The impact of obesity on health and social care needs among older adults (50+) in England

The impact of obesity on health and social care needs among older adults (50+) in England.

A thesis submitted in partial fulfilment of the requirements of the University of West London for the degree of Doctor of Philosophy.

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DEDICATION

This doctoral thesis is dedicated to my family. To my parents, who taught me the importance of education and personal integrity. To my family for being supportive and sacrificing time with me to achieve my dream.

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Abstract

Background: The prevalence of obesity and its implication on individual health and public health was a worldwide concern for the last few decades. Along with the increasing longevity, particularly in high income countries, there is a noticeable shift in the disease profile of the population towards more long-term non-communicable diseases due to socio-demographic transitions. From an economic viewpoint, the effect on health and social care cost related to overweight and obesity is getting more attention, but the less visible mental health and wellbeing effects have often been missed. The key theories that underlie the findings of the present study are, seeing obesity through a life course approach and social cognitive theory lens. In addition, understanding disability through a human rights approach and social model of disability.

Aim and objectives: The purpose of the study is to explore the factors that influence the health, wellbeing, and the future burden on social care services for overweight and obese older adults in England. The present study critically reviews the literature on the causes and consequences of obesity among older adults (aged 50 years and over) and their health, wellbeing, and social care needs. Gaps identified during literature review led to formulation of four research questions to satisfy the research objectives: 1) Is there any relationship between obesity, disability, and morbidities in older adults? 2) Is there any link between current health status and the overall wellbeing of obese older adults in England? 3) Is there any association between high body mass index and social care needs in older adults? 4) What are the dynamics of unmet needs for the social care of obese older adults?

Methods: A literature search was conducted to identify gaps in knowledge. A mixed-method approach is adopted that included quantitative secondary data analysis of data from the English Longitudinal Study of Ageing (ELSA) population survey and qualitative primary data

collection and analysis of patients from a National Health Service (NHS) General Practice (GP) surgery. The secondary data was statistically analysed with the help of Statistical Package for the Social Sciences (SPSS) V.25.0. The primary qualitative interview data was analysed using narrative analysis. Two conceptual models were developed. The first one, to map out the theoretical threads and answer the research questions. The second one to conceptualise the unmet care needs for overweight and obese older adults.

Findings: The findings of the quantitative data analysis show that high Body Mass Index (BMI) compared to normal weight is positively correlated with self-reported impairment of functional activity in older adults. High BMI is also positively associated with subjective and objective health status, subjective wellbeing, and the amount of social care received by older adults after adjusting for other environmental factors. The findings of the narrative analysis of the qualitative interview data were that there is a range of unexpressed and partially expressed unmet needs among overweight and obese older adults.

Contribution to knowledge: The study has advanced not only the knowledge base of consequences of high BMI and other environmental factors on the health, wellbeing, and social care need of overweight/obese older adults, but also for the first time, the nature of unmet care needs among this population.

Implications of future research: The study outcomes will enable policymakers and the health and social care providers to have a new perspective and insight into the needs of overweight and obese adults and how they can design an obesity management service for overweight and obese older adults in England that considers their both health and social care needs in a more holistic way. Social care providers and policy makers should take a life course and human rights approach when designing social care services. They should also take account of the wider

social and environmental context when delivering social care services by using a social cognitive and social model of disability framework.

Declaration of Authorship

I declare that this THESIS was composed solely by myself and that it has not been submitted, in whole or in part, in any previous academic programme for a degree. I WOULD LIKE TO STATE THAT EXCEPT where quoted OR OTHERWISE indicated by reference or acknowledgment, THE RESEARCH WORK presented here is entirely MY OWN.

Part of the thesis has already been published in academic journals or presented at seminars and conferences that I declare here.

A list of my dissemination of research activities is provided below:

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List of Abbreviations

WHO	World Health Organization
ELSA	English Longitudinal Study of Ageing
BMI	Body Mass Index
HSE	Health Survey for England
TILDA	The Irish Longitudinal Study on Ageing
NHS	National Health Service
GP	General Practitioner
ADL	Activities of Daily Living
IADL	Instrumental Activities of Daily Living
CAPI	Computer-Assisted Personal Interviewing
PAPI	Pen and Paper Interview
NICE	National Institute for Clinical Excellence
CASP	Control Autonomy Self-realisation Pleasure
SHARE	Survey of Health, Ageing and Retirement in Europe
CINAHL	Cumulative Index to Nursing and Allied Health Literature
MEDLINE	Medical Literature Analysis and Retrieval System Online, or MEDLARS Online
SPSS	Statistical Package for the Social Sciences
EBSCO	Elton Bryson Stephens Company
CEUs	Continuing Education Unit Modules
UK	The United Kingdom
USA	The United States of America
CIRT	Centre for Innovation in Research and Teaching

MREC	Multicentre Research Ethics Committee
UKDS	UK Data Service
IRAS	The Integrated Research Application System
LIC	End Users Licence
DF	Degrees of Freedom
CI	Confidence Interval
LGA	Local Government Association
PHE	Public Health England
BNF	British Nutrition Foundation
COVID	Coronavirus Disease
TAMS	The Academy of Medical Sciences
ONS	Office of National Statistics
IFS	Institute for Fiscal Studies
SHS	Subjective Health Status
ANOVA	Analysis of Variance
MORI	Market and Opinion Research International
NIHR	National Institute for Health Research
VIF	Variance Inflation Factor
FOJP	Federation of Jewish Philanthropies
CPC	Centre for Population Change
CDC	Centres for Disease Control and Prevention
ONS	Office for National Statistics
CNMH	College of Nursing, Midwifery and Healthcare
HRA	Health Research Authority
REC	Research Ethics Committee

PEEP	Personal Emergency Evacuation Plan
WSA	Whole Systems Approach
OECD	Organisation for Economic Co-operation and Development

CHAPTER 1

Introduction of the Research

Obesity is defined as the unusual and excessive fat accumulation in a person to the degree that may impair health (World Health Organization, WHO, 2021a; Kumanyika and Brownson, 2007). Obesity is a significant contributor to insulin resistance and metabolic syndrome and various non-communicable diseases, such as stroke, heart attacks, diabetes, and a range of musculoskeletal conditions (Jura and Kozak, 2016; WHO, 2011; Lumsden and Hor, 2015; LGA, 2020).

Obesity is commonly measured using Body Mass Index (BMI). BMI or "Quetelet index" is a value obtained from the body mass (weight) and height of an individual (WHO, 2006). The BMI is calculated as an individual's body mass divided by the square of their height, and it is expressed in units of kg/m2, mass in kilograms and height in metres. This is an effort to quantify the volume of an individual's tissue mass (muscle, bone, and fat) and then categorize that person as underweight, normal weight, overweight, or obese based on the BMI value calculated (WHO, 2006). The WHO classifies BMI into five categories, BMI<18.5 kg/m2= underweight, BMI =18.5- 24.9 kg/m2 as normal weight, BMI= 25-29.9 kg/m2 as overweight, BMI ≥ 30 kg/m2 = Obese and BMI ≥40 kg/m2 can be considered as morbidly obese (WHO, 2006).

There was some debate about the need for different cut-off points for different ethnic groups, as some ethnic groups experience cardiovascular and metabolic risks at lower BMI levels than categorised by WHO. For example, Asian populations have a higher proportion of body fat than the general United Kingdom (UK) population with the same age, gender, and BMI

(Department of Health, 2008; Centres for Disease Control and Prevention (CDC), 2020a). In addition, professional athletes may possess high BMIs due to their increased muscle mass (Jonnalagadda et al., 2004). The National Institute for Clinical Excellence (NICE, 2006) has suggested that evaluating health risks associated with overweight and obesity should be judged by waist circumference and BMI together for those with a BMI of less than 35kg/m2.

Obesity is a global problem and is one of the biggest public health challenges today, with increasing prevalence and incidence in high, middle, and low-income countries over the past 3-4 decades in both adults and children (Marinos, 2001; Bell et al., 2016). In 2017, there were 4 million deaths each year associated to overweight or obesity (WHO, 2021a). Obesity-related comorbidities and disabilities is regarded as the second leading preventable cause of death after tobacco (Jia and Lubetkin, 2005). The increasingly sedentary working practices and personal lifestyles, the widespread accessibility to energy-rich and highly processed foods, time poverty as individuals and families juggle paid employment and busy family lives, alongside an 'obesogenic environment' where walking and cycling are often not prioritised and parks and play spaces reduced or removed has led to the rapid escalation of obesity (Government Office for Science, 2007). Socio-economic and environmental factors alongside energy imbalance and genetic factors together create one big complex multifactorial web of determinants that are increasing body weight and leading to a rise in obesity. In addition, several studies found that smoking and high BMI (overweight and obesity) are the two prominent lifestyle factors associated with the presence and extent of sick leaves and the level of productivity deprivation at workplace (Robroek et al. 2011; Weng et al., 2012; Goettler et al., 2017). An Institute for Employment Studies by Bajorek and Bevan (2019) informed that among the highest three communal burdens created by human beings, obesity is one of them, where ‘armed violence and smoking’ and ‘terrorism and war’ are in the topmost position.

Regardless of gender and racial groups, all age groups are experiencing this complex and multifactorial problem to varying degrees (Jura and Kozak, 2016). Obesity though is a more significant issue for the poor than for the rich, for ethnic minorities (people of colour) than for whites and for women than for men (Flegal et al., 2004; Djalalinia et al., 2015).

The Centre for Policy on Ageing (2013) found that in England, the obesity-related public health burden is partly related to the rapid increase in older adults in the UK. Abdominal obesity in older women aged 60 years is more prevalent, 73.8%, nearly double the rate of population wide obesity (Flegal, 2010; Lumsden and Hor, 2015). A study on racial or ethnic differences related to obesity and overweight in older adults found that older adults from the Blacks and Hispanics population were more vulnerable to functional impairment for daily living than White population groups (Wei and Wu, 2014).

Obesity in old age is different because it acts synergistically with other health problems, leading to more severe chronic health conditions and disabilities. Both obesity and ageing lead to significantly increased risk of non-communicable disease and premature death among older adults (Jura and Kozak, 2016). Obesity in older adults, therefore, can impose a significant burden on the adult social care system. In England, obesity-related expenditure and burdens on the NHS were the policy focal point for many years at the expense of the pressure and burdens on social care (Local Government Association, LGA, 2020). A report by NatCen social research (2018) using The British Social Attitudes Survey found that in England and Scotland, there are several existing health inequalities related to the distribution of health and social care benefits, socio-economic status and social engagement in old age. Therefore, it is important to investigate the effect of obesity on the health and wellbeing in older adults, particularly understanding the nexus between obesity, complex morbidity, disability, and social care needs.

1.1 Background to the study

A report by Department of Health and Social Care (Gov.UK, 2020) informed that currently in England, about 63% that is two-thirds of adults are having high BMI and among those halves of the adults are obese. Whereas, in 2011 about 62% of adults were either obese or overweight; besides, the ratio of overweight adults, including obese, rose from 49% to 58% in women and from 58% to 65% in men between 1993-2011 (NHS Digital, 2013). According to the NHS Digital (2020) 67% and 60% of men and women respectively are classified as obese or overweight in England. Whereas Samper-Ternent and Al Snih (2012) reported that an average prevalence of obesity among older adults is 16.2% for men and 17.8% for women in Europe. The rate of obesity between 2009 to 2011 was 22.9% in the United States (Musich et al., 2016). Compared to the rest of Europe, England has high levels of overweight and obesity. Public Health England (PHE, 2013) stated that in England one in four adults being obese. Since 2007, the adult obesity graph was inclined faster than predicted (UK Government, 2020). It is estimated that by 2024, the number of obese adults in England will be between 26.6% and 33.9% (PHE, 2019).

The proportion of adults in England with a healthy BMI (18.5-24.9 kg/m^2) has reduced between 1993-2011 from 41% to 33.6% in men and 49.5% to 39.4% in women (NHS Digital, 2013). NHS Digital (2020) estimated that obesity including morbid obesity rates are on the rise for women (29%) compared to men (26%) (NHS Digital, 2020), and the prevalence of overweight is higher among men (41%) than women (30%). The report also informed that in between 1993 to 2018, the prevalence of morbid obesity has increased from fewer than 1% to 3%. A report by British Nutrition Foundation (BNF) (2007) predicted that by 2050, the majority of the UK population is estimated to be primarily obese, with some 40% obese by 2025 and almost 60% obese by 2050.

Some past studies have reported that high BMI may have a protective role in relation to premature mortality in older adults (Janssen, 2007; Pischon et al., 2008). For example, a study on older adults by Han et al. (2011) found that high BMI, increases the absolute mortality risk up to the age of 75 years, with the association becoming weaker for older adults over 80 years of age. This phenomenon was called the 'obesity paradox' or ‘reverse epidemiology’ (Chapman, 2010; Hainer and Aldhoon-Hainerova, 2013), which states that the increasing body weight can be positively associated with increases in maximal survival rates with increasing age in older adults. It is important to note that the obesity paradox does not take into account the adverse effect of obesity on the number of years individuals live free from disability.

So, as individuals are getting overweight and obese as children and adults they are also living longer. In 2015, globally, there were almost 900 million older adults aged 60 years and over and 125 million aged 80 years plus (Raeisi et al., 2017). In the United Kingdom, the prevalence of obesity is more visible among older adults than their younger counterparts, which is about three quarters of the elderly aged between 65-74 years were classified as overweight or obese (Gulland, 2010). It is estimated that by 2050 the former will rise to reach 2 billion and the latter to 434 million older adults (Gulland, 2010). Ageing by itself also causes changes in body composition and is a pivotal contributor to reducing lean body mass (muscle) and altering body fat distribution associated to the reduction in basal metabolic rate and energy requirements ((National Obesity Forum, 2012; BNF, 2016). There has also been an epidemiological transition, in most countries, as national disease burdens move to a greater or equal predominance of non-communicable diseases compared to communicable diseases (Arokiasamy and Selvamani, 2018).

Older adults are therefore more prone to develop multiple chronic diseases, frequently described as 'multimorbidity', due to the biology of ageing and the shifting disease burden profile described above (Arokiasamy et al., 2015). In addition, there is a positive association

between the complex morbidities, multiple functional limitations with the daily activities for the elderly (Dhalwani et al., 2016), where complex morbidities are represented as 'complex comorbidity' and 'complex multimorbidity'. Harrison et al. (2014) defined 'complex comorbidity' and 'complex multimorbidity' as co-existing of two or more and three or more chronic conditions respectively, involving two or more and three or more body systems, besides the index disease under study. Individuals with complex morbidities are most likely to have a complex health and social care need related to their body, mind, and societal need. Increase in longevity and obesity leads to an increase in chronic conditions, complex morbidities, disability, and premature mortality in older adults, particularly in the developed countries (Nam et al., 2012; Gallagher and Gates, 2006). A study by Ng et al. (2014) stated that globally, obesity is the root cause of more than 3.4 million deaths, 4% of life years lost and at least 4% of 'Disability-Adjusted Life Years'. Therefore, the disease burden of increasing numbers of chronically sick older adults (aged 65 years and over old as defined by the WHO) is a significant concern internationally and in England (Han et al., 2011; Local Government Association, 2020). Lastly, the accumulation of excessive fat mass may itself also lead to lower muscle strength and functional impairments (Tomlinson et al., 2016; Alexandre et al., 2018).

A report by Office for National Statistics (ONS, 2013) stated that in Great Britain (England, Scotland, and Wales), 36% and 20% of adults reported having long-term conditions or disability and limiting long-term conditions, respectively, more than one in three and one in five adults. People with chronic conditions, complex morbidities and impaired mobility who are also obese have lower wellbeing (LGA, 2020). In addition, health inequalities related to socio-economic status and disadvantage exacerbates the physical health problems and further lowers wellbeing (Williams et al., 2020). Increasing health inequalities is also one of the contributing factors for rising obesity among older adults (Raeisi et al., 2017). The prevalence of the obesity rate among adults in the most disadvantaged areas is approximately double that

in the least deprived area, 36% compared to 20% (Batterham, 2020). There is debate regarding the effect of higher socio-economic status on the prevalence of overweight and obesity among the elderly as older adults who have a higher socio-economic status do also become overweight and obese due to high energy intake and lower expenditure (Philipson and Posner, 2003; Raeisi et al., 2017).

Cognitive capacity in older adults contributes to determining their health status, psychological wellbeing, life satisfaction (Banjare et al., 2015) and wellbeing (Singh et al., 2017). A study by Shirley et al. (2016) found that complex morbidities with more than two diseases are negatively connected with cognition. Older adults face extra mental health challenges with the major transitions of life due to retirement, bereavement, relocation, 'empty nest', widowhood or being single (Age UK, 2019; Kaplan and Berkman, 2021; Zhang et al., 2020a). Obesity is also associated with social discrimination (related to age and obesity), stigma and body image distortions in older adults (Trull et al., 2012; Abdelaal et al., 2017). A significant portion of the elderly population reported encountering age-related discrimination in their day-to-day life. The population surveys found that 35% of older adults (aged 52 and over) living in England and 29% living in the United States of America (USA) reported encountering age-related discrimination more than once a year (Jackson, 2019a). A report by Wharton et al. (2020) stated that the association between obesity with stigma and social bias is one of the essential contributors to increase morbidity and mortality regardless of the weight categories. The above factors can increase the risk of low self-esteem, loneliness, depression, problems with the interpersonal relationship, communication, mood changes and poor health behaviours among older adults (Djalalinia et al., 2015; Age UK, 2019).

The health economy of countries is also adversely affected due to the challenges related to preventing and treating overweight and obesity. For example, in the UK, treating obesity costs the National Health Service (NHS) an estimated £6.1 billion a year (Gov.UK, 2020) with

almost 900,000 hospital admissions from the year 2018-2019 were related to obesity. It was observed that obese older adults spend more time in hospital inpatients due to the problems associated with the skeleto-muscular system and orthopaedic procedures (Rössner, 2001).

A cross-sectional qualitative study by Themessl et al. (2007) on the Scottish elderly (aged 80 years and above) population evaluated that the older adults with frailty are the high users of services. However, they were not satisfied with the services they received, since the received services were not fully meeting their needs of helping to maximise independence and support to live a fulfilling life. A cross-sectional study by Sørbye et al. (2007) on care need for extremely obese older women aged 65 years and above evaluated that extremely obese women require more help with their personal care than their thinner counterparts. Being obese is also positively associated to an increasing risk of frailty among older adults (Blaum et al., 2005; Falsarella et al., 2015).

Obese older adults with learning disabilities frequently experience multiple morbidities and increasing demand for health needs. Schoufour et al. (2013) found that older adults aged 50 years and over with intellectual disability have a degree of frailty compared to the broader population aged 75 years and over. This is partly explained by the existing health inequalities and disadvantage experienced by adults with learning disabilities (Biswas et al., 2010).

Shirley et al. (2016) demonstrated that obesity-related disbursement associated to chronic medical conditions could be reduced with the interventions that promote healthy behaviours and lifestyle and weight management among older adults. In addition, Djalalinia et al. (2015) have argued that there is a need to evaluate the influence that obesity has on various dimensions of health (for example, physical health and illness, mental health and wellbeing), particularly for older adults.

The above discussion shows there is an urgent need to investigate the relationship between overweight and obese older adult's health, wellbeing and social care need, particularly unmet need for social care and support, in more detail.

