unit costs of care. Older people in other countries or regions may follow different trajectories of mortality and disability rates in the long run, so the projected increase in long-term care expenditure is likely to differ markedly from that in England. Furthermore, the rising demand for better-quality care and the recognition that professional caregivers should be better rewarded and paid will increase the unit costs of care, which in turn will elevate the projected costs of care.

2.9 Conclusion and policy implications

Demand for long-term care for older people is projected to rise worldwide over the coming decades due to rising numbers of older people, and especially rising numbers surviving to late old age when the need for care is highest. Population ageing could in principle be offset, at least partially, by declining rates of disability in old age, but it is very doubtful that disability rates will fall sufficiently to fully offset the rise in the numbers of older people.

To fully understand the implications of population ageing for long-term care demand, it is useful to distinguish between absolute and relative growth in demand. Countries with an advanced level of

population ageing face great challenges because the absolute level of care needs in older people is already enormous. Even a small proportionate increase in care demand will translate into a big rise in absolute terms. Meanwhile, countries with a younger population structure normally have a lower level of care needs in the older population in absolute terms, but this does not necessarily mean that the long-term care system is free of pressure because the relative growth in care demand may be substantial in the future.

The implications are twofold. First, countries at different stages of population ageing all need to plan for rising expenditure on long-term care and rising numbers of people working in the care sector. This requires that an increasing proportion of the economy's resources (GDP) be devoted to long-term care and a higher proportion of the workforce in the care sector. Second, long-term care policies should be carefully designed to ensure equitable access to long-term care for all older people with care needs. It is vitally important to raise the awareness of long-term care as a social and human right and build a robust regulatory framework to continually monitor and improve the quality of care in the system.

In the health care sector, it is well known that the supply of hospitalisation may induce its own demand where a third party provides financial support for usage. This is known as Roemer's Law, namely 'a built bed is a filled bed' (Roemer, 1961). It can be argued that this supply-induced demand also applies to nursing home utilisation and thus constitutes another driver of long-term care demand and expenditure. Use of nursing home services when this could be avoided may also be the result of how public support is set up, availability of benefits and the necessary co-payments, rather than the available supply. In addition, residential care remains the final safety net for low-income individuals in many countries with well-developed long-term care systems. To address this issue, it would be useful for policy makers to optimise the mix of services. This would involve a paradigm shift away from nursing homes and a call for heightened support for unpaid caregivers and home care services. Treating the de-institutionalisation of long-term care as a long-term goal and identifying new, innovative forms of 'institutional' care should be at the top of the government agenda.

There is evidence that policies and technologies that encourage ageing in place help people maintain their social networks and continuity in life, bringing down the long-term care costs (Graybill et al., 2014)

and improving older people's wellbeing (Wiles et al., 2012), even though ageing in place may not be suitable for every older person (Fernández-Carro, 2016). All in all, a crucial question we must address in the context of population ageing is: what mix of services best preserves health and functioning and enables people to stay at home for as long as possible and in that sense minimises current and future long-term care needs? The components of good quality rehabilitation – access to assistive devices, good nutrition, fall prevention, home adaptations and reablement services – are the key here. Policy choices should also be based on an understanding of how demand patterns may change in the future as preferences for different types of care evolve. From this perspective, more needs to be done to understand and reflect people's preferences for care, moving away from the tendency of long-term care policies to consider preferences to be of secondary importance at best, and certainly much less important than costs and efficiency considerations.

Rising demand for long-term care also has important policy implications for the workforce and the labour market. The majority of long-term care for older people is provided by unpaid carers. If the availability of unpaid care does not rise in line with the demand for care, this will place additional pressure on the demand for formal services. Rates of childlessness are rising in some countries and the average family size is falling in many countries. If the supply of unpaid care is to keep pace with rising needs, a higher proportion of people will need to provide unpaid care for a longer period. Changes in society, including rising female labour market participation and both internal and external migration, suggest that it is doubtful that the supply of unpaid care will rise in line with demand. It is therefore important that countries provide support to unpaid carers both to support their wellbeing and to enable them to combine caring with other aspects of their lives including, in many cases, employment and/or child care responsibilities (Colombo et al., 2011). This support can include information and training about caring, respite care to allow carers to take a break, financial support for carers and labour market flexibilities. It is also important to encourage the division of care responsibilities within families and communities, to reduce reliance on primary caregivers. This is crucial not only from a gender perspective but also in order to protect the health and wellbeing of caregivers.

Countries that have developed long-term care systems frequently face workforce shortages and challenges with recruiting and retaining sufficient staff to provide quality care to those who need it (Colombo et al., 2011; OECD, 2020). Countries that are developing their long-term care systems will need to recruit and retain substantially greater numbers of care staff. These two dynamics are not independent: richer countries, with more developed health and long-term care systems, continuing to recruit trained personnel from lower-income countries is exacerbating shortages in the sending countries. A global discussion around ethical recruitment in health and long-term care is long overdue and rendered more urgent by the Covid-19 pandemic.

Finally, care workers tend to be low paid and to have low qualifications and limited career prospects in the care sector. Wages for care staff may need to rise faster than wages in other sectors in order for sufficient staff to be recruited and retained. At least as importantly, the status of care staff needs to be raised, training and qualifications for care staff need to be increased, and career structures for carers need to be introduced (OECD, 2020). Given that the care workforce, both formal and informal, is overwhelmingly female, it is vital that these interventions prioritise gender equity.

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