1.2 Rationale in researching obesity, wellbeing and health and social care needs in older adults in England

Thompson et al. (2014) using HSE 2013 data analysis found that 63% of older adults of 65 years age and over received community-based social care. The Local Government Association (LGA, 2013) in its "Social Care and Obesity" report found that social care is primarily needed to support people with chronic medical conditions. Report commented that social care is needed to support obese older adults in their daily activities, allowing them to live as independently as possible. Obesity among older adults also impacts on adult social care. A report by LGA (2020) estimated that the annual cost towards providing Local Authority (LA) funded social care for a community based older adult with a BMI of 40kg/m2 would be £1086, while the cost for an individual with a BMI of 23kg/m2 is almost half. A longitudinal study on the elderly (aged 60 years and above) by Nizalova et al. (2018) found a positive relationship between overweight and obesity and long-term need for social care and support.

The LGA (2013) judge that there is not enough published data to establish whether obesity is directly associated with an increase in social care need in older adults. Though, a recent English modelling study on older adults (aged 65 years and over) by Copley et al. (2017) using cross-sectional survey data found that self-reported need for social care is positively related to BMI even after adjusting for socio-demographic factors and limiting long-term illness. The study modelled the need for care rather than the receipt of care. Given the recent cost-cutting in this area and the challenges associated with dealing with obesity, more research is needed to determine the social care need among overweight and obese older adults by identifying the

amount of informal and formal social care support those older adults receive from different sources. Moreover, the factors that influence the demand for different sources of social care support for older adults needs to be evaluated appropriately to redesign future adult social care services.

Thompson et al. (2014) using HSE 2013 data analysis found that a higher percentage of social care need, and support was reported among older adults than the percentage of help and care they actually received. The study provides some initial evidence for the potential unmet need among older adults for social care and support. Other recent studies have also found that there are many unmet care needs among older adults in England (Age UK, 2019, Dunatchik et al., 2019). In the present study, unmet social care need is defined as, "the determinants of need for care differing from the determinants of the amount of help actually received" (Copley et al., 2017, p.3). The cuts to adult social care budgets in England have reduced that capacity of these services to meet current and future needs for social care (Vlachantoni et al., 2011).

An English exploratory study by Northway et al. (2017) on older adults living in a residential care setting identified the need for health and social care providers to tailor their support for obese older adults:

"While many of the same concerns regarding mortality and morbidity due to obesity in younger people hold true for the elderly, age-related changes in body composition, physiology, and lifestyle may necessitate changes in management and care for older people" (Federation of Jewish Philanthropies (FOJP) Service Corporation, 2012, p. 16).

The above discussion shows there is an urgent need to investigate the relationship between obesity among older adults and their health, wellbeing, and social care needs, in more detail in England. To the student researcher's knowledge there is no published study to date, specifically

exploring unmet needs for social care and support among overweight and obese older adults in England.

1.3 Research aim and objectives

The above discussions reveal that although obesity is a significant contributor to insulin resistance and metabolic syndrome and various non-communicable diseases, obesity among older adults need to be examined carefully due to the controversial medical hypothesis 'obesity paradox'. However, from the 'obesity paradox', it is unclear whether there is any impact of obesity among older adults regarding their disability and morbidity status, which is the first research gap identified for the present study. In addition, from the 'obesity paradox', it is also not clear whether there is any impact of obesity in older adults on their health and wellbeing, which is the second research gap identified for the present study. Moreover, the existing obesity management, framework and guidelines do not address this issue. Furthermore, it is not established from the 'obesity paradox', whether there is an association between the amount of social care received and the demand for social care with an individuals' increasing degree of BMI, which is the third research gap identified for the present study. Finally, there is no study so far identified various aspects of unmet need among overweight and obese older adults, demanding to be cared for and supported, which is the fourth research gap identified for the present study. The key gaps in knowledge are clearly pointed out in a tabular format (Table 2.3) under literature review (Chapter 2).

Aim

The study aims to explore the effect of obesity on health and social care needs among older adults in England.

Objectives

The specific research objectives are as follows:

- To investigate the association between obesity, disability status, morbidities in older adults.
- To determine the association between current health status and wellbeing in older adults with obesity.
- To explore the differences in social care needs by the degree of obesity.
- To examine the role of obesity among older adults in determining social care needs by identifying their unmet care needs.

The objectives and the research questions are well aligned with the background literature under literature review in Chapter 2. In addition, the development of the research objectives and research questions against the knowledge gaps are presented in Table 2.3.

1.4 An overview of the methodology

A mixed-methods approach is used to accomplish the aim and objectives of the present research, where both quantitative and qualitative methods are used to generate data. Both methods have their advantages and disadvantages in examining an issue and interpreting the findings. The study methodology is discussed in Chapter 3. From the pragmatic point of view, merging both research methodologies allow different types of applied knowledge to be generated to explore the complexity of the issue (Kelly and Cordeiro, 2020). The approach also improves the quality of the research in terms of the quality of the overall findings, and to develop a thorough understanding of the study context and answer the chosen research questions. Combining the quantitative and qualitative methodologies is seen as a useful approach to provide a complete picture of a research problem (Creswell, 2012).

For the first part of the study, secondary data is accessed from the English Longitudinal Study on Ageing (ELSA) Wave 8 (2016-2017) dataset. This is a nationally representative survey of the non-institutionalised population aged 50 years and over living in England. The secondary data was used to answer the first three research questions. To answer the fourth question a qualitative interview with obese older adults were conducted at a single centre NHS GP surgery.

1.5 Structure of the thesis

The thesis is structured into nine chapters.

Chapter One

The first chapter discusses the study's rationale, describes the study objectives and research questions from the identified literature gaps and gives an overview of the study methodology. It defines obesity and its worldwide prevalence to show why obesity is one of the significant public health challenges for today and the future. It also explores the future projections for global obesity combined with age-associated disabilities and morbidities for older adults and how it affects the health economy of the UK. Finally, the chapter highlights the need to promote effective health and social care for obese older adults to improve their psychological wellbeing and reduce inpatient hospital admissions.

Chapter Two

The second chapter reports on the literature search undertaken on the impact of obesity among older people regarding their health and social care needs for the past two decades. It discusses the inclusion and exclusion criteria applied to select the most relevant articles for the study. The chapter critically discusses the relevant theories on obesity, disability, comorbidity, health status and wellbeing to support the current study. Finally, it presents a comprehensive literature

review and discusses the literature gaps, which helped develop the research questions and how the conceptual framework was developed.

Chapter Three

The third chapter critically appraises the choice of research methodology for the present study based on the availability of different philosophical approaches. Besides, the ethical aspects of both arm of the study are clearly informed. Finally, this chapter provides a road map on the study design, data access, data collection, data management, data validity and provides a plan for the data analysis.

Chapter Four

The fourth chapter provides a comprehensive discussion of the different study variables, their coding and the different tools used to measure these variables. Besides, it displays the summary analysis of all the variables used in the study, based on the English Longitudinal Study of Ageing (ELSA) dataset. Moreover, the section provides a conceptual model that would help examining the primary data. Finally, the chapter examines the results of exploratory data analysis and descriptive statistics to explore the relationship between obesity, disability and morbidities in older adults.

Chapter Five

The fifth chapter describes the strategies used to build the statistical models, including multivariate logistic regression. In addition, it indicates the other statistical measures used to answer the study's second research question. Finally, the chapter presents a logical argument to display the outcomes of the statistical analysis.

Chapter Six

The sixth chapter describes the strategies used to build the statistical models, including multivariate logistic regression and the other statistical measures used to answer the third research question of the study. Finally, the chapter presents a logical argument to display the outcomes of the statistical analysis.

Chapter Seven

The seventh chapter presents a logical argument to display the outcomes of the primary data analysis.

Chapter Eight

The eighth chapter highlights the critical exploration of the key study findings in the light of relevant existing literature and indicates the strengths and limitations of the present study. The chapter also highlights a brief analysis of the implications of the research findings for future policy and practice.

Chapter Nine

The nineth chapter draws together the study findings with a summing up of the observations and arguments that have emerged on the four research questions and sets out the contribution of this research study to the broader field of study.

1.6 Summary of the chapter

The chapter highlights the study background and the knowledge gaps, where further research is needed. It also points out the research aim and objectives, developed based on the knowledge gaps concerning the study context. The chapter is concluded by briefly outlining the structure of the thesis.

CHAPTER 2

Literature Review

2.1 Introduction

This chapter's objective is to assemble and review key research studies on the impact of obesity among older people in relation to their social care needs. An overview of the study topic has been provided in the introduction chapter. This chapter examines findings from a range of sources, including nationally representative, and widely cited, research on obesity among older adults its effect on their health, wellbeing, and social care needs in England. It also identifies the areas where more research work is required. Based on the identified gaps in the literature, an aim, objectives and four key research questions are developed.

2.2 Literature search strategy

The literature search was carried out using three bibliographic databases: Cumulative Index of Nursing and Allied Health Literature (CINAHL) Complete, Medical Literature Analysis and Retrieval System Online (MEDLARS Online, MEDLINE), and Academic Search Elite (Elton Bryson Stephens Company (EBSCO) Industries, 2018). These databases index journal citations and abstracts for clinical, biomedical, and social studies research literature worldwide, from academic journals, journals, magazines, news, reviews, trade publications, dissertations, CEUs (CINAHL Continuing Education Unit Modules), books and government documents. The databases index literature published in English and other languages. The search parameters for the literature review for this present study were, research studies on humans, between 1995-2019, for MEDLINE, middle-aged + Age-related: 45 + years, for CINAHL Complete (which includes Academic Search Elite), All Adult.

The identified search keywords are classified into eight groups as follows:

A. obesity or overweight or fat* or obese or unhealthy weight or high BMI or high body mass or increas* body mass or increas* weight
B. elderly or aged or older or elder or geriatric* or elderly people or old people or senior* or ageing or older adult*
C. disability or disab*or impairment or impair* or special need*
D. comorbidity or comorb*or morbidity or morb* or multimorbidity or moltimorb* or multiple chronic conditions* or multiple chronic disease* or multidiseas* or multidiagnos*
E. health or health status or health condition* or health situation* or state of health
F. wellbeing* or wellbeing* or quality of life* or welfare* or standard of living*
G. social care or social care* or social care management or social care support* or care support*
H. unmet need or unmet need* or unmet support* or unmet care or unmet care need* or care need*

A TI Title search and AB Abstract search using the above search keywords in CINAHL Complete, MEDLINE, and Academic Search Elite were undertaken. However, the category A keywords, which are the obesity- related words / phrases, were kept as TI Title search from the beginning as obesity is core keyword for the present study. Table 2.1 shows the database search by keywords and the number of search results identified in all languages and in English.

Table 2.1: Database search by keywords

Keywords	***TI Title* search**			***AB Abstract* search**		
	All languages	**English**	**No. of papers obtained from each database**	**All languages**	**English**	**No. of papers obtained from each database**
A	136,447	131,563	CINAHL- 2,728 MEDLINE- 34,450 Academic Search Elite- 91,084			
A + B	4,475	4,307	CINAHL- 256 MEDLINE- 1,807 Academic Search Elite- 1,880	17,805	17,035	CINAHL- 669 MEDLINE- 6.799 Academic Search Elite- 8,670
A+B+C	177	174	CINAHL- 12 MEDLINE- 72 Academic Search Elite- 75	1,327	1,295	CINAHL- 55 MEDLINE- 565 Academic Search Elite- 601
A+B+D	2	1	CINAHL- 0 MEDLINE- 0 Academic Search Elite- 1	134	131	CINAHL- 0 MEDLINE- 0 Academic Search Elite- 66
A+B+C+D	0	0	CINAHL- 0 MEDLINE- 0 Academic Search Elite- 0	7	7	CINAHL- 0 MEDLINE- 6 Academic Search Elite- 5
A+B+E	317	307	CINAHL- 25 MEDLINE- 127 Academic Search Elite- 125	5,973	5,726	CINAHL- 297 MEDLINE- 2,241 Academic Search Elite- 2,877
A+B+F	70	67	CINAHL- 4	673	633	CINAHL- 34

			MEDLINE- 29 Academic Search Elite- 25			MEDLINE- 239 Academic Search Elite- 319
A+B+E+F	22	20	CINAHL- 3 MEDLINE- 13 Academic Search Elite- 14	467	445	CINAHL- 27 MEDLINE- 165 Academic Search Elite- 221
A+B+C+F	2	2	CINAHL- 0 MEDLINE- 1 Academic Search Elite- 3	139	136	CINAHL- 7 MEDLINE- 62 Academic Search Elite- 56
A+B+G	2	2	CINAHL- 0 MEDLINE- 2 Academic Search Elite- 2	50	30	CINAHL- 4 MEDLINE- 17 Academic Search Elite- 24
A+B+C+G	0	0	CINAHL- 0 MEDLINE- 0 Academic Search Elite- 0	6	6	CINAHL- 2 MEDLINE- 3 Academic Search Elite- 6
A+B+E+G	0	0	CINAHL- 0 MEDLINE- 0 Academic Search Elite- 0	27	26	CINAHL- 3 MEDLINE- 13 Academic Search Elite- 20
A+B+F+G	0	0	CINAHL- 0 MEDLINE- 0 Academic Search Elite- 0	4	4	CINAHL- 1 MEDLINE- 2 Academic Search Elite- 3
A+B+H	0	0	CINAHL- 0 MEDLINE- 0 Academic Search Elite- 0	3	3	CINAHL- 0 MEDLINE- 3 Academic Search Elite- 3
A+B+E+H	0	0	CINAHL- 0 MEDLINE- 0	2	2	CINAHL- 0 MEDLINE- 2

			Academic Search Elite- 0			Academic Search Elite- 2

***(Keywords: A**-obesity or overweight or fat or obese or unhealthy weight or high BMI,*
***B**-elderly or aged or older or elder or geriatric or elderly people or old people or senior or ageing,*
***C**-disabilities or disability or disabled or impairment or impaired or special needs,*
***D**-comorbidities or comorbidity, **E**-health status or health,*
***F**-wellbeing or wellbeing or quality of life,*
***G**-social care or social care management or care need,*
***H**-unmet need or unmet support or unmet care or unmet care need.)*

Along with the above database search, Google Scholar, Google, and PubMed search have also been undertaken.

Table 2.2: Inclusion and exclusion criteria for article selection

Inclusion Criteria	Exclusion Criteria
• Literature that was available in English. • For MEDLINE (Middle-aged + Age-related: 45 + years), for CINAHL Complete (All Adult). • Studies about over nutrition or overweight and high level of BMI.	• Studies with participants younger than 50 years old. • Older people aged 50 years and over with cognitive or intellectual disabilities. • Studies about under nutrition or malnutrition.

2.3 Overweight and obesity: underpinning theory

The proximal cause of obesity is 'energy imbalance' i.e., higher calorie intake and lower calorie expenditure, for example, a high calorie diet and low levels of physical activity. However, the distal causes of overweight and obesity are complex and relate to a combination of genetic, social, and physical environmental factors that influence the kinds of foods people eat, how and where and when they eat it, and the kinds of physical activity people take part in and how and where they carry out physical activity. This includes the global food and drinks production, manufacturing, processing and distribution systems and the kinds of urban planning and development occurring in towns and cities (WHO, 2014). Alongside these factors is the issue of health inequalities and health equity how they influence the above factors as well as overweight/obesity and physical, mental, and social wellbeing.

Health inequalities or disparities are the differences in health status found across a population. Health inequalities are often associated to wider social inequalities in a society (Bartley, 2016; Seaman, 2015). Health inequality is defined as the "unfair and avoidable differences in health across the population, and between different groups within society" (NHS England, 2010, para, 2). Health inequalities and inequity are related to demographic (age and sex), geographical, ethnic, cultural, economic, and social factors i.e., the circumstances in which "people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life" (Arcaya et al., 2015; WHO, 2020b, para 1).

Mccartney (2017) proposed four theories about how health inequalities emerge. Those are artefacts, selection theories, behaviour and culture, and structural and political economy. Artefact means health inequalities are not true differences but relate to how things are

measured and researched, for example, people born with Autism or Down syndrome are not measured well or really not related to inequalities. Selection theory relates to unhealthy people becoming unable to work or do other activities which affects their health and wellbeing, i.e., the inequalities relate to their poor health. It is about selection effects and reverse causality where for example, a person susceptible to depression loses their employment and friends which leads to inequalities in income and social capital rather than that they lose their employment and friends which leads them to become depressed. Behavioural and culture theory relates to behaviours and cultural factors that affect health status. For example, these could be the prevalence of certain lifestyle behaviours such as drinking alcohol, smoking and eating high calorie foods, cultural differences in family structure, such as men going out to work and women look after the family meaning that women are not able to do as much physical activity as men, or passing on of skills such as good parenting. Lastly, structural, and political economy explains inequalities as the interplay between differences in power, economic position, and resources. For example, racial, age and sex discrimination, social exclusion, and systematic lack of opportunities in education, employment and access to services experienced by certain groups. In the context of the present study, obesity progression and prevention, health and wellbeing, and social care need are likely to connected with health inequalities in older adults should be considered in relation to their employment status, i.e., lack of income/wealth (poverty), living in disadvantaged neighbourhoods (deprivation), lower levels of health literacy and fewer social and economic advantages (educational achievement and high-quality secure jobs).

Examining individuals' lives within the context of social change, structural and cultural circumstances is named life course approach (Elder et al., 2003). The life course approach "explain ways in which different factors may act to cause chronic diseases across the life course: they focus on a critical period (with or without effect modifiers), an accumulation of

risk model and a chain of risk model" (Jacob et al., 2017, p. 7). It was developed from evidence that early life experiences had profound health effects in later life (the Barker Hypothesis) (Edwards, 2017). Therefore, a life course approach needs to be taken to prevent disease and protect, promote, and improve health and wellbeing (Rashbrook, 2019). Elderly or ageing is, therefore, one pivotal phase of developmental change in the life course particularly in countries like the UK where the older adult population is increasing over time (Age UK, 2014). They are also more vulnerable to chronic diseases due to the biological ageing process and the potential for an increase in unhealthy behaviours in old age. Research by Age UK (2019) found that for older adults, the effects of inadequate social connection are as dangerous as the effects of inactivity, obesity, and smoking. So, there is an association between lack of social connection and increased risk of chronic disease in older adults (Age UK, 2019). The impact of life course transformations and adaptations on an individual's behaviour has been predominantly ignored in relation to obesity until recently (Musingarimi, 2008). Rashbrook (2019) argues that the trajectories of a life course can be improved by changing the policies, reducing health inequalities, and altering environmental and societal conditions. In the context of the presents study, overweight and obesity, health and wellbeing, and social care need in older adults must take account of the life course of an older adult and how they may have experienced a cumulative burden of adverse social, economic, physical environment and social impacts during childhood, adolescence, and adulthood.

Health behaviour theories can also shed some light on determining the factors that influence an individual's health behaviours. Social cognitive theory (SCT) states that "learning occurs in a social context with a dynamic and reciprocal interaction of the person, environment, and behaviour" (LaMorte, 2019, para. 5). An individual's health behaviour, therefore, depends on the impact of an individual's past and present experiences, environmental factors, and the

act of others (Bandura, 2004). In the context of the present study, the last point about the act of others (informal, formal public or state, and paid private social care) is an important issue to bear in mind and how an individual's life course (past and present experiences) alongside their current social and physical environment (health inequalities) is likely to influence their level of obesity, their wellbeing, and their level of social care need.

In the context of the present study, whether, and how, social care empowers and enables individuals to take charge of their own physical, mental, and social health and wellbeing, i.e., so that they stay independent for as long as possible, is an important issue to be considered.

2.4 Disability: underpinning theory

Disability study is an academic area of study that discusses the meaning, the nature of the impairment, and the implications of disability as a complex social affair (Simon, 2013). The primary aim of the field is to enable individuals with disabilities to access civil rights and maintain their quality of life. A report by WHO (2021c) informed three aspects of disability: impairment, activity limitation and participation restrictions. At the same time, impairment is connected to an individual's functionality regarding their body and mind. In addition, activity limitation is associated to the difficulty of doing some activities (such as walking, hearing, problem-solving). Moreover, participation restriction is connected to the difficulty of doing essential daily activities (for example, working, seeking help, engaging in social activities). A report by the CDC (2020b) defined disability as a state that influences an individuals' mind and body ('impairment'), making it harder for that person with the state to do specific activities ('activity limitation') besides, connecting with the environment around them ('participation restrictions').

Simon (2013) found four disability models: 1) medical model, 2) human rights model 3) social model and 4) critical disability studies model.

The medical model regards disability as an individual's impairment, whereas the social model is developed by disabled people and explains that people are disabled due to the societal barrier, not by their bodily impairment or differences (Forhan, 2009). At the same time, the barriers can be either physical (for example, accessibility to a building) or can be caused by people's attitudes towards impairment or difference (for example, presuming individuals with a disability would be unable to do certain things) (Forhan, 2009). In contrast, the medical model is a deficit model, and the focus is on repairing the deficit through medication, surgery, prosthetics, and equipment. Hence it is difficult to explain a disabled person's needs through this model (Forhan, 2009). A study by Goering (2015, p.134) found that the main disadvantage of the people with disabilities is not directly associated to their body, "but rather from their unwelcome reception in the world, in terms of how physical structures, institutional norms, and social attitudes exclude and/or denigrate them".

The adults with severe obesity may have physical impairments which inhibit activities of daily living. The social model, therefore, emphasises the distinction between impairment and disability. While the former is associated to a condition of a person's mind or body, and the latter is the outcome of environmental and societal response towards that impairment (Degener, 2014). Primarily from a social model of disability perspective, the model has resource implications for social care services (such as housing adaptations for specialist mattresses, doors, toilet frames, hoists and stairlifts, community transport and facilities like specialist leisure services) (Public Health England, 2013). It is because the social model emphasises more on societal obstacles than an individual's condition. According to the

model, a person is impaired due to social barriers (for example, a building without wheelchair access or inaccessible toilet) (Oliver, 1998).

In contrast, from a medical model of disability perspective, if obesity is considered a disease or something is ‘wrong’ with that individual, then an individual with disabilities feels “excluded, undervalued, pressured to fit a questionable norm, and/or treated as if they were globally incapacitated” (Goering, 2015, p.134). The social model, therefore, assists us to rethink the term- disability and acknowledge the roadblocks that force an individual with functional difficulties or ill health to be impaired and dependent. However, as disused before, helping a person to overcome societal impairments have an association with significant cost implications and workforce. Hence it demands an improvised public health policy and planning.

The human rights model of disability aims at the fundamental human rights of a person with disabilities (Degener, 2014), which is primarily grounded on the social model of disability. According to the model, disability is viewed as a shift from an individual's everyday health and illness status. Fundamentally, the purpose of the model is to focus on preserving an individual's self-worth and dignity. In addition, this model considers an individual's medical need and the nature of the illness (Degener, 2014). In contrast to the social model, “the human rights model encompasses the values for a disability policy that acknowledges the human dignity of disabled persons” (Degener, 2014, p.6). A report by LGA (2020) informed that the Equality Act of 2010, is yet to be safeguarded a person's weight category. Anyhow, perhaps there is a legal provision against unfairness for an obese individual, given that an increasing degree of body weight adversely affects an individual's ability to continue daily activities (LGA, 2020). Even so an appeal produced by the United Kingdom Employment Appeal Tribunal database (2013) emphasised considering 'obesity discrimination' as 'disability discrimination’.

The critical disability theoretical model raises questions on the dualism between impairment and disability, and it is grounded on the social model and human rights model of disability. A paper presented by Hosking (2008, p.5) explained that “Critical disability theory centres disability as it compares liberalism's norms and values with their actualisation in the daily life of disabled people”. Primarily, the model is based on the principles that assist any countries law and legal system to view and respond towards a disabled person. In addition, most of the disability models are partially based on the 'structural and political economy' theory of health inequalities. Mccartney (2017, p.19) reported that "Those with most resources are always the healthiest, regardless of their behaviours”.

In the context of the present study, disability is theoretically framed using a human rights approach and the social model of disability.

2.5 Obesity and morbidity: underpinning theory

Obesity, particularly high levels of obesity lead to inflammatory responses in the body which in turn lead to cardiovascular disease and cancer (Garvey and Mechanick, 2020; Wharton et al. 2020). This biological obesity-related process increases the risk of complex morbidity and reduces life expectancy by 6 to 14 years (Grover et al., 2015).

Ording and Sorensen (2013) identified the clinical effects of obesity in relation to the Edmonton obesity staging system to determine the degree of obesity and clinical risk to a person. Key comorbidities that obesity-related are type 2 diabetes, hypertension, hypercholesterolaemia, sleep apnoea, cancer, cardiovascular diseases, and osteoarthritis. Each of the comorbid conditions may facilitate developing further impairment, disability, and risk, leading to new comorbid conditions (DOH, 2003).

In the context of the present study, obesity and morbidity are closely related in older adults both directly and indirectly and hence potentially increases the older adult's health and social care need directly and indirectly.

2.6 Health and wellbeing: underpinning theory

The medical or biomedical model of health considers health as the absence of disease or pain and stresses the role of clinical diagnosis and intervention (WHO, 2003). Accordingly, as per the medical or biomedical model of health, ill-health mainly caused by biological factors, including lifestyle choices like unhealthy diets, lack of exercise and smoking (Browne, 2020). The World Health Organization (WHO) however, defines health as "a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity" (WHO, 2021b, para 1).

Considering this is a different outlook from the medical or biomedical model of health. Thus, health is a debated term, and a study by Huber et al. (2011) proposed health as the ability of a person to adapt to their situation and their ability to 'self-manage'. In addition. the bio-psychosocial model of health emphasises the influence of social, psychological, and physiological factors. Consequently, the clinical outcomes concerning diseases may have resulted from the interactions between these factors on health, disease, and a person's subjective experience (Taukeni, 2019). By acknowledging the complexity and diversity of 'health', a study by Blaxter (2010) proposed 'health' as a subjective view, the way different people define their health, and this is conceptualised as a lay concept of health.

In the present study, health and, therefore, health status will be referred to as the body's ability to function, which may not be disrupted by the effect of obesity or comorbidities supported by the biomedical perspective of health. However, the biomedical model is

criticised as overall health is associated with environmental and social changes rather than medical impact (Taukeni, 2019).

The WHO (2021d, para, 2) definition for mental health is “Mental health is a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community.” A report by DOH (2014a) stated the two-way connection between health and wellbeing, where both situations influence each other. While according to WHO (2012, para 1), "wellbeing exists in two dimensions, subjective and objective. It comprises an individual’s experience of their life as well as a comparison of life circumstances with social norms and values” (DOH, 2014a, para, 1).

Moreover, Fayers and Machin (2000) argued that quality of life is an evaluation of the variance between an individual’s desire and presumption versus their existing circumstances. The measurement of wellbeing, quality of life and life satisfaction, however, vary from study to study. A report by CDC (2018) proposed wellbeing as the presence of positive emotions and moods, the absence of negative emotions, positive functioning, overall satisfaction, or fulfilment with life. In addition, many studies regarded wellbeing as the combined effects of mental health (mind) and physical health (body) (Diener and Biswas-Diener, 2008). At the same time, DOH (2014a) informed that mental health is not synonymous with mental illness. Anyhow, wellbeing and mental illness are interconnected considering there is an association between a low level of wellbeing with anxiety and depression (DOH, 2014a). Accordingly, wellbeing can be determined as a scale to measure a person’s life satisfaction that covers an extended range of feelings (from joy to depression) (Diener et al., 2010).

Nevertheless, several studies found that higher levels of wellbeing may influence reducing the risk of disease, illness, health behaviours, productivity, may provide better immune

functioning, speedier recovery, and increased longevity (CDC, 2018). Therefore, from the public health point of view, determining the factors that may influence one's wellbeing is an important area, considering "Wellbeing is a valid population outcome measure beyond morbidity, mortality, and economic status that tells us how people perceive their life is going from their own perspective" (CDC, 2018, p.1). Moreover, from the holistic point of view, preventing diseases and promoting health can be an outcome of a person's positive wellbeing (Diener et al., 2010). Thus, "Measuring, tracking and promoting wellbeing can be useful for multiple stakeholders involved in disease prevention and health promotion" (CDC, 2019, p.1). In addition, the interplay between health status and wellbeing can partly be explained by the behavioural and cultural selection and artefact theories of health inequalities.

In the context of the present study, mental health and wellbeing is seen as a positive concept and not just about the absence of a mental health disorder. It has an objective and subjective component. It also focuses on an individual's recognition of their abilities, how they cope with stresses of daily life, feel productive and not a burden and are able, or empowered and enabled, to make a contribution to his or her community.

2.7 Need: underpinning theory

Before discussing social care need in England, it is important to discuss what 'need' is. Davis (1955) defined the need is as a state of individuals' mind that encourages them to choose amidst various available therapeutic resources. The term 'need' is therefore, a complex concept and interpreted and defined in many ways that can change over time. Thus, each of the definitions of need has been developed to improve quality-of-service delivery to meet individuals' expectations and demands according to their physical, mental, and social health and wellbeing. A study by Foot et al. (2014) informed that the health system had been gone through several stages by the driving force of interest is 'need' (for example, individual need,

population need, community need, economical need, policy need). As such, in the 1990s, a needs-driven resource allocation was introduced by NHS reform, and this is followed by 'collaborative action' by the year 2000, with the aim that the health care need could be jointly explored by the key 'stakeholders' (Asadi-Lari et al., 2003). Accordingly, the Medical Research Council evaluates the "need to exist when a patient's functioning falls below -or threatens to fall below- some minimum specified level, and there is a remediable cause" (Asadi-Lari et al., 2003, p. 3). In addition, this definition concentrates on the efficacy of the care system and considers that a need is fulfilled "when it has attracted some at least partly effective intervention" (Brewin et al., 1987, p. 973). Nevertheless, to explore individuals' need, one needs to be aware of the different dimensions of human need and the difference between an individual's need and health and social care needs.

In the context of social care need, it is vital to mention Bradshaw's taxonomy (Bradshaw, 2013), which compares four different aspects of social needs an individual can have: normative, felt, expressed and comparative need. While professionals can set normative need according to the desired standard of care, a felt need refers to 'what people want, or the expectation of a service user based on their own beliefs of need. An expressed need refers to a demand, which is unmet, partially met and fully met. Finally, the comparative need is defined as comparing the degree of service received by two service users. Along with Bradshaw's taxonomy of social care provision, there is a shred of evidence (Kettner et al., 1990) of another important social care need: technical need. A Centre for Population Change (CPC) report by Vlachantoni (2011, p.4) informs "technical need occurs when existing provision is made more effective, or a new kind of provision is invented, in which case a need for a new kind of solution arises".

HSE (NHS Digital, 2016) defines social care need as solely connected to satisfying individuals' functional activities of daily living and helping them live as independently as

possible in their own home. Functional activities refer to the activities of daily living (ADL) or instrumental activities of daily living (IADL) and the standard of mobility to enable an individual to live independently without any support (See Chapter 4, for a detailed discussion on ADL and IADL).

In the context of the present study, it is important to recognise that need is complex and multi-dimensional, it includes felt need and expressed need that is unmet, partially met or fully met.

2.8 Unique pattern of obesity in older adults

A multicentre study by Zhang et al. (2020b, p.274) stated that "Age is one of the most important factors in organ degeneration and diseases, with the ageing process leading to gradual degeneration of organ function to a pathological extent". In addition, sarcopenia among older adults, which is a degenerative muscle loss, adds more complexity (Gill et al., 2015). As such, the onset of muscle loss among older adults generally results from a more extended period of inactivity and ill health (Han et al., 2011). Accordingly, for older adults', unintentional weight loss (in the absence of few specific diseases, like cancer) can be associated to age-associated muscle loss or sarcopenia.

On the other hand, central obesity, or intra-abdominal visceral fat percentage increases with age due to the disruption in body fat redistribution and loses of subcutaneous or peripheral fat (Kuk et al., 2009). Specifically, the raised visceral fat percentage among older adults directly associates to increased mortality and morbidity (Marinos, 2001). As Jura and Kozak (2016, p. 23) explained, the possible cause is "ectopic fat deposition in skeletal muscle, heart, liver, pancreas, or blood vessels, a trend leading to lipotoxicity in aged individuals". Consequently, the co-occurrence of increased fat mass and increased loss of lean body mass (muscle) together is called 'sarcopenic obesity (Han et al., 2011), which is increasingly prevalent with advancing

age for older adults. In addition, previous studies on the elderly population found an association between sarcopenic obesity with impaired functional capacity, multiple chronic diseases, general health status, poor quality of life and mortality (Han et al., 2011; Hamer et al., 2015). The sarcopenic obesity is, therefore, one of the significant risk factors for older adults and places older adults in a unique position in the health care system. The challenges related to sarcopenic obesity among older adults were raised the policy concern from both the economic and public health perspectives.

At the same time, few past studies (Marinos, 2001; Jia and Lubetkin, 2005) found that for older adults, the relation between BMI and mortality curve can either be J-shaped or U-shaped. Particularly, it implies that for older adults, less mortality takes place at a higher BMI than younger adults (Marinos, 2001), considering BMI (body mass index) does not report the changes in fat mass, lean muscle mass or body fluid retention (Oreopoulos et al., 2009). Thus, BMI may conceal the loss of muscle mass (while accumulating more visceral fat but losing lean mass) among older adults (Han et al., 2011). Given that some studies reported the positive association between obesity and mortality among older adults (Corrada et al., 2006), whereas others did not find any association (Stessman et al., 2009), and few studies evaluated a reverse relation (as above). A systematic review by Romero-Corral et al. (2006) using 40 cohort studies with 250,152 patients found that overweight and marginally obese individuals had a better recovery for total mortality and cardiovascular mortality.

On that account, the controversial association between high BMI and mortality among older adults has helped develop the hypothesis of the 'obesity paradox' (as discussed in chapter 1), grounded on the reverse relation of high BMI with mortality among older adults.

Unlike the controversial relationship between high BMI and mortality in older adults, the relationship between obesity-related all-cause mortality and morbidity (notably, the

progression of type 2 diabetes and the metabolic syndrome and its consequences) is very similar in older adults compared to younger adults (Samper-Ternent and Snih, 2012). Thus, the impact of obesity in older adults is an essential field of research for the national and local government to provide their targeted intervention and investment, besides promoting healthy ageing by minimising health inequalities.

Despite the widely known adverse effects of obesity on overall health, obesity in old age must be determined with caution due to the controversial medical hypothesis of the 'obesity paradox' (Chapman, 2010).

2.9 Rationale of using Body Mass Index (BMI) to measure degree of obesity

Body mass index (BMI), a static measurement of an individual's body weight, is still predominantly used worldwide to determine an individual's obesity status (Yin et al. 2014). Yet one must think carefully to use BMI as a measuring unit of obesity for older adults, since it does not truly reflect the age-related degenerative loss of muscle mass (TILDA, 2014), at the same time, it is not sensitive enough to identify increased abdominal fat deposition associated with ageing (FOJP Service Corporation, 2012). In addition, for the older population, height may be reduced due to age-associated spinal shortening as an outcome of bone decadence or kyphoscoliosis (Han et al., 2011).

Several studies on older adults (Flegal et al., 2012; Musich et al. 2016) however, confirm that the BMI measurement is ‘sufficiently accurate’ categorising individuals into a suitable weight category and predict the risk of health and wellbeing associated with the high BMI (Zaninotto et al., 2010).

Nevertheless, self-reported height and weight can be arguably under doubt since individuals tend to overrate their height and underrate their weight (Kuczmarski et al., 2001). Thus, the

dependence on self-reported height and weight measurement may underrate BMI (Shirley et al., 2016). Anyhow the current study uses the objective measurement of an individual's height and weight to calculate BMI, eliminating the doubt associated with the subjective height and weight measurement.

Therefore, in the present study, BMI measurement is used to categorise individuals into different weight groups.

2.10 Obesity-related disabilities, morbidities, and dependencies in older adults

Obesity is the source of many chronic diseases, particularly for older adults. The foremost concerns are related to the numerous health risks, medical comorbidities: such as metabolic syndrome, diabetes mellitus, hypertension, heart failure, obstructive sleep apnoea, pressure ulcers, and difficulty with mobility (as discussed in chapter 1). Moreover, a report by Cancer Research UK (2016) informed that just being overweight increases the risk of developing ten different types of cancer.

Additionally, the three most common types of arthritis affecting older adults affect ageing, primarily due to its implication on overall physical and mental health concerning disability (Samper-Ternent and Snih, 2012), Considering there is an association between arthritis and impaired functional limitation among older adults (Veeranki et al., 2017). Consequently, this may have contributed to impairing physical activity among the elderly.

On the other hand, obesity accelerates the deterioration of joint function in older adults with arthritis (especially osteoarthritis and rheumatoid arthritis) and negatively affects some of the outcomes from surgical interventions (Samper-Ternent and Snih, 2012). Reynolds and McIlvane (2012) found that obesity reduces the probability of recovery from disability in older adults. Besides, the studies which examined obesity's effect on the elderly population,

summarised that overweight and obesity directly or indirectly increase the significant risk of disability regarding physical and mental impairments (as discussed in chapter 1). Although, a study on older adults by Boateng et al. (2017) found no strong connection between obesity and difficulties with learning a new task or recalling. Particularly, the study evaluated those overweight older adults are less likely to have difficulties with recall or learning new tasks.

Several studies use 'activities of daily living (ADL) and 'instrumental activities of daily living (IADL) to define disability with functional impairment due to poor physical or mental health (Samper-Ternent and Snih, 2012); given that the poor ADL and IADL score reflect the difficulty performing one or more tasks of daily living that is essential for an individual to live independently on their own (detail discussion on ADL and IADL is in chapter 4).

Nonetheless, older adults who are morbidly obese (BMI $\geq$ 40 as defined by WHO, 2020a) encounter many more complex issues and challenges (Zamboni et al., 2005). The challenges associated with obesity among older adults, inevitably increase healthcare resource use and functional decline and homebound status (Jensen et al., 2006).

A study on the elderly by Gallagher (1998) concluded that diverse problems are faced by the home healthcare providers when caring for morbidly obese clients in the home care setting. In addition, the normal ageing process is also associated with different levels of disabilities, particularly with sarcopenia (Hamer and O'Donovan, 2017).

The definition of an individual's health status is reviewed by Currie (2016), which informs that when health is regarded as a person's body composition and its functionality regardless of the presence or absence of disease or illness, it is called health status. Yet by the concept of the 'obesity paradox,' it is difficult to establish an association between obesity among older adults with their disability and complex morbidity status. It is, therefore, essential to examine the weight of disabilities and complex morbidity among overweight and obese older adults

concerning increasing dependency for this population group. In consideration of this, the current research poses the following question:

Is there any association between obesity, disability, and morbidities in older adults? (Research question 1)

2.11 Obesity, health, and wellbeing nexus

Several past studies have established that obese individual experience significant impairment in quality-of-life due to their heavy body weight, with more significant impairments associated with greater degrees of obesity (Bottone et al., 2014; Giuli et al., 2014). Considering it is well regarded that many obese adults may experience mental health problems due to stigma and bullying or discrimination in society or workplaces due to their physical impairment (Puhl and Heuer, 2009; National Institute for Health and Care Excellence (NICE), 2015). Furthermore, a study by Jackson et al. (2019a) evaluated an association between age-related discrimination with increased poor subjective health and the danger of serious health condition.

At the same time, the HSE (NHS Digital, 2017) defined psychological wellbeing as not just the lack of mental ill-health; it is a measure of overall health status, including loneliness, depression, anxiety, self-confidence, sleep disturbance. Moreover, each of which or all can contribute to an individual's poor wellbeing status. Particularly for the older adults, despite the adverse effects related to the body image distortions, they possibly face more challenges related to the various life transitions (for example, retirement, financial hardship, widowhood, 'empty nest') than their younger counterparts (Conklin et al., 2013).

Therefore, dealing with these life hardships perhaps add extra physical and mental challenges for an older adult. A study by Kaplan and Berkman (2021) evaluated that these significant life transitions (for example, retirement, relocation, and bereavement) in old age are not only

detrimental for their health but also affect their psychological wellbeing (for example, anxiety, depression, feeling of guilt, worthlessness, hallucination and even the suicidal thoughts) for a very long period. Nevertheless, an English study by Conklin et al. (2013) evaluated that the challenges that come with life transitions may force an older adult to change his/her lifestyle and health behaviours (concerning healthy eating and physical activity). Specifically, according to the life course theory (as discussed above), prolonged practice towards a negative health behaviour (For example, regarding food and lifestyle choices, such as smoking or alcohol intake or physical inactivity) may have a detrimental effect on older adult's physical and mental health and wellbeing. For obese older adults, therefore, the situation must be physically and mentally more challenging with chronic diseases and functional impairment.

Simultaneously, wellbeing is perceived as life positivity, such as positive emotions and moods, the absence of negative emotions, positive functioning, overall satisfaction, or fulfilment with life (CDC, 2018). In addition, the previous studies informed that an individual's wellbeing status might only be determined by the combined effect of one’s mental health (mind) and physical health (body) (Diener and Biswas-Diener, 2008; CDC, 2018).

On the other hand, a postal survey on English adults (aged 18 years to 64 years) by Doll et al. (2000) found that physical wellbeing can be markedly affected with the increasing degree of obesity. For the individuals who were obese without any chronic conditions, however, the association between obesity and emotional wellbeing was weakened (Doll et al., 2000). Nonetheless, the study evaluated that obese individual with two or three chronic illnesses are particularly vulnerable in both dimensions of physical and emotional wellbeing.

Moreover, Currie (2016) reported that traditionally, health-related quality-of-life or wellbeing was connected to patient outcomes and was generally showcased as deficits in functioning (for example, pain and other adverse effects). In contrast, the above discussions on wellbeing so far

logically guided towards the fact that "wellbeing focuses on assets in functioning, including positive emotions and psychological resources (e.g., positive affect, autonomy, and mastery) as key components" (CDC, 2018, para, 9).

Several studies found that a higher level of wellbeing is influential for older adults in reducing the risk of injury, disease, illness, and increased longevity, better immune functioning, and speedier recovery (CDC, 2018). A study by Amarya et al. (2014) evaluated that quality of life may be the most crucial goal of therapy in older adults. Furthermore, a study on older adults by Bell et al. (2016, p.1) informed that "care of older adults should be designed to better respond to a broader perspective of patient-centred concerns, and target not only improved longevity, but improved function, independence, and quality of life". Hence from the economic and health, and social care policy concern for any country, it is essential to promote quality of life for overweight and obese older adult by determining the factors that harm their wellbeing. However, by the concept of the 'obesity paradox,' it is difficult to establish an association between obesity among older adults with their health status and wellbeing.

At the same time, NICE guidelines (2015) on obesity management emphasised people's overall satisfaction using services with their care to ensure that people have a positive experience of care and support as part of the 'Adult Social Care Outcomes Framework 2015–16'. Accordingly, England's health and social care should aim to enhance quality-of-life for people with care and support needs (NICE, 2015).

The 'Obesity Care Pathway Toolkit', developed by National Obesity Forum (2005), 'Care pathway for the management of overweight and obesity by National Health Service (NHS) (2006), NICE guidance on obesity (2014), 'Wandsworth Healthy Weight Care Pathway Toolkit' by Public Health Wandsworth Council (2018) and The 'Report of the working group into: Joined-up clinical pathways for obesity' by a joint working group with representation from

various health regulatory bodies of England (NHS England, 2014a); sub optimally addresses the areas under the care pathway for overweight and obese older adults for all aspects of their wellbeing related to their current health status to improve their quality-of-life. It is, therefore, essential to explore the association between current health status and wellbeing among older adults with obesity. In consideration of this, the current research poses the following question:

Is there any association between obesity with current health status and the wellbeing of older adults in England? (Research question 2)

2.12 Social care needs of obese older adults

Health and social care in the UK are defined as services provided by the health and social care provider's team (Brown and Bussell, 2011). In addition, it is referred to the whole health and social care delivery infrastructure, public and private sector. The HSE proposed "Social care is the provision of help with personal care and domestic tasks to help enable individuals to live as independently as possible" (Marcheselli and Ridout, 2019, p. 4).

There are three community support systems in England to meet older adults' need for support: formal state support, informal support, and formal paid support or the combination of three. Grundy and Read (2012) informed that the informal or unpaid support network is considered the foundation of the support system for older adults, given that, most informal care and support in England are provided by family or friends (Pickard, 2013), which is the most common and desirable support system for older adults than formal state support or formal paid support (Age UK, 2019). A study by Brown and Morris (2018) using HSE data found that in England, unpaid help solely covered 68% of social care support for the care recipients aged 65 years and over. The number is progressively increasing in England due to the increasing longevity (LGA, 2020) and the recent adult social care funding cuts (The King's Fund, 2020). Anyhow, variations in an individual's demographic and socio-economic characteristics facilitate the level

and nature of support needed (Beesley, 2006). In addition, several studies have informed that informal caregiving may increase the poor health status and quality of life among the care providers (Pinquart et al., 2007; Lacey et al., 2018). Considering a report by Organisation for Economic Co-operation and Development (OECD) informed that “demographic ageing … enlarges the potential pool of care providers among the elderly because older people are 'net providers of support" (Haberkern et al., 2012, p.194).

In the UK, delivering formal state support concerning social care for older adults is based on various elements. The following elements that determine one's eligibility are individual's marital status, living arrangements (if they have children to provide informal support), individual's physical and mental health status, the extent to which a person can use the technologies (which may be needed to improve their living environment) and finally the individual's economic condition (whether they can pay for their social care) (Vlachantoni et al., 2015). A group of professionals can provide formal paid service, for example, private occupational therapist or private physiotherapist and paid carer. Consequently, there are increasingly more significant gaps for the informal and formal paid system to fill in and an individual's need remains outside the entitlement criteria's of obtaining formal state support (Vlachantoni et al., 2011), since “The formal long-term care system in England is means-tested providing a ‘safety-net’ for those in greater need” (Nizalova et al., 2018, p.4). Accordingly, in England, the eligibility needs for receiving state support provided by local government is determined by the functional difficulties for daily living with at least one activity under ADL and IADL (Dunatchik et al., 2019). A report by Care Act (Statutory instrument, 2015), however, emphasised the ten key areas that should be considered about determining eligibility for providing care and support. "These include basic physical outcomes such as nutrition, personal hygiene, toilet needs, and safety” (Dunatchik et al., 2019, p.195).

A study by Bien et al. (2013) yet evaluated that, regarding the care needs of the elderly, the national health and social care systems across Europe stand poorly integrated.

At the same time, an English longitudinal study by Nizalova et al. (2018) found that obese older adults (aged 65 years and over) are 25% more likely to be the recipient of long-term care support, particularly informal care, or privately paid care, than their normal-weight counterparts.

Simultaneously, Public Health England (2013) informed that the dramatically increasing obesity prevalence in older adults and the growing demand of an ageing population reveals serious challenges and cost implications to adult health and social care systems. The Public Health England (2013, p. 3) reported that in England the adult social care and support is defined as "all forms of personal care and other practical assistance for individuals who by reason of age, illness, disability, pregnancy, childbirth, dependence on alcohol or drugs, or any other similar circumstances".

In England, the resource implications for a social care service for older adults with severe physical disabilities are situated in housing adaptations, specialist carers, and transport provision (Public Health England, 2013). At the same time, for very obese people, effective social care can be significantly costly, which may include housing adaptations and carer provision, although, there may have existing inequalities regarding care need and the social care service provision since the obesity prevalence varies by socio-economic and ethnic group (Public Health England, 2013).

On the other hand, the role of carers in supporting individuals with disabilities (For example, for the obese older adults with intellectual disabilities) was recognised as an essential factor in meeting the needs of individuals (Spanos et al., 2013). Therefore, carers may have a strong influence on an individual's health behaviour. Accordingly, if carers have inadequate

knowledge about an individual's health condition, whom they are caring for, health risks may have consequences for the individuals they support (Spanos et al., 2013). Moreover, the study by Spanos et al. (2013) informed that, sometimes, for informal carers, particularly for family carers, delivering care and support for the obese older individual can be stressful. In addition, family carers may have difficulties in coping with their busy lives. As such, an English study by Pickard (2013, p.97) reported that “a shortfall in the supply of care” cannot be compensated with the care provided by either spouses or other older family members or friends, considering an OECD study by Colombo et al. (2011, p.66), the "increase in supply of care is unlikely to compensate fully for the expected decline Longer-term prospects for European countries remain uncertain”. Furthermore, it is essential to mention that health inequalities play an essential role in determining the sources and the receipt of social care service. In the UK, the current health care delivery system is based on the coexistence of a two-tier system: publicly sponsored and privately insured healthcare. Subsequently, better healthcare provision can be accessible for the population from the higher economic class and the facilities to reach the health care provision in different countries (Bhutoria, 2010).

Judging by the recent cost-cutting in this area and the challenges associated with obesity, research work is needed to determine the social care need among overweight and obese older adults by identifying the number of social care support receipt from different sources. In addition, the factors that influence the demand for different sources of social care support for this group of the population need to be evaluated. At the same time, the findings may help the national and local government target the resource and supply to redesign the future adult social care service. On the other hand, the findings will provide some insight on the ground of the 'obesity paradox' (as discussed earlier) by evaluating whether there is an assisioation between the amount of social care received and the demand of different sources with individuals' increasing degree of BMI.

In consideration of this, the current research poses the following question:

Is there any association between obesity and the amount of social cares received in older adults? (Research question 3)

Nevertheless, recent budget restriction for adult social care providers raised concerns whether many older adults' social care needs are being met (Vlachantoni et al., 2011). The unmet needs can be explained as a shortfall between the social care and support individuals necessitates and what they obtain. A study by Vlachantoni et al. (2011, p. 1) explored that "different kinds of need tend to be supported by particular sources of care, and that there is a significant level of 'unmet need' for certain activities". Moreover, the Commission for Social Care Inspection (2008) considers 'unmet need' as a vital and challenging part of social care policy, and the measurement of unmet care need is the key in evaluating the efficacy of social care provision.

Furthermore, The Academy of Medical Sciences (TAMS) (NHS England, 2017, p. 6), together with support from the British Academy and NHS England, reported that individual might have 'unexpressed demand' or 'expressed demand that is sub-optimally met' or may have a combination of the two, while the unexpressed demands refer to the existing health or social care needs those individuals are having. However, they are either unaware of their needs or prefer not to seek health and social care support. At the same time, the sub-optimally met expressed demands referred to the existing health or social care needs that individual are currently having. The situation has arisen whether the individuals are not eligible to seek treatment / social care support or receive more insufficient quality treatment/care support that their needs are not optimally met.

In addition, a study by Brimblecombe et al. (2016) on carers and care recipients explored that about 47% of care recipients expressed that they required more services to satisfy their needs. Moreover, the report by the NHS England (2017) stated that unmet care needs based on the

service-based drivers of health and social care system are the result of either inability of the services to reach the target population or they somehow drop out of the system. Particularly, the HSE (NHS Digital, 2020) reported that there were 19% of men and 28% of woman over 65 years had an unmet need with at least one ADL difficulty, and 12% of men and 15% of women had an unmet need with at least one IADL difficulty, while HSE defined unmet care needs (service-based unmet care needs) considered if someone is having at least one ADL or IADL difficulties and for which he/she had not received any help or support in the last month. Anyhow, the population-driven unmet needs may be raised by the individuals who felt the need or expressed need, where individuals are not eligible to access the health and social care system (NHS England, 2017). Therefore, 'population push' or 'service pull' is needed to engage people into the health and social care system or bring the target population into the right part of the health and social care system accordingly (NHS England, 2017, p. 8). At the same time, a study by Hewitson et al. (2014) informed that many of the patients are possibly admitted as hospital inpatients due to not having the effective care and support by the primary and community care settings or having insufficient social care support.

On the other hand, preventing the formation of care needs is one of the primary duties of the Local authorities, since the Care Act (DOH, 2014c) demanded more focus on the prevention of care needs. The Care Act 2018 (Department of Health and Social Care, 2021) report has addressed the outline of three staged prevention plans depending on the formation of different stages of care need, while primary prevention is concerned to stop the formation of care and support needs for individuals not having any existing care needs. Additionally, the secondary and tertiary prevention is focused on meeting the existing needs. Perhaps the secondary and tertiary prevention can be achieved either by providing adaptations /different aids (for example, mobility aids) or support to increase independence for the vulnerable population, at risk of developing care needs or having established care needs (Dunatchik et al., 2019). A study by

Vlachantoni et al. (2011, p.15) informed that "As local councils find themselves facing both expenditure cuts and reforms in their assessment and delivery procedures, evidence on unmet need is an essential element of the planning of their future provision". Moreover, the study found various types of needs, despite the activity-based 'unmet need' (ADL or IADL or mobility), among older adults (ages 65 years and over), that demands to be supported from specific care sources.

Bien et al. (2013) established that older people in the United Kingdom use a more balanced structure of socio-medical services than the other European countries. Yet according to the study, there is a negative relationship between the number of varying services used and the number of different areas of unmet care needs across the country. In addition, a book chapter by Liddiard (2007, p.121) stated that "definitions of need, whether they are explicit in policies and eligibility rules, or implicit in the decisions made by welfare providers, are rationing devices: they determine who gets what".

Moreover, to satisfy the NICE guidelines on the Adult Social Care Outcomes Framework, Domain 1: "Enhancing quality-of-life for people with care and support needs", exploring unmet social care needs (if any) for obese older adults is an important area to enhance the quality of life for these group of people. Anyhow, an English longitudinal study based on the secondary survey data by Dunatchik et al. (2019) explored that the development of older adult's unmet care needs is not dependent on an individual's health behaviour and wellbeing.

On the other hand, a report by LGA (2020) informed that in England, there is a long waiting list for obtaining formal state support and the demand is mainly related to the implications of obesity. Moreover, Vlachantoni et al. (2011, p. 2) stated that "The concepts of 'need' and 'want' have always been at the centre of policy design and policy provision in modern welfare

states and the extent to which the needs of people are met by the delivery of benefits and services is a key indicator of the effectiveness of a welfare state".

Thus, the research work is needed from the economic and public health policy point of view and improves the quality of social care service by assessing the dynamics of unmet care needs among overweight and obese older adults. Moreover, identifying the existing needs (even less important or low-level needs) at the developmental level is beneficial to minimise the future social care service demand and maximise its effectiveness. Furthermore, to identify the gaps between demand and supply, it is essential to identify the nature of unmet care needs for overweight and obese older adults, given that a rapid response report by Bhutoria (2010, p.1) stated that although the "Disparities in provision of healthcare facilities will remain but the gap can certainly be narrowed."

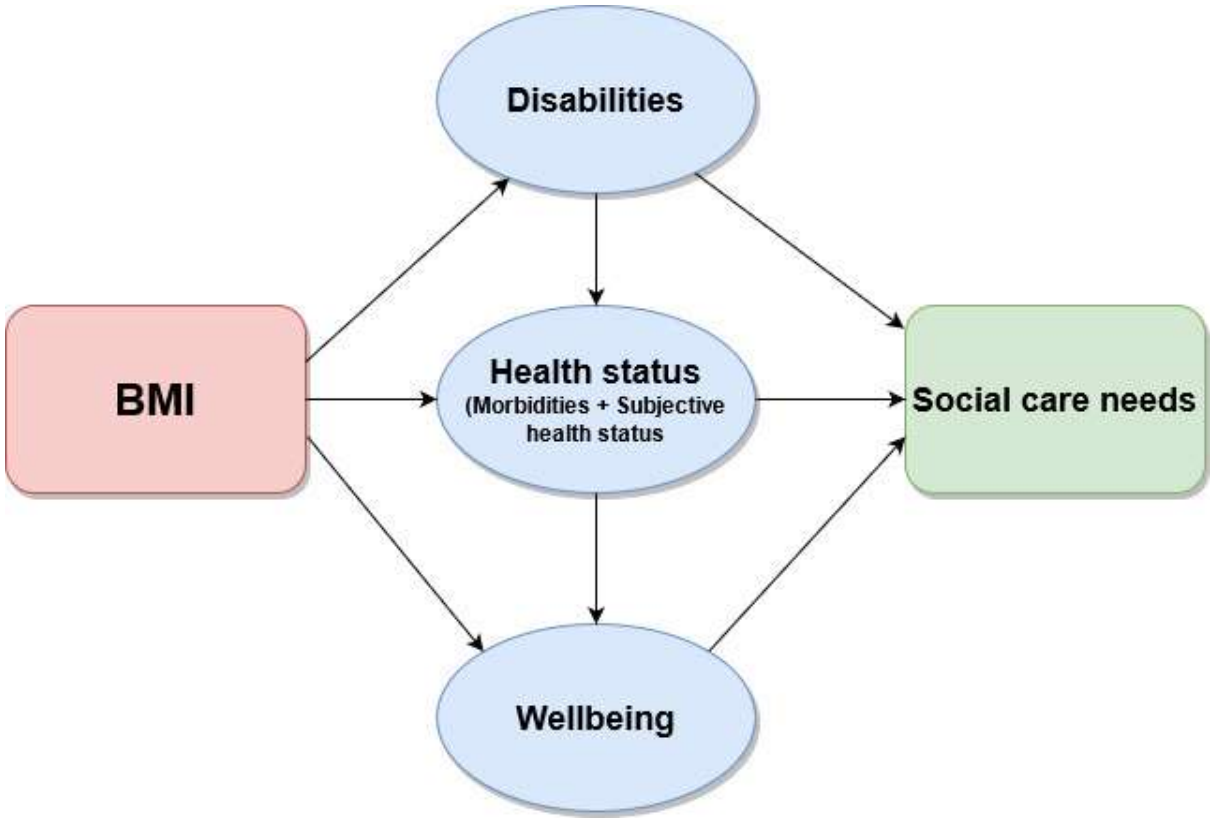
In consideration of this, the current research poses the following question:

What are the dynamics of unmet care needs for social care and support of obese older adults? (Research question 4)

2.12.1 Conceptual framework

A research framework is developed that is linked to the study aim, objectives, and research questions to conceptualise the study topic. The framework organises the study concepts, assumptions and hypotheses and maps out inter-relatedness of the theoretical threads explored in previous sections, that it helps to visualise the links between concepts (Sinclair, 2007).

Figure 2.1: The conceptual framework of the study



Constructed by the student researcher

Table 2.3: Development of the research objectives and research questions according to the gaps in the literature

Background	Gaps in the literature/ ideas	Research objectives	Research questions
'Obesity paradox' informed that weight loss for older adults can be dangerous since high BMI among older adults has a protective effect on their mortality (Chapman, 2010).	From the paradox, it is unclear whether there is any impact of obesity among older adults regarding their disability and morbidity status.	To investigate the association between obesity, disability status, morbidities in older adults.	Is there any association between obesity, disability, and morbidities in older adults?
The 'Obesity Care Pathway Toolkit', developed by National Obesity Forum in 2005, NHS document: Care pathway for the management of overweight and obesity in 2006, NICE guidelines on obesity (2014), the report of the working group into Joined-up clinical pathways for obesity by representations from	It is not clear whether there is any impact of obesity in older adults on their health and wellbeing. The existing obesity management framework and guidelines do not address this issue.	To determine the association between current health status and wellbeing in older adults with obesity.	Is there any association between obesity with current health status and wellbeing of older adults in England?

various health regulatory bodies (NHS England, 2014a) and Wandsworth Healthy Weight Care Pathway Toolkit by Public Health Wandsworth Council (2018).			
The controversial medical hypothesis, the 'Obesity Paradox', states that the increasing body weight can be positively associated with maximal survival increases with increasing age for older adults.	It is not established whether there is an association between the amount of social care received and the demand for social care with an individuals' increasing degree of BMI.	To explore the differences in social care needs by the degree of obesity.	Is there any association between obesity and the amount of social cares received in older adults?
Vlachantoni et al. (2011, p.15) found various types of needs, despite the activity-based 'unmet need', among older adults and demands to be supported from specific care sources. Hence, they informed that "evidence on unmet need is an essential element of the	No study identified various aspects of unmet need among overweight and obese older adults, demanding to be cared for and supported.	To examine the role of obesity among older adults in determining social care needs by identifying	What are the dynamics of unmet care needs for social care and support of obese older adults?

planning of their future provision" in the context of bringing changes to the health and social care service by addressing population need.		their unmet care needs.	

2.13 Summary of the chapter

Both obesity and ageing lead to significantly increased risks of premature mortality, morbidity and lower wellbeing. Obesity is increasing in England among older adults and that the level of disabilities and comorbidities related to obesity are also increasing. However, very little is known regarding the nexus between obesity, complex morbidity, disability and health and wellbeing for older adults. This literature review has identified gaps in the literature where further research work is needed. The research aim, objectives and questions are developed according to the identified gaps, and a conceptual framework is also developed to conceptualise the links between the research questions.

Increasing life expectancy and obesity jointly lead towards disability and dependencies. As a result, obesity in older people is becoming a significant burden to family and society. Alongside this, England is under increasing financial pressure as the demand for health and social care from obese older adults increases. Older adults with or without obesity have the right to live a well-supported and dignified life at the very end of their life journey, and it is our responsibility as public health researchers to investigate the factors that will promote their health and wellbeing.

Encouraging healthy behaviours in old age is essential to minimise the obesity-related chronic conditions, impairment, and disability alongside and through high quality social care that

holistically meets the needs of older adults is key to a disability-free old age. The present study provides some answers to the unmet care needs of overweight and obese older adults and how they relate to their weight status.

CHAPTER 3

Methodology

3.1 Introduction

This chapter describes in detail the methodology used in this study. At first, the chapter will establish the philosophical approach/orientation of the research and then set out and justify the research methodology and methods used to conduct this study. Then the selection of variables, data sources, data collection techniques, data presentation techniques and the analytical techniques are discussed. Lastly, the ethical considerations of the study are explained.

For the quantitative part, the English Longitudinal Study on Ageing (ELSA) data, the way of data access, study variables, sample size and power calculation, participants of ELSA and finally about the validity and reliability of ELSA data are discussed. In addition, for the qualitative part, a critical evaluation of data collection, sampling strategy, data management, data verification and data validation are articulated.

Lastly, the data analysis plan/strategy for both phases of the research are outlined.

3.2 The philosophical approach

According to Doyle et al. (2009), one of the first steps for a researcher is to recognise and establish a research paradigm to collect data suitably and effectively. A research paradigm is “the set of common beliefs and agreements shared between scientists about how problems should be understood and addressed” (Feilzer, 2009, p.6-16). Cresswell (2014, p. 10) adds that "Instead of focusing on methods, researchers emphasize the research problem and use all approaches available to understand the problem”. Saunders et al. (2009) argues that the

research philosophy enables researchers to decide and adopt an appropriate approach derived from research questions.

In a single study, a research paradigm is therefore the way researchers view about the world and how it should be perceived and interpreted, their worldview or a set of assumptions. The research methods and research philosophy are the parts of the research paradigm (Williams, 2011) and assist the researcher to evolve their knowledge and understanding about the research context. A particular philosophical approach and suitable methodologies are therefore crucial to comprehend and examine a research problem.

To underpin the research questions of the current study, the philosophical approach of 'pragmatism' is chosen as the principal paradigm and a mixed-methods approach the principal research methodology. The reason to follow a pragmatic paradigm and a mixed-methods methodology is that its theoretical background and its role in the research process are judged, by the student researcher, to be the most suitable approach to achieving the research objectives.

It is important to recognise that paradigms are not fixed, and they assist in forming an individual's approach to a research problem and recommend ways to address certain assumptions about the world (Shannon-Baker, 2016). Creswell (2009) identifies the four leading paradigms that can be used to support social research: positivism, constructivism, participatory, and pragmatism. Positivism is grounded on a visible social entity, and positivists work on quantifiable surveys or observations (Thakurta and Chetty, 2015). Positivists aim to "reduce ideas into a small, discrete set to test, such as the variables that comprise hypotheses and research questions" (Creswell, 2014, p.7). They focus on testing a hypothesis to seek 'objective truth'. They use a quantitative research methodology that is reductive, where positivists researchers initiate the research process with a theory or framework and gather data to either support or reject the theory. In contrast, "social constructivists believe that individuals

seek understanding of the world in which they live and work" (Creswell, 2014, p. 8) and focus on the 'subjective' interpretation of the social moment or phenomena (Thakurta and Chetty, 2015). The objective of constructivist research is to understand the participants' perspective and perceptions and how they interact with other social phenomena including other people. They try to interpret the participant's response and views about the world and 'inductively' generate a theory or 'pattern of meaning' (Creswell, 2014). Constructivism research therefore use a qualitative research methodology.

The participatory paradigm uses a collaborative research process (Hall, 1981). Where researchers and participants jointly work together towards social transformation (McTaggart, 1997). Amartya Sen has criticised this philosophical approach because due to the restricted information and societal circumstances, individuals' subjective assessment regarding their condition may overpower their objective, therefore possibly be biased (Sen, 1976).

The pragmatist paradigm associates the choice of approach directly to the aim and nature of the research questions posed (Creswell, 2009). Creswell (2014, p.10) states that "there are many forms of this philosophy, but for many, pragmatism as a worldview arises out of actions, situations, and consequences rather than antecedent conditions." Pragmatists prioritise the nature of the research questions as the leading determinant of the research philosophy (Dudovskiy, 2012) and their beliefs are more directly connected to action (Dewey, 2008). Pragmatism, therefore, aims to bridge the gap between two traditional philosophical approaches: positivism and constructivism which are perceived as a 'continuum' instead of contradictions to look at what is meaningful from both perspectives (Chetty, 2016). This needs to be done with care, attention, and caution (Chetty, 2016). Pragmatism applies 'abduction', that is, "moves back and forth between induction and deduction-first converting observations into theories and then assessing those theories through action" (Morgan, 2007, p.71). Pragmatism helps to answer the crucial question, whether the research has supported finding

out what the investigator wants to explore (Hanson, 2008). The pragmatists, therefore, encourage the researcher to use any methods to answer the research questions while achieving the study objectives. Moreover, a study by Morgan (2007) informed that the pragmatic paradigm offers various ways to create a suitably merged methodology for the areas of social discipline by admitting the significance of both quantitative and qualitative research methods. At the same time, building up understanding by using the pragmatic paradigm to advance our current knowledge of social life is comprehensive and invaluable (Feilzer, 2009). However, the philosophical basis of pragmatism was criticised for not being well defined and supported. The paradigm allows for a methodology and methods to be chosen that best suits the research problem and the researchers' aim and objectives (Chetty, 2016; Creswell, 2014).

The pragmatic paradigm is well established approach in health and social care research, however its connection to a mixed-methods approach is more recent (Tashakkori and Teddlie, 2010; Pearce, 2012). Pragmatism rejects the need to choose between quantitative and qualitative research methodologies and methods and advocates the use of mixed research methods (Feilzer, 2009). The focal point of the pragmatic paradigm is 'what works' better in case of seeking the truth about the research inquiries (Teddlie and Tashakkori, 2003, p.713). Feilzer (2009, p.6) argues that the research paradigm- pragmatism backs up using any integrated research methods and supports the ways of analysis and a constant rotation of 'abductive reasoning' where primarily being led by the researcher's expectation to generate socially applicable knowledge. That it goes "beyond its instrumental link to mixed methods research to thinking about its philosophical basis and implications for the advancement of knowledge and research methodology generally" (Feilzer, 2009, p. 9).

Pragmatists argue that there are various ways to interpret the world and manage a research process. Therefore, it is not possible to understand the entire social moment or phenomena by using one single point of view or approach as there may be several elements of truth to be

explored (Saunders et al., 2019). Pragmatists therefore apply a combination of suitable approaches, in a single research study, to understand a research problem.

Hence the pragmatic paradigm that has been demonstrated is a useful philosophical approach/orientation to ground mixed-methods research design by recognising the uncertainty in generating knowledge and acknowledging that any knowledge produced through this process is relative rather than absolute (Feilzer, 2009).

For the reasons discussed above, the pragmatist paradigm and a mixed methods approach were used to ground and orientate the present study. For the present study, using mixed methods design is intended to use quantitative research methods to measure specific aspects of the phenomenon in research questions and qualitative research methods for the other aspects.

3.3 Research design and planning

A research design acts as a road map for a study and specifies strategies to manage research effectively. Brown and Lent (1992) explain that research design can be described as a blueprint for an inquiry or a set of approaches guiding and empowering a research project. Researchers use an appropriate research design to provide a framework for the study to enable them to plan the detailed strategies for data collection, interpretation, and analysis. Accordingly, a research design is conscious planning that identifies suitable methods for data collection and data analysis to fulfil the study's rationale taking into account financial, time and other constraints.

Kelly and Cordeiro (2020) argue that it is essential to consider the three critical fundamental propositions before designing a study. These are: 1) giving importance to applied knowledge, 2) acknowledging the interdependence between knowledge, experience and acting and 3) examining an issue empirically. This is why the present study incorporates both quantitative and qualitative approaches to understand the research problem.

The first phase of the study is quantitative and answers the first three research questions (the impact of obesity on health, wellbeing, and social care need), because they are empirical and are best answered “by obtaining direct, observable information from the world, rather than, for example, by theorising, or by reasoning, or by arguing from first principles" (Punch, 2006, p.3):

- To investigate the association between obesity, disability status, morbidities in older adults.
- To determine the association between current health status and wellbeing in older adults with obesity.
- To explore the differences in social care needs by the degree of obesity.

It analyses data from the nationally representative large-scale survey data set from the English Longitudinal Study on Ageing (ELSA), using a conceptual framework developed from a review of the literature. The exploration of this research question requires a quantitative research methodology, “because it provides data that are precise and, arguably, unambiguous” (Feilzer, 2009, p. 11). The data set provides relevant study variables from a large sample of participants set. Quantitative analytical measures were used to draw inferences from the survey data and understand the associations between the variables of interest.

The second phase of the study is qualitative and answers the fourth, and final research question. Given the nature of this research question, a qualitative semi-structured interview or "guided conversation" methodology is adopted as a means of data collection from primary data sources. This is because qualitative interviews are “attempts to understand the world from the subjects’ point of view, to unfold the meaning of peoples’ experiences, to uncover their lived world prior to scientific explanations” (Kvale, 1996, p. 1). Data is collected in face-to-face and one to one real-time interviews using a semi-structured interview guide. This approach helps to

understand the social picture of older adult's perspectives and experiences and compliment the secondary survey data:

- Identifying unmet care needs among overweight and obese older adults were planned to be explored using a small sample.

3.3.1 Justifying the application of mixed method approach by highlighting the strengths and limitations of quantitative and qualitative methodologies

Shannon-Baker (2016) has argued that mixing qualitative and quantitative methodologies and methods in a single research study can deliver a more diverse insight into a phenomenon, which would not be otherwise accessible by applying a single approach. It is common to use structured questionnaires and semi-structured interviews in mixed-method studies, because their different methods of data collection, data interpretation and analysis give a complementary understanding of the research topic (Harris and Brown, 2010). Harris and Brown (2010) have argued that questionnaires are helpful to identify patterns, especially within a large population and qualitative interviews help to provide insights and a deeper understanding of participants perceptions, thoughts, attitudes, behaviours, and actions (Harris and Brown, 2010, p.1).

Questionnaire survey data enables researchers to access data about outlooks, practices, or situations at one point in time (Chetty, 2016). They are therefore often regarded as objective instruments that provide generalisable findings due to their large sample size (Harris and Brown, 2010). The use of questionnaire surveys also offers a researcher the ability to collect data on many variables in a short space of time. The major weaknesses of questionnaire surveys relate to their design and use/implementation. Key issues are related to questionnaire design, which can be faulty (not in proper order or sentence phrasing/wording for sensitive information) or biased (towards a specific group/population/culture). The other issues are

regarding respondent's ignorance and unreliability, misunderstanding, non-response errors and sampling, coding errors, errors related to statistical test and wrong interpretation of findings (Harris and Brown, 2010).

Interviews allow the study of the wider context of participants lives. The participants are free to explain their perceptions, thoughts, attitudes, behaviours, and actions in detail and to have a two-way dialogue with the researcher. At the same time, the researcher can guide the direction of the interview to ensure that key issues being researched are discussed. However, there is a potential that the researcher or "the interviewer can use questioning to lead or manipulate interviewee responses" (Harris and Brown, 2010, p. 2). Even where researchers ensure they do not influence or manipulate participants the personal interaction during qualitative interviews, may make participants behave and respond in a socially desirable ways (social desirability bias) based on what they think is socially acceptable and will please the researcher instead of what is true, or they think is true (Yin, 2013). Lankshear and Knobel (2004) therefore argue that interviews are always engineered and can only generate partial and incomplete understandings of a participant's point of view. Lastly, due to the small sample size of most qualitative studies, the findings can be difficult to generalise to populations other than the one studied (Harris and Brown, 2010).

A NatCen research by Dunatchik et al. (2017), which was funded by the Ipsos MORI (Market and Opinion Research International), and the National Institute for Health Research (NIHR) used both secondary ELSA data and primary data sources to evaluate older adult's unmet need for care in England. This study successfully evaluated the amount of existing social care gap and the nature of unmet need for care and support among the elderly (aged 65 years and above) by using the multivariate regression analysis for the secondary data and qualitative interview for the primary data. Moreover, the study by Dunatchik et al. (2017) is a very similar study to the present one in respect to the use of mixed methods of quantitative and qualitative data

analysis for the secondary and primary data respectively. However, the present study is not intended to explore the amount of existing unmet care need, rather the present study aims to evaluate the amount of existing informal and formal social care need by BMI. Nevertheless, the objectives of both studies are very similar, that is to explore the nature of unmet need for care and support.

Another CPC research by Vlachantoni et al. (2011) uses a secondary ELSA data source to estimate the unmet need for social care for the elderly (aged 65 years and above). The study successfully predicts the amount of unmet need for social care with the help of quantitative date analysis. However, the study is unable to determine the nature of the unmet need, while the purpose of the present study is to explore the nature of the unmet need for care and support among the overweight and obese older adults.

Another study by Age UK (2019) uses both secondary ELSA data and primary data sources to estimate older adult's need and their perspective living with those needs. The study has focused on six areas of need and with the help of quantitative data analysis estimated the amount of existing need in each six areas. In addition, the study (Age UK, 2019) has used the qualitative analysis on primary qualitative interview data to explore the older adult's view on living with those six needs. The study is very similar to the present study in a way that present study also intends to explore the older adult's view on identifying their unmet need for care. Moreover, the present study too intends to estimate the amount of existing social care need. Thus, the present study distinctly learned from the previous studies while addressing its methodology.

As discussed earlier, from the pragmatic point of view, merging both research methodologies allow building up different knowledges to better explore the complexity of an issue, offering a multidimensional perspective, leading to actionable knowledge (Kelly and Cordeiro, 2020). The strength of each methodology complements and reduces the weaknesses of the other.

3.3.2 Ethical consideration

Ethical considerations are an inseparable part of the methodology (Thomas and O'Kane, 1998). They help differentiate between right and wrong, between acceptable and unacceptable behaviours, when carrying out research. They protect participants and the wider research community from being harmed, being informed, having the choice to participate or not, control over their data, the deception or falsification of data. They also encourage the pursuit of awareness and truth that are the key objectives of any research (Centre for Innovation in Research and Teaching, CIRT, 2019). Ethical standard is a way of agreement between a researcher and a study participant to encourage an environment of trust, accountability, and mutual respect between researchers and participants. Furthermore, adhering to ethical standards is essential for the researchers to obtain public support and believe in the research (CIRT, 2019).

For the ELSA dataset, the data was already collected and publicly available to be analysed. The survey participants gave written informed consent when taking part in the ELSA study. All participants were explained the aim and objectives of the study, how long the data will be stored, and how to opt in or out from the study (IFS, 2018). All the ELSA waves also obtained ethical approval from the National Research and Ethics Committee, London Multicentre Research Ethics Committee (MREC/01/2/91) (Zaninotto et al., 2010; Hulman et al., 2019).

The ethical considerations for the qualitative component of the study, which involves primary data collection by one-to-one, face-to-face semi-structured interviews, is an essential step for the present study. Factors like cultural, racial, religious, ethnic, and linguistic differences can influence research ethics (Nazroo, 2014). For example, certain questions might be misinterpreted because of different ways of using the English language or some topic may be culturally sensitive. Hence, it is important for a Research Ethics Committee or Institutional

Review Board to review such a research proposal to ensure that all the participants are protected from harm, their dignity is maintained, they take part in an informed way, understand their rights, that is voluntary and can request their data is not used and deleted, and their information kept confidential and anonymous (Creswell, 2009). It also ensures that vulnerable populations are not engaged in the study or engaged in an appropriate way. Ethical approval was obtained first from the University of West London ethical approval board (College of Nursing, Midwifery and Healthcare (CNMH) Research Ethics Panel) and then from the UK Health Research Authority (Health Research Authority, HRA, 2017). In the UK, where the present study is undertaken, all health, community, and social care research, involving human participants, must apply for ethical approval through the HRA's Integrated Research Application System (IRAS). A research application form was submitted to the HRA through a single system IRAS for both HRA approval and for Research Ethics Committee (REC) review. Therefore, the risk of adverse consequences of exploring sensitive topics are avoided or minimised among this potentially socially disadvantaged population group. The main aspects of the study that were considered rechecking carefully by IRAS included an overview of the research, purpose and design of the study, risks and ethical issues, research procedures, risks and benefits, recruitment and obtaining informed consent, confidentiality, publication and dissemination processes, scientific and statistical review procedures, management of the research and the information about research sites and investigators. The copies of the University of West London, College of Nursing, Midwifery and Healthcare (CNMH) Research Ethics Panel approval letter, the REC and HRA approval letters can be found in Appendix 1.

3.4 The first phase of the study by secondary dataset

The English Longitudinal Study on Ageing (ELSA) is a multidisciplinary longitudinal panel study involving a representative cohort of a community-dwelling English men and women aged 50 years and over (IFS, 2018). It is investigating ageing and quality-of-life among older adults

and explores the connection between quality of life, health and functioning, social networks, participation and social care, economic situation (NatCen Social Research, 2019). The ELSA study is a sister study to the Health and Retirement Study in the USA (Pongiglione et al., 2017). The UK Department of Health, Department of Work and Pensions, Office for National Statistics, Department for Environment Food and Rural Affairs, Department for Transport, HMRC, Communities and Local Government and the National Institute on Aging, in the USA fund ELSA (IFS, 2018).

The ELSA survey is carried out every two years since its inception in 2002. The sample was recruited from a Health Survey of England. At the time of data collection for the present study, there are currently 0-8 waves (1998-2018) of data collection covering 15 years of the sample (IFS, 2019). The survey collects data, using self-completion questionnaires and face-to-face interviews regarding quality of life, health and functioning, social networks, participation and social care, economic situation during each wave. A broad range of bio-measures - physical function assessment and anthropometric measurements - are collected by nurses at regular intervals for every alternate wave (UK data service (UKDS), 2018). Key topics and questions are covered in every wave to enable year on year comparisons, and some less important areas are rotated on and off the questionnaire between waves (IFS, 2018). During the data collection of the present study, the Wave 9 fieldwork was in progress. The survey cohort was refreshed for wave 6 to "maintain the representation of people aged 50-55 years and to boost the scope for fine-grained analyses" (Maelstrom Research, 2019, para. 9).

For the present study, the most recent available ELSA dataset was used, Wave 8 (2016-2017), archived in April '18. The Wave 8 surveys were carried out between May 2016 and June 2017 with a sample size of 8,445 participants (IFS,2018).

3.4.1 First phase of the study: ELSA data access

The ELSA wave data are anonymised and freely available to all researchers through the UK data service (NatCen Social Research, 2019). According to the UKDS (2018), data are available to all researchers who can demonstrate public interest. The primary ELSA datasets are available to download in Statistical Package for the Social Sciences (SPSS) and Stata and ASCII tab-delimited formats.

3.4.2 First phase of the study: ELSA data collection

Three methods of data collection were used in Wave 8 of ELSA: one of two formats of a self-completion questionnaire completed using pen and paper (PAPI), a face-to-face interview conducted using computer-assisted personal interviewing (CAPI) and a nurse visit to take bio-measurements. The PAPI self-completion questionnaires and CAPI interview were administered by an interviewer and carried out at every wave (IFS, 2018). Face-to-face interviews were undertaken by trained interviewers using laptop computers at the participant's residential address to document demographic information for each participant along with their physical and mental health status (Slater et al., 2018). The interview questionnaires consisted of a range of survey questions "that were comparable with the questions used in UK government and international surveys, including the Survey of Health and Retirement in Europe, and the US Health and Retirement Survey" (Bowling and Windsor, 2008, p. 82). During the questionnaire designing stage, two 'expert panels' were set up to evaluate the draft questions and approve them. Respondents were randomly assigned to one of the two formats of the self-rated health questionnaire by an electronic interview programme. Once the self-rated health questionnaire was completed by one group at the start of the health module (''Would you say your health is...'') with five multiple feedback choices (from 'excellent' to 'poor'); a self-rated health item (''How is your health in general? Would you say it was...'')

with five response choices (from 'very good to 'very bad') were introduced at the end of the module (Bowling and Windsor, 2008, p. 82). The format of questionnaire administration, therefore, provided a chance to investigate the effect of question order, 'question order effects', that is "the distribution of responses to the item asked before and after the administration of the module of health questions", and the 'response wording effects' (for example, self-rated health components can be sensitive depending on its location in the questionnaire and the response format applied) (Bowling and Windsor, 2008, p. 82).

The nurse home visit occurred at alternative waves, every four years and involves collecting data for anthropometric measures and physical performance measures along with bio-measurements. Wave 8 was a wave with nurse home visits. However, in Wave 8, the participants' height was not measured as part of the anthropometric measurements. The UKDS, to confirm that the ELSA survey team did not measure participants' height in Wave 8, as the Wave 8 cohort are the same cohort in Wave 6. It was advised by the UKDS to use then participant's height measurement variable from ELSA Wave 6 for the present, in order that an individual's BMI could be calculated. Therefore, the participants' height variable from Wave 6 were merged into the Wave 8 dataset.

According to the UKDS (2018), ELSA uses the following standard questionnaire measures that are relevant for the present study:

- Activity of daily living (ADL)
- Instrumental activity of daily living (IADL)
- Control, autonomy, self-realisation, pleasure scale (CASP-19)

3.4.3 First phase of the study: ELSA variables selected for use in the present study

Only the essential variables used in ELSA that are relevant to the present study are discussed below. The rationale for selecting these specific variables is discussed in Chapter 4 in detail.

Dependent or outcome variables

The outcome variables that are relevant for the present study, based on the conceptual framework developed in Chapter 2, are: older adult's disabilities, morbidities, health status, wellbeing, and the receipt of social care. These are discussed in more detail in Chapter 4.

Independent variables or predictors

The predictor variables that are relevant for the present study, are: BMI, age, gender, marital status, co-residence status, smoking, alcohol, education, employment and self-reported general health, self-rated long-standing illness. These are discussed in more detail in Chapter 4.

3.4.4 First phase of the study: the present study sample size and power estimation

Kadam and Bahlerao (2010) state that using a large diverse and representative sample improves the generalisability of findings. The secondary data used in the present study is from ELSA, a moderately large nationally representative community-based English population survey of 8,445 participants. At the same time, recruiting more participant than needed can be ethically unsound as more participants are exposed to potential harm than need to be. Undertaking a power calculation for a study, is crucial when determining the sample size needed for a study to ensure that the study has enough power to detect a true difference or change, so that the actual number of participants needed for a study can be determined to avoid a type I or a type II error (Burkholder, 2012). While type I or alpha error represents the failure to credit the true null hypothesis, type II or beta error represents the probability of accepting the false null

hypothesis. The typical recommendation for most studies is to set it at 5% at the alpha level and maximum 20% at the beta level to have an appropriate study outcome (Nayak, 2010).

Vittinghoff and McCulloch (2007) argue for the use of the number of predictors by the number of occurrences for a multivariate logistic regression model, given that the use of five to nine occurrences for each predictor is regarded as reliable. However, this issue is the subject of debate, and an alternative 'rule of thumb' was suggested by Ranganathan et al. (2017), that there must be a scope of at least ten affairs to be considered for each independent variable. Such as, with a sample size of 100, a maximum limit of 10 predictors should be used.

A priori power estimation was conducted for the present study, using G*power version 3.1, a computer software tool to estimate statistical power (Faul et al., 2007). The power estimation was calculated for a multivariate logistic regression with a binary outcome variable and multiple predictor variables, applying a medium effect size ($f^2 = 0.30$), (α error = 0.05) and the level of confidence ($1- \beta = 0.95$). The calculated sample size was 46 for one predictor variable. Therefore, for the 14 independent variables, the maximum number used in the present study, the needed sample size is 644. As the present study used secondary data drawn from a national survey dataset of 8,445 participants, for the quantitative part of the present study, the sample size, and the number of affairs per predictor is well above than the minimum number of participants needed.

3.4.5 First phase of the study: ELSA participants

The Institute for Fiscal Studies (2011) stated that the ELSA sample, aged 50 years and over, both men and women, was drawn from participants who took part in the Health Survey for England (HSE) before taking part in ELSA. The HSE is a study that was carried out by the Department of Epidemiology and Public Health, UCL, and the National Centre for Social Research, on behalf of the DOH (IFS, 2018). The advantage of using the HSE sampling source

is that the baseline data on participants' health - details of morbidity, lifestyle, diets, and blood samples - had already been gathered before the first wave of ELSA data collection started (IFS, 2018). The positive aspect of interviewing the same age cohort who participated in HSE is that the existing data can be combined with the new data to have more in-depth information about the population's economic position, health, and quality of life over time (NatCen Social Research, 2019). The ELSA study sample was drawn from the three survey years of the Health Survey for England (1998, 1999 and 2001), who were born before March 1952 (UKDS, 2018). Although the sample was revised and updated at several following waves, not all participants have taken part in follow up waves (UKDS, 2018).

3.4.6 First phase of the study: ELSA validity and reliability

Validity and reliability are an essential aspect of a study and must be considered before conducting a study. The secondary dataset was drawn from a nationally representative survey, thus reducing any direct bias from the student researcher. The instruments used in ELSA were widely tested to ensure their high validity and reliability.

Two pilots of the CAPI for ELSA Wave 1, the self-completion survey questionnaires, and related documents, were carried out in August and November 2001 (UKDS, 2018). All respondents for the pilot study were selected from the same households that had taken part in HSE 2000 (NHS Digital, 2021). The pilot study's purpose was to test the fieldwork procedures and the content of the questionnaires and interview guide. Cognitive testing was used for some new questions; though few new measurements were added to ELSA (UKDS, 2019). A Wave 8 pilot was not undertaken as there were minimal changes to the survey questionnaires and interview guide from other waves of ELSA. A dry run was conducted to evaluate the survey process. Feedback from this dry run was used to change and improve the main Wave 8 process (IFS, 2019). ELSA questionnaires are freely available to download from the UKDS.

3.4.7 First phase of the study: ELSA data analysis plan

First, the secondary data, The End Users Licence (LIC) version of ELSA, the English Longitudinal Study on Ageing: Wave 0-8, 1998-2017 (SN 5050), was exported from the UKDS (2018). This is freely available for any researchers to download after registering with UKDS. This was then extracted, formatted, uploaded into, and analysed using the Statistical Package for the Social Sciences (SPSS) V.25.0. The data that was exported, included the outcome and predictor variables mentioned previously for example, participants' socio-demographic status and the measure of health, disability, and health behaviour.

The present study used a cross-sectional study design to test the relationship between obesity and outcome variables in older adults, the presence or absence of other confounding factors. The analyses were weighted by Wave 8 cross-sectional weights to make the dataset more nationally representative. This is because one of the limitations of longitudinal studies with older adults is that following up participants can be challenging and so it was judged that using cross-sectional data would be more useful in identifying relationships between obesity, wellbeing, and social care need.

3.5 Second phase of the study by primary data: qualitative one-to-one interviews

Initially, the study was designed to have two closely overlapping stages exploring unmet care needs among obese older adults. It was decided that a semi-structured questionnaire will be given to the randomly selected potential participants divided into two groups, obese and non-obese, for face to face and one to one real-time conversation and an in-depth one to one interview would follow with a small sample equally and randomly drawn from these two groups. However, given the current crisis with the COVID-19 pandemic, it was intended to do purposeful sampling minimising contacts with participants as much as possible. Therefore, a

semi-structured one-to-one interview or "guided conversation" was performed for the potential participants who met the study inclusion and exclusion standards.

3.5.1 Second phase of the study: the venue

Convenience sampling was used to identify a single NHS GP surgery as the venue for the present study. Choosing a GP surgery provided a private, quiet, non-threatening environment that encouraged participants to engage in a rich and in-depth conversation, besides, the surgery provided easy access for participants as it was their GP surgery. The surgery also had essential amenities such as a water dispenser and toilets. To ensure heterogeneity the student researcher attempted to ensure that the sample was a diverse mix of socio-economic backgrounds and ethnicity, i.e., as representative as possible for the UK population.

3.5.2 Second phase of the study: privacy and confidentiality

The participants' General Practitioners (GPs) were informed of their involvement in this study to ensure that GPs could discuss and follow up that participant after the interview. No identifiable information was taken from the participants (not even their names/hospital numbers/date of birth). All audio recordings were saved in a password protected computer as digital files and destroyed once the audio transcriptions had been completed and written up. Direct quotations from the respondents will be used for publication/ conference presentation, but any person's name/company name/organising committee name was removed from the written transcriptions. Participants were assigned a unique numerical case number to ensure anonymity. Only the student researcher and an independent researcher from the UWL heard the recordings and read the transcripts to verify the transcription. The field notes and the student researcher's reflective diary were shared with doctoral supervisors. A copy of physical security arrangements for the storage of personal data during the study can be found in Appendix 5.

3.5.3 Second phase of the study: participant welfare

During the design of the study, no major adverse risks were identified for the participants taking part in a one-to-one semi-structured interview. However, it was considered that some questions or topics might be more emotional than others, for example, talking about the coping strategies and the support or care they had or had not received related to their increasing weight or complex morbidity. Therefore, it was decided, and agreed by the ethics committees, that if any participants find any discussions upsetting, then the interview would be ended and the interviewer would give the participant time to calm down, discuss their mood with themselves or to call someone else and offer them the opportunity to withdraw from the interview. It was anticipated that the length of interview could be a potential concern for participants. Therefore, before beginning the consenting procedure, the likely length of the interview (30 minutes) was mentioned both verbally and in writing as part of the participants' information sheet. Finally, due to the current Coronavirus Disease (COVID-19) pandemic, it was essential to undertake all the necessary measures to ensure participant's COVID safety. Hence, before bringing the participants into the interview room and after they left the interview room, the following measures were undertaken, such as, wearing musk and plastic apron, sanitising hands/chair /pen/ door handles before and after each interview, maintaining 2-meter distance, and keeping the windows open during the interview. In addition, at the beginning of every day the temperature of each recruiting GP surgery staff member, the student researcher and each participant were undertaken, and the questions about symptoms of COVID were asked. If the student researcher, participants, or GP staff member would have diagnosed positive for COVID, then the interview would be cancelled, and the participants would be allowed to go home if they felt okay, or a family member or carer would be asked to escort the participant home.

3.5.4 Second phase of the study: researcher's safety

A risk assessment was carried out to explore any potential risk to the student researcher in carrying out the one-to-one semi-structured interview in a closed room of the recruiting NHS GP surgery. All GP surgery staffs, and the local research lead were informed about the location of the interview room at the beginning of every planned interview day. The student researcher also kept their fully charged mobile phone in the interview room. In addition, while being aware of the NHS lone worker's policy as the research was conducted inside a GP surgery it was not judged necessary to have a chaperone. Lastly, due to the COVID pandemic the safety measures discussed in the previous section were also followed by, and applied to, the student researcher.

3.5.5 Second phase of the study: debriefing and feedback

After completing a one-to-one semi-structured interview, the recording device was turned off, and each participant was encouraged to ask further questions which were then answered by the student researcher. In addition, the participants were reminded about the ways the study findings would be disseminated (as discussed in a previous section). Finally, all the participants were provided with the student researcher's university student email address, and they were informed that they were always welcome to discuss any future concerns that they might have regarding their participation in this study.

3.5.6 Second phase of the study: data collection methods

Data was collected through one-to-one guided interviews with the help of an interview guide. The interview duration ranged from 30-40 mins. A notice stating 'interview in progress' was hung from the interview room door handle. Prospective participants were asked for the written consent followed by a full verbal explanation of the study, and the opportunity was given to read the participants' information sheet. Two participants requested to be withdrawn from the

study before signing their consent forms. One participant stated, *"I am in a rush"*, as she had another appointment to attend. Another participant considered the length of the interview was too long. All the participants were offered either an in-person interview on a scheduled day or phone interview to be conducted later. Family members and the carers were asked to wait outside in the waiting area lounge. Out of the total 33 cohorts, 5 participants requested a phone interview. All phone interviews were carried out using the surgery's phone. All participants were asked for their current disability and health status and demographic details. All interviews were digitally recorded with the permission being asked for from participants as part of the opening interview session. In addition, field notes were taken with pen and paper for each participant.

A reflective diary was maintained to record the experiences of the student researcher and memos produced after interviewing each participant. Last but not the least, all participants were debriefed after completion of the interviews.

3.5.6.1 Second phase of the study: informed consent

Each suitable participant interested in taking part in this study was given a participants' information sheet and consent form before starting the one-to-one semi-structured interview. Every participant had to give signed consent before participating in the study. The study purpose, design, and their involvement were discussed with the interviewer, that is the student researcher (me). All participants were reassured that their participation was voluntary, that the care they would typically receive would not be affected by their decision to participate or not in the research, and that they had the right to withdraw their consent at any time both for the interview and any data already collected. In addition, the participants were informed that their personal identity would be protected; all data entered in this study would be by case number not names. Finally, the participants were informed that an executive summary of the study

findings would be shared with the participating NHS GP surgery (recruitment site) either by email/ letter or poster following the completion of the study and that they could receive a copy if they so wished directly. The participants were also asked and consented to their interview being used for teaching, future research, and publication after removing their identifiable details. Each participant was given a copy of the signed consent form, and one copy of the consent form was given to the local collaborator or local research lead to be placed in the participants' file. A copy of the participants' information sheet and the consent form can be found in Appendix 2 and 3.

3.5.6.2 Second phase of the study: semi-structured interviews

Adopting semi-structured one-to-one interviews as a data collection is ideal "to explore participant thoughts, feelings and beliefs about a particular topic and to delve deeply into personal and sometimes sensitive issues" (DeJonckheere and Vaughn, 2019, p. 1). Therefore, this data collection method was well-suited to collect relevant, distinctive, and meaningful stories of participants' life experience and aspirations and concerns. According to Bernard (1988), this method is the best when the interviewees are available to have a one-off in-depth interview. However, to obtain reliable, comparable qualitative data through semi-structured interviews, the interviewer must be curious and actively engaged in the conversation and develop trust and rapport with the interviewees. Where possible and appropriate the interviewer can create an 'interview guide' (DeJonckheere and Vaughn, 2019), where the interview questions and topics are prepared ahead of time and in a particular order with questions loosely structured, to help guiding the interview. Open-ended questions are used so that the participants have more opportunity to express their views in their own words.

For the current study, an interview guide was prepared to guide the interview to make effective use of time. According to the study context and objective, a validated questionnaire from ELSA

(freely available) was used to form a loosely structured interview guide. Each question was supplemented by open-ended follow-up and probing questions that were dependent on the interviewee's response. Specific questions focused on weight-related perceived barriers in terms of disability, health and wellbeing and social care support and their perception of their coping strategies. The term ‘care and support’ was used throughout the interviews to assess the gaps between demand and service received.

The interview guide was reviewed by several reviewers as part of the ethics committee's approval, along with the student researcher’s supervisors. A copy of the interview guide can be found in Appendix 6.

3.5.6.3 Second phase of the study: sampling strategy

Due to the current pandemic, the participants had limited access to the GP surgery, which meant a change in the original representative sampling strategy to a purposive sampling strategy to collect this qualitative data. Initially, the study was designed to have two closely overlapping stages. The first stage would be semi-structured questionnaire given to randomly selected potential participants divided into two groups, obese and non-obese, for face to face and one to one real-time conversation and an in-depth one to one interview would follow with a smaller sample of participants randomly drawn from these two groups. However, given the COVID-19 pandemic, a purposeful sampling strategy minimised contacts between student researcher, participants and GP surgery staff. As the qualitative inquiry is used to evaluate and measure the older adults’ perceptions of whether providing social care support in any forms is effective or not was judged to be acceptable. A purposive sampling strategy provided the scope to access the "information rich" (Patton, 2015) hard-to-reach samples of obese older population groups. Moreover, it enabled a heterogeneous sample of participants with differing demographic characteristics (including gender, age groups, ethnicity, marital status/ existing partner,

cohabiting status and co-residence status). According to the study's theoretical framework, the purpose was to have found the most significant degree of information till no new information was generated (data saturation). Therefore, sampling was done to the point of redundancy. This is a common strategy in qualitative studies, where selection can be terminated when data is saturated or no new facts are forthcoming (Merriam, 2009; Butina, 2015). According to Patton (2002, p. 244), "There are no rules for sample size in qualitative inquiry".

3.5.6.4 Second phase of the study: eligibility criteria

The following eligibility criteria were used for the recruitment process:

Inclusion criteria:

The population group to be included in the study satisfied the following criteria-

- Older adults of 50 years and over
- Older adults BMI ≥ 18.5 kg/m2
- Can speak and understand English.
- Older adults visiting minor illness clinic.
- Having the ability to deliver informed consent according to the UK Mental Capacity Act (Gov.UK, 2005)

Exclusion criteria:

Patients with a history of any of the following were excluded-

- Cannot speak and understand English.
- Advanced stage dementia
- Individual with severe or profound ID (intellectual disabilities)
- Individual with Prader Willi syndrome, Cohen syndrome or Bardet-Biedl syndrome.

3.5.6.5 Second phase of the study: recruitment of participants

Prospective 33 participants for the semi-structured interviews were recruited by me as the student researcher. Individuals who visited the surgery for flu vaccination and satisfied the inclusion and exclusion criteria set for this study were considered potential participants. Every Tuesday, except a few Tuesdays, either the surgery was closed due to the current pandemic, or the local collaborator was on leave, older adults who attended, the minor illness clinic of, the NHS GP surgery for their flu vaccination were invited by the local research lead. The minor illnesses are generally defined as a wide range of self-limiting conditions, normally managed through self-care (Wood, 2008). The local research lead informed potential cohorts about the study and asked them whether they were interested in taking part. The potential participants were assessed against the inclusion and exclusion criteria except for their BMI by the local research lead before sending them to me. Then the participant's height and weight were measured in the interview room by the student researcher to assess whether they met the inclusion standard for BMI. Participants who did not meet the inclusion and exclusion standards were thanked for their interest and offered a summary of the research findings upon their request. Participant who did meet the eligibility criteria and were still happy to take part were then asked to have a meeting on the same day or to arrange an interview date and time before they left the GP surgery.

3.5.6.6 Second phase of the study: pilot study

A pilot test is one of the essential phases of any research, especially qualitative interview preparation (Hassan et al., 2006). A pilot interview can be used as a rehearsal before the actual interview and helps a researcher determine the potential problem areas, weaknesses, and limitations of the interview design. The present study interview protocol was tested with the first two participants (case number 1 and 2). The same interview protocol was followed as

agreed on for the actual interview. Therefore, the study recruitment process, consenting process, the interview questions and the recording device were tested to verify the clarity and accuracy of the whole process, as well as the appropriateness and effectiveness of the interview questions for the actual interview. The pilot test helped in determining the pace of asking questions and identifying the length of interview time needed for each participant. Finally, following the pilot test, all the interview questions were reviewed and refined.

3.5.7 Second phase of the study: data management

Data management is a demanding and complex process in any research study (Lin, 2009). It encompasses data storage and record-keeping, data conservation and retention. This section discusses the storage of research data, how the privacy and confidentiality of participants' information was protected and the length of time the data will be kept safe.

For the present study, all field notes were scanned and saved as digital formats in a password protected private laptop for the student researcher's personal use only. All participants were identified by numerical case numbers as discussed above. A digital tape recorder-Sanyo ICR-S25ORM, was used to record all the interviews. All the recordings were transferred from the recording device to a personal laptop in the MP3 file. The audio files were transcribed in verbatim by the student researcher and saved in Microsoft Word format. Then the transcriptions are cleansed for any personal information to protect the anonymity of the participants. An independent researcher colleague double-checked the transcriptions against the audio tapes to verify their accuracy.

The data protection and retention comply with the University of West London's data protection policy. Once both audio and paper notes were converted to digital files, all paper documents and the audio tapes were destroyed. All digital files were kept in a password-protected USB flash drive in a locked filing cabinet of the student researcher's house. Due to the pandemic, it

was not possible to access the University computer, once the pandemic was over, data was saved in a password-protected University computer. The working files were kept in the student researcher's laptop were free from any identifiable information and was only accessible to her. Data is stored in a USB flash drive and will be kept for up to 5 years after the end of the project, then the data will be disposed of appropriately.

3.5.8 Second phase of the study: trustworthiness and credibility

To measure the accuracy of any qualitative inquiry, the trustworthiness of the findings was assessed to see whether they are coherent/congruent? with real-life (Morrow, 2005). "The "truths" of narrative accounts are not in their faithful representations of a past world, but in the shifting connections they forge among past, present, and future" (Riessman, 2005, p.6). To establish the study's credibility, a theoretical framework was developed following the extensive literature search, and a suitable methodology was adopted that was supported by a philosophical orientation/stance (please see chapter 2, Figure2.1 and 3.2). A prolonged relationship was developed with the study participants by establishing a positive, constructive interpersonal relationship during the recruitment process, before starting the actual interview, throughout the interview session and during the debriefing process. According to Lincoln and Guba (1985), a prolonged involvement with the interviewees can help the interviewer gain their faith and confidence and better understand their life philosophy or beliefs. Data were collected through several sources: interview recordings, field notes, transcripts, and reflective diary. The field notes and reflective journal were shared with supervisors and an independent university researcher heard the recordings and read the transcripts to verify the transcriptions. The student researcher had an ongoing discussion with doctoral supervisors at every stage of the study. This enabled the student researcher to identify the gap in the process (such as, sequence of the questions) and helped to strengthen the study design. In addition, the study design was shared with my colleagues, peers, in different conferences, and the UWL Doctoral Research

Committee for their feedback. The Doctoral Research Committee examined the study's methodology to verify the credibility of the methods applied in this study. Buman et al. (2010, pp. 225) argues that "The pragmatic approach to validity in science relies upon discourse and shared understanding of phenomena and ongoing reflections on the implications of research findings".

Most of the interview guide questions were adapted from ELSA survey self-completed questionnaires. The format of any questions that are adapted from ELSA were not changed. The open-ended questionnaires were discussed, checked, and proofread by doctoral supervisors. In addition, before finalising the questionnaire for a qualitative interview, a pilot study was undertaken based on a couple of respondents to validate the interview guide. The details of the pilot study were discussed in a previous section. The biases were openly and honestly discussed (student researcher's assumptions and orientation). The study's strengths and weaknesses are discussed in Chapter 8. Furthermore, it was attempted to do the member checking, as several studies (Janesick, 2000; Shelden et al., 2010) mentioned the fact that it is one of the useful tools to validate a qualitative interview data's trustworthiness. However, I (the student researcher) was unable to gain permission from the ethical body to collect the participant's email details. Moreover, due to the COVID (Coronavirus Disease) situation it was difficult for the GP research lead to take the responsibility of member checking after few failed attempts. Finally, the rich accounts of the participant's circumstances are presented in Chapter 7 to permit the readers to determine the interview data's trustworthiness (Buman et al., 2010).

3.6 Research questions and hypotheses

The research aim of the present study is to explore the effect of obesity on health and social care needs among older adults in England.

The specific research objectives are:

1. To investigate the association between obesity, disability status, morbidities in older adults.
2. To determine the association between current health status and wellbeing in older adults with obesity.
3. To explore the differences in social care needs by the degree of obesity.
4. To examine the role of obesity among older adults in determining social care need by identifying their unmet care needs.

The research questions that were developed from the above objectives are set out below.

RQ1: Is there any association between obesity, disability, and morbidities in older adults?

H_0: There is no statistically significant association between obesity, disability, and morbidities in older adults.

H_1: There is a statistically significant association between obesity, disability, and morbidities in older adults.

RQ2: Is there any association between obesity with current health status and the wellbeing of older adults in England?

H_0: There is no statistically significant association between obesity with current health status and wellbeing of older adults in England.

H_1: There is a statistically significant association between obesity with current health status and wellbeing of older adults in England.

RQ3: Is there any association between obesity and the amount of social care received in older adults?

H_0: There is no statistically significant association between obesity and the amount of social care received in older adults.

H_1: There is a statistically significant association between obesity and the amount of social care received in older adults.

RQ4: What are the dynamics of unmet care needs for social care and support of obese older adults?

H_0: There are no unmet care needs for social care and support of obese older adults.

H_1: There are existing unmet care needs for social care and support of obese older adults.

(Where H_0 is the null hypothesis and H_1 is the alternative hypothesis)

3.7 Statistical tools used for analysis

For the quantitative first stage of the present study, exploratory data analysis, correlation and regression, and multivariate logistic regression are used to analyse the secondary data. Multivariate logistic regression is used to analyse the relationship between multiple predictor variables and one dependent variable at a time (Hazra and Gogtay, 2017). Correlation analysis is used to demonstrate whether, and how strongly, pairs of variables are related.

For the qualitative second stage of the present study, a structural narrative analysis method is used to analyse the semi-structured qualitative interview data to analyse human experience and action. Detail of the data analysis of the qualitative primary data from the interviews is discussed in Chapter 7.

A methodological matrix that relates research questions to types of data analysis is presented below.

Table 3.1: Matrix on the methodologies used in this study that connects research questions to data and analysis.

Number	Research Questions	Data Collection	Data Analysis
1	Is there any association between obesity, disability, and morbidities in older adults?	ELSA data	Descriptive analysis Exploratory data analysis Graphical analysis Pearson's correlation analysis
2	Is there any association between obesity with current health status and the wellbeing of older adults in England?	ELSA data	Exploratory data analysis Multivariate logistic regression analysis
3	Is there any association between obesity and the number of social cares received in older adults?	ELSA data	Exploratory data analysis Multivariate binary logistic regression analysis
4	What are the dynamics of unmet care needs for social care and support of obese older adults?	Face-to-face one to one real-time semi-structured interviews of 33 cohorts	Structural narrative analysis

Source: Developed by the student researcher

3.8 Summary of the chapter

The chapter has discussed the philosophical approach underpinning the research methodology used in the present study and described the study's design and planning. It has explained rationale for choosing a mixed methods quantitative and qualitative research design as the best way to achieve the aim and objectives of the study. An overview of the ethical issues that are considered for both arms of the study, is presented along with the study design, data access, data collection, data management, data validity and a road map of data analysis.

CHAPTER 4

Association between obesity, disability, and morbidities in older adults

4.1 Introduction

This chapter reports on the statistical analysis of a secondary dataset, ELSA wave 8, to answer the first research question of the present study. The aim is to analyse the connection between obesity, and other socio-demographic factors, on disability and morbidity in older adults aged 50 years and over in England. The variables were cleaned, and missing, improper, and unacceptable data were removed. The results are based on selected variables from ELSA. The results of the statistical analysis were presented in tabular and graphical forms and are interpreted and explained in the text.

The chapter also discusses the rationale for choosing the dependent and independent variables for all four research questions (see chapter 2 and 3), the numerical coding, and the measurement instruments. A conceptual framework to identify the 'unmet care needs' among overweight and obese older adults has also been constructed as part of the present study. Finally, the chapter concludes with a summary of the results of the first research question whether they support or reject the null hypothesis (H_0).

4.2 Selection of variables for investigation

Different researchers have defined the term variable differently. In the present study, variables are several phenomena that take on different values in a different situation and rises or drops over time (Flannelly et al., 2014).

The dependent or outcome variables of the present study, as mentioned in Chapter 3, are disability, morbidity, health status, wellbeing, the amount of social care received and unmet care needs. Several health measures were used in the present study so that the biological process of ageing can be better represented and understood (Singer et al., 2019); these are: multiple functional impairments, complex morbidities, and subjective and objective health status.

The study's predictors or independent variables are socio-demographic factors, behavioural or lifestyle factors, socio-economic factors, self-rated health status or subjective health status (SHS), and long-standing illness. The SHS was used as an outcome variable for health status and also as a predictor to determine disability, morbidity, wellbeing and social care needs.

The socio-demographic factors used were age, gender, marital status, education, and the socio-economic factor used was employment status. The behavioural or lifestyle factors used were body weight by BMI measurement, and amount of smoking and drinking alcohol. Several past studies on the elderly have found good agreement when using the variables mentioned above as the risk factors for health, wellbeing, and social care outcomes (Pongiglione et al., 2017; Jackson et al., 2019b; Fernihough and McGovern, 2015; Copley et al., 2017). However, another useful demographic variable, 'ethnicity' (Sutaria et al., 2019), was not used as a predictor in the present study because the study sample was not a representative sample of non-white respondents. The number of 'white' participants was 6,746 (94.6%) whereas the number of non-white respondents was 387 (5.4%). Hence, the study sample was predominantly a 'white' population sample.

The anthropometric measurements of an individual's height and weight are used to calculate BMI, so the study participants were categorised into different weight groups according to the WHO BMI classification. Underweight respondents (BMI<18.5 kg/m2) were removed from the analytic dataset to avoid bias. It is because several past studies found that individuals with

malnutrition or underweight (BMI<18.5kg/m2) can also have difficulties with daily activities and mobility (Oliveira et al., 2009; Sawada et al., 2021). A study by Wei et al. (2018) stated that morbidities and physical or mental impairments or disabilities could be a causal effect of poor nutrition among older adults. Therefore, the present study only considers 5,640 participants (out of 8,445) as the sample size for the secondary data analysis.

4.3 Measuring instruments and the coding

All the study variables based on the ELSA dataset, their description and summary analysis were displayed in Table 4.1.

Socio-demographic factors

Age was calculated by subtracting the respondent's year of birth from the interview year and classified into four age groups. The four groups are 50-60, 61-70, 71-80 and 81 years and older. The older adults' age range for this study ranging was 50 to 100 years. The age variable was coded as 0 for 50-60, 1 for 61-70, 2 for 71-80 and 3 for 81+ years of aged cohorts.

Likewise, gender was categorised as female and male and was coded as 0 for female and 1 for male.

Marital status was grouped as married and unmarried/others. 'Married' was defined as current legally married participants or the participants who were in a stable relationship. 'Unmarried' was defined as participants who were not married or single, separated, divorced, or widowed. Marital status was coded as 0 for married and 1 for unmarried/others.

Educational status was defined as the age the respondents finished formal education. The respondents were categorised into three educational groups: a) no education/age of leaving education at 14 years or less (coded as 0), b) age of leaving education between 15 years to 18

years (coded as 1) and c) age of leaving education at 19 years and more/not yet finished (coded as 2).

Socio-economic factors

Employment status was assessed with four items as retired, employed, self-employed and unemployed. The responses were dichotomised to whether participants were currently employed or not with currently retired and unemployed participants categorised as ‘retired or unemployed (coded as 0) and currently employed participants (employed and self-employed) categorised as 'employed' (coded as 1).

Co-residence status

The three categories of co-residents were identified from the ELSA data set were, cohabiting partners, children, and grandchildren. The responses were dichotomised, and the co-resident status was coded as 0 for no co-residents and 1 for at least one co-resident. The term 'cohabitation' is used in ELSA to represent if the participant lives with a partner in the same household. Positive co-residents – partners, children and grandchildren - are often a vital source of informal care (Copley et al., 2017; NHS Digital, 2016). Therefore, this independent variable was used determining the social care need (in Chapter 6).

Behavioural or lifestyle factors

Smoking status was assessed by asking participants whether they currently smoked (any type of tobacco products) or not and coded as 0 for “No, currently smoking” and 1 for “Yes, currently smoking”. There was a possibility of misclassification as some current non-smokers may were ex-smokers who quit a few weeks or months before the interview.

The responses for alcohol consumption status in the last 12 months period was dichotomised as none/rarely (once or twice a year OR once every couple of months OR once or twice a

month) and frequently (once or twice a week OR three or four days a week OR five or six days a week OR daily). The categories are coded as 0 for “never or rarely and 1 for “frequently or daily”.

Anthropometry

BMI was measured as a continuous variable as objective measurements of height and weight were taken in the ELSA survey during nurse visits. For the present study, the height variable was merged from the ELSA Wave 6 dataset into the Wave 8 dataset, as discussed in Chapter 3. Participant’s height was objectively measured to the nearest millimetre by a portable stadiometer, asking them to stand upright without shoes. One measurement was taken with the informants stretching to the maximum height and the head in the Frankfort plane (Daly et al., 2019). Weight was measured using a portable electronic scale Tanita THD-305 (Tanita Corporation, Arlington Heights, IL) to the closest 0.1 kg. (Daly et al., 2019). However, the portable electronic scale has the limit to weigh up to 130 kg and is inaccurate above this level; therefore, for those participants, weights were estimated (Daly et al., 2019). Participants were requested to take their shoes off and to wear only light clothing. Each informant's BMI was calculated as weight in kilograms divided by height in metres squared.

In the present study weight was categorised into three groups: normal weight (BMI ≥ 18.5 to <25kg/m2), overweight (BMI ≥ 25 to < 30kg/m2) and obese (BMI ≥30kg/m2). Weight was coded as 0 for 'normal weight', 1 for 'overweight', and 2 for 'obese'.

However, to determine social care needs and unmet care needs (in Chapter 6 and Chapter 7), weight was categorised into five groups: normal weight (coded as 1), overweight (coded as 2), moderate or class I obesity (coded 3), severe or class II obesity (coded as 4), and morbid or class III obesity (coded as 5). This was based on the three categories of obesity developed by

WHO: obesity class I (BMI = 30-34.9 kg/m2), obesity class II (BMI = 35-39.9 kg/m2) and obesity class III (BMI ≥ 40 kg/m2) (WHO, 2020a).

Self-rated health status (SHS)

Self-rated health status was assessed by asking respondents to mark their health on a 5-point Likert scale from excellent to poor. Responses were coded as 0 for excellent, 1 for very good, 2 for good, 3 for fair and 4 for poor self-rated health.

This single self-reported health measure is a very common way of measuring health status in research studies and other contexts and was evaluated to be a robust measure of health status (Ware et al., 1993). Although, the questions for subjective measurements can be sensitive based on the rank in the main questionnaire, besides the way the response formats are used (Bowling et al., 1999; Bowling and Windsor, 2008). To reduce this bias, the self-rated health question was answered before the specific health and disease questions in the ELSA survey (Bowling and Windsor, 2008).

Long-standing illness

Self-reported long-standing illness was also assessed by each participant being asked "whether has self-reported long-standing illness", and the answers were grouped into "yes" and "no". For the present study, the responses were dichotomised and coded as 0 for "no" and 1 for "yes". Self-reported long-standing illness was mentioned used extensively in past research and in government and health and social care surveys as a key indicator alongside self-reported health status (Copley et al., 2017; Hewitson et al., 2014). In the present study, this independent variable is only used determining social care needs (Chapter 6).

Dependent or outcome variables

Disability

Disability was measured by the degree of functioning or the ability and inability of an individual to perform daily personal care activities necessary to live self-sufficiently. The 'activities of living model' or the 'model of nursing care' by Roper et al. (2000), is grounded on activities of living (AL), that was later modified to 'Katz's index of activities of daily living' (ADL) that sums up the number of ADLs an individual needs help to live independently (Coyne, 2019). In 1969, Lawton and Brody further developed another scale to assess the less severe degree of functional disability creating the 'instrumental activities of daily living' measure (IADL) (LaPlante, 2010), which was later named the Lawton Instrumental Activities of Daily Living Scale (Coyne, 2019).

This narrow focus on physical function was criticised for ignoring the effect of the impairment on an individual's functioning and the effect of other elements such as wider social and environmental factors (Palmer and Harley, 2011). However, the "ability to perform ADLs and IADLs is dependent upon cognitive (e.g., reasoning, planning), motor (e.g., balance, dexterity), and perceptual (including sensory) abilities" as each task under ADL and IADL demands an individual's 'physical and/or cognitive ability' to apprehend the nature of the task first and then complete it without any support (Mlinac and Feng, 2016, p.506).

The ELSA interviewer gathered data on self-reported ADL activities. There are six domains of basic functional activities within ADLs, and functional disabilities are defined as difficulty in undertaking the following ADLs: difficulty in walking, difficulty in bathing, difficulty eating, difficulty getting in and out of bed, difficulty using the toilet. Although, the Lawton modified IADL Scale is an eight-item scale, the ELSA-IADLs measurement scale consists of nine domains of activities to obtain a better picture of participant's functional impairment. The

activities are, difficulty using a map, difficulty recognising physical danger, preparing a hot meal, difficulty shopping for groceries, difficulty making phone calls, difficulty with communication, difficulty taking medications, difficulty working around the house and garden, difficulty managing money. However, despite the literature supporting the fact that incontinence in older adults is considered another essential element of functionality, it is not included in the list of ADL or IADL activities. The scores were skewed negative, with most of the respondents reporting no impairment for an individual activity. Therefore, the responses were dichotomised using a two-point coding scale (0-1). All the ADLs activities were combined into one group to assess if the respondents have 'no impairment of ADL' (coded 0) or 'at least one impairment of ADL' (coded1). In the same way, all the IADLs are combined into one group to assess if the respondents have 'no impairment of IADL' (coded 0) or 'at least one impairment of IADL' (coded 1).

Morbidity

Morbidity was classified into four categories, no morbidity, single morbidity, comorbidity and multimorbidity. The definition of morbidity is adapted from a study by Hernandez and Kim (2021, p.1) that regard it as "being symptomatic or unhealthy for a disease or condition". Morbidity is commonly measured as prevalence, the number of existing cases of a morbidity. ELSA Wave 8 provides eleven self-reported clinically diagnosed morbidities. These are: high blood pressure, high cholesterol, angina, heart attack, stroke, other heart diseases, diabetes, cancer, dementia, arthritis, and osteoporosis. Although, some additional diagnosed diseases are provided in the ELSA dataset, the number of respondents is too low for these to be considered in the present study. There is no international consensus on a list of chronic conditions for older adults to be used in research and surveillance (Li et al., 2016). For example, sleep apnoea in older adults was classified by the literature (Jehan et al., 2017) as one of the health risks that may affect an individual's physical and mental health. However, it is not treated as a clinically

diagnosed disease in the ELSA survey. All eleven self-reported medically diagnosed conditions were categorised as no morbidity, single morbidity, comorbidity and multimorbidity as a dichotomous categorisation would not evaluate the complexity of morbidity and its influence on older adults' health status correctly (Barnett et al., 2012; Salisbury, 2013).

The definition of 'comorbidity' and 'multimorbidity' was adapted from past studies (Fortin et al., 2012; Pes et al., 2019). The former is defined as the co-occurrence of two clinically diagnosed disease conditions, and the latter is the co-occurrence of three or more clinically diagnosed disease conditions (excluding overweight and obesity for the present study). However, these definitions do not consider the severity of the disease conditions or the combinations of disease conditions. Both of these factors are likely to influence the impact of co and multi- morbidities on older adults' health, wellbeing and social care need. However, there is a lack of research on the identity of 'killer combinations' (DOH, 2014b). Different researchers have defined comorbidity and multimorbidity differently according to their study purpose. Feinstein (1970) defined comorbidity as the presence of another condition along with the primary disease or index disease. Multimorbidity was defined as the coexisting of two or more chronic conditions without links to any primary disease (van den, 1996). There are also different definitions that include idea of 'acute' conditions and 'chronic' conditions to define multimorbidity as well as other ways of defining 'comorbidity' and 'multimorbidity' (Bernell and Howard, 2016; TAMS, 2018).

In the present study, the primary or index condition is a high level of BMI above what is defined as normal weight for a participant, and the aim is to explore the connection between obesity and other clinically diagnosed conditions. A four-point scale was used to measure morbidities, where "no morbidity" was coded as 0, 1 for "single morbidity", 2 for "comorbidity", and 3 for "multimorbidity".

Health status

The measure of overall health status used both a subjective and an objective measure: self-rated health status (subjective) and the eleven self-reported medically diagnosed morbidities (objective health status) as discussed in previous sections. To determine a connection between the outcome variables and predictors variables mathematically. i.e., to build a regression analysis model, the self-rated health status was grouped dichotomously where fair/poor was coded as 0 and excellent/good coded as 1.

Researchers have used many different approaches to measure health status in populations. Bergner and Rothman (1987, p. 196) amongst others have argued that “multi-dimensional measures of health can provide a single aggregated score across all the dimensions". The multidimensional measures include physical, mental health and social components following the WHO definition of health, that health is a "state of complete physical, mental, and social wellbeing and not merely the absence of disease or infirmity” (Constitution of the World Health Organization, 2006, p.1). This provides a more holistic measure of health status as each component influences the other components. A single score multi-dimensional measure does not provide a nuanced view of health i.e., that some aspects of an individual's health may be better than others (Bergner and Rothman, 1987). Therefore, in the present study both subjective and objective measures of health status were used.

Though there is debate regarding the reliability of the subjective health status ratings. Evidence has accumulated that "Subjective measures of what people think about their health, regardless of whether they are right or wrong, have proven to be valid for such purposes” (Ware et al. (1981, p. 624). One argument for the use of subjective measures is that they allow comparison of small changes in health over time and between individuals (Bergner and Rothman, 1987).

Wellbeing status

Wellbeing was measured as hedonic or psychological wellbeing. Hedonic wellbeing was measured using the validated scale, the Control Autonomy Self-realisation Pleasure Scale (CASP). This scale was developed specifically for older adults (Hyde et al., 2003) and “The measure is based on the theory of "need satisfaction" which assumes that QoL at older ages is conceptualised as the degree to which human needs are satisfied in four domains: "control," "autonomy," "self-realisation," and "pleasure" (Zaninotto et al., 2010, p. 1981). CASP measures the positive factors of life for older adults (Zaninotto et al., 2010), and was widely used in various cross-sectional studies (Marmot, 2003). The 19-items CASP-19 measuring instrument was included as part of the self-completion document. Participants were asked how frequently each statement (all the statements are presented in Table 4.1) applied to them on a 4-point Likert scale ranging from 0-3, where 0 represents often, and three represents never. For the present study, the Likert scale was adapted, so that all the statements of CASP-19 scale were progressively coded as poor wellbeing. All the responses were arithmetically summed up to give a total score (range from 0-57), with higher scores reflecting poor wellbeing.

There are differential conceptualisations of wellbeing and how it should be measured. There are at least three broad conceptualisations of wellbeing, and each of them focuses on a different aspect of wellbeing: life evaluation, hedonic wellbeing, and eudemonic wellbeing (Diener et al., 2010; Shankar et al., 2014; Poole et al., 2019). Life evaluation marks an individual's overall life satisfaction, hedonic wellbeing represents individuals' different feelings in everyday life - contentment, sadness, anger, stress, and eudemonic wellbeing refer to individual's thoughts about the meaning and goal of their life (Shankar et al., 2014). Most studies measure one of the aspects of wellbeing depending on their study objectives. Hedonic or psychological wellbeing or an individual's quality of life positively impacts overall health, morbidity, and mortality, particularly for older adults and therefore is the most relevant for the present study (Jackson,

2019a). However, it is important to note that the three conceptualisations discussed above overlap with each other in that and individuals' positive or negative state of mind is affected by whether individuals' basic psychological need is fulfilled or not (Shankar et al., 2014). Similarly, an individual's view of their life (eudemonic wellbeing) can positively and negatively impact on their hedonic wellbeing.

Social care need

Social care need was measured as the amount of social care received. In ELSA, the amount of social care received is a measured by self-assessing by the number of Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs) that participants were able to, or not able to, carry out (Nizalova et al., 2020). Each participant was asked whether they can perform each task of ADL and IADL activities in terms of four categories: on their own manage on their own with difficulty, only do the activity with help or not at all (Copley et al., 2017, p.2).

As explained in chapter 2, the sources of care in England are informal support, formal state support (free public support) or formal paid private support, or a combination of informal and formal support. The definitions of informal and formal care were adapted from the HSE (NHS Digital, 2016). Informal care is defined as any help or support received for at least one task of ADLs or IADLs or mobility activities and from any (or in combination) of the following sources. These are, spouse or partners, family members, friends, and neighbours. Formal care is defined as any help or support received either from the local authority funded care or formal private paid for support for at least once a week and at least with one task.

The sources of formal care and support include one, or a combination, of the following providers: homecare worker/home help/personal assistant, member of staff at care/ nursing home, member of the reablement team, voluntary helper, warden/ sheltered housing manager,

cleaner, council handyperson or any other formal helper. The informal support responses were dichotomised and coded as 0 for none and 1 for at least one. Likewise, the care and support receipt responses through formal sources were coded as 0 for none and 1 for at least one.

Assessing the amount of social care received by BMI, the predictors were adapted from a study by Vlachantoni et al. (2015) and modified according to the requirements of the present study. The seven sets of categorical variables that were considered were: 1) demographic variables (age group, gender, marital status, co-residence status), 2) socio-economic variables (employment status and level of education), 3) physical health (self-reported general health, ADL and IADL disability), 4) mental health (wellbeing by CASP-19 scale), 5) receipt of support/use of services variables (a self-reported receipt of informal and formal support), 6) report of limiting long-standing illness, and 7) lifestyle variables (smoking, alcohol consumption and anthropometric measurement for BMI by height and weight). The measurement and coding of all the predictors were discussed in previous sections.

Unmet care needs for social care and support

The present study defines unmet care needs as any needs that an individual identifies, related or unrelated to functional or mobility impairment, that are not cared for, or supported enough by, existing social care services. This definition is broader than other definitions and encompasses the activity-based aspects of need (the ADL & IADL) along with other keys aspects of life such as, a sense of purpose, safety, loneliness, social contact, so that as many hidden unmet needs for social care can be identified.

Vlachantoni et al. (2011) argued that unmet care need (U) is the gap between demand and supply. Where demand is either impairment in mobility or inability to perform one of the tasks under ADLs or IADLs activities (i.e., service-based or normative needs, as explained in Chapter 2) and supply is the informal family, formal public or state, and formal paid private

care. Dunatchik et al. (2019, p.196) however argue that applying a task-focused approach (ADL and IADL activities based) to evaluate unmet care needs "may underplay the importance of other aspects of life such as social contact and maintaining a sense of purpose". In addition, exploring 'low level needs' which may not be function or impairment related care needs is an issue highlighted in the Care Act Guidance Secondary Prevention Plan (Department of Health and Social Care, 2021). According to the Care Act (DOH, 2014), it is crucial to prevent care needs by preventing the development of low-level needs.

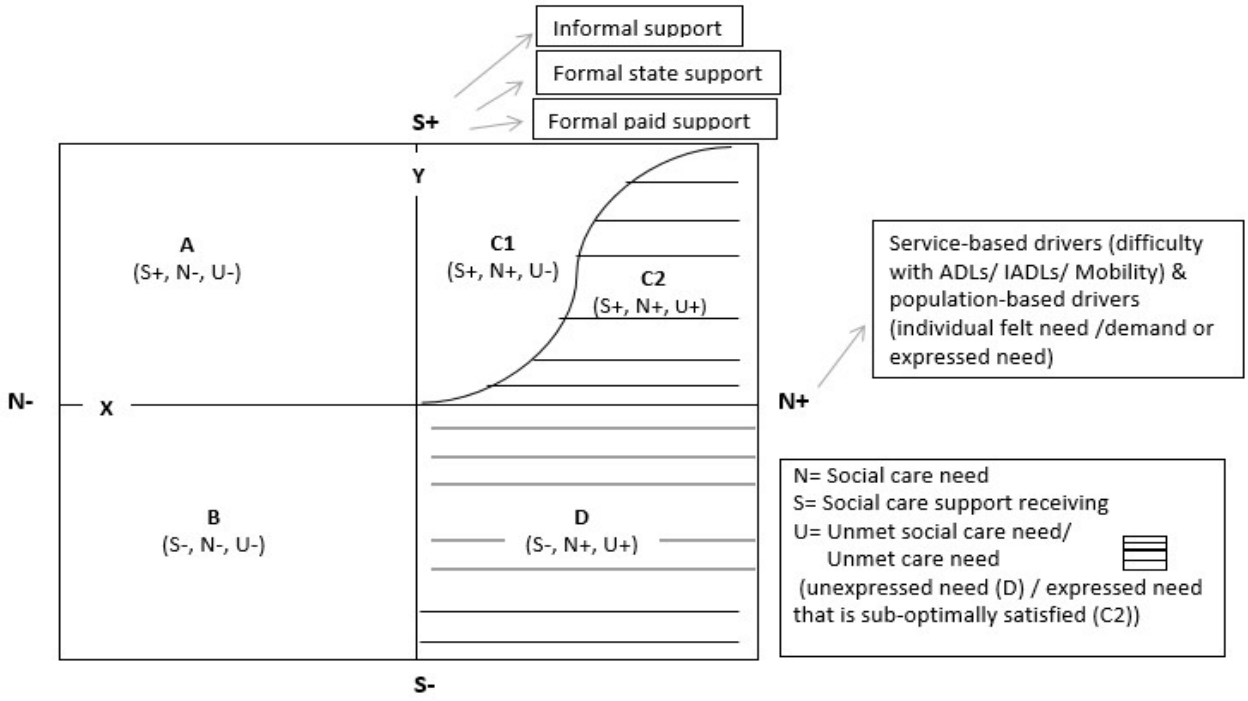
'Unmet care needs for social care and support' conceptual model

An 'unmet care needs for social care and support' conceptual model was conceptualised (See Figure 4.1) to fulfil the present study's objectives. The purpose of the model is to predict a range of needs that need to be supported by formal social care. This model helps to identify gaps in service provision, even among those who do not meet the eligibility criteria (by Local Authorities of England) for current social care support and those who are eligible but may not realise their needs. However, the present study might have overestimated the amount of unmet care need. Identifying the potential needs at the developmental level and exploring existing unmet care needs due to the lack of service provision may help to plan ahead and protect society from higher health and social care costs in the long term. This study also uses a qualitative research methodology on a small sample to evaluate the older adult's perspectives and generate new knowledge about the types and levels of unmet need older adults have, rather than estimate the number of people having unmet needs of various types.

In this model (See Figure 4.1), the Y-axis denotes the social care support (S), and the X-axis refers to social care need (N). According to the model, from the centre (0,0), social care support increases through along the Y-axis, and social care need increases along the X-axis. Therefore, according to the need and support received, the population are divided into five groups. Group

A represents older adults who do not have any need (in terms of functional and mobility impairments and any other individual felt needs), but they receive support (whether informal family, formal state or formal private paid for care or a combination). Group B represents the older adults who do not have any needs and are not receiving any social care. Group C1 represents older adults who have at least one need (either social care service-defined or individual felt), and their needs are fulfilled by the social care they receive. Group C2 represents older adults who are not satisfied with the support they are receiving according to their felt need. Hence, they have existing unmet felt need and unmet needs for social care. Group D represents older adults who have at least one need, but they are not receiving any social care. Therefore, this group of people has unmet felt need and unmet needs for social care. The present study's focus is to collect primary data about two groups of older adults in the mode, Groups C2 and D, and explore the association between unmet felt need and unmet needs for social care by degree of BMI in older adults.

Figure 4.1: Conceptualised model on unmet care needs for social care and support



Constructed by the student researcher

4.4 Characteristics of respondents

All selected characteristics of the participants are presented in Table 4.1. Considering the cases filtered out by BMI ≥18.5 kg/m2, a sample of 5640 eligible respondents aged 50 years and over were selected for the analysis. The mean age of the respondents was 68 years, out of which 32.7% of the participants were obese. Compared to the normal-weight participants, there were 9.8% and 0.5% more obese and overweight participants, respectively, in the working dataset. The study population comprised of more females than males (50.5% vs 49.5%), with most of them were married (65.4%), having at least one co-resident (76%), currently not smoking (53.4%) and retired or unemployed (68.5%). About half of the participants (49.7%) consumed alcohol frequently or daily. Out of 5640 participants, only 1111 (19.7%) participants were either continuing their education during data collection or left their formal education at 19-year age or over. About three quarter (73.1%) of participants left their formal education between 15-18-year of age. Most older adults marked their subjective health status (SHS) as good (32.1%) and very good (29%) than poor (8.5%), with more participants had single morbidity (30.7%), and very few participants reported of having no morbidity (1.5%). More participants reported having comorbidities than multimorbidity (22.3% vs 16%). In addition, 17% and 20% participants reported of having a disability with at least one ADL and at least one IADL, respectively. Participants who received social care support at the time of data collection reported having more informal care (18%) than formal care (5.1%).

Table 4.1: Description of variables used in the study and their summary analysis based on ELSA wave 8 dataset (n=5640)

Characteristics of respondents' survey question ID Measurement of variables							
Variables	**ELSA wave 8 survey question ID**	**Measurement of variables**	**Variables Coding**	**n**	**%**	**Sort cases by BMI ≥ 18.5**	
						n	**%**
Body mass index in kg/m2	ehtm (from Wave 6) estwt	(Weight/Height squared) Underweight Normal Overweight Obese	 0 1 2 3	 637 1636 1670 2334	 8.9 22.9 23.4 32.7	 1636 1670 2334	 22.9 23.4 32.7
Age in years	Indobyr iintdaty	(Interview year-year of birth) 50-60 61-70 71-80 80+	 0 1 2 3	 2309 2384 1571 870	 32.4 33.4 22.0 12.2	 1347 2163 1413 717	 23.9 38.4 25.1 12.7
Gender	indsex	Female Male	0 1	3742 3391	52.5 47.5	2848 2792	50.5 49.5
Co-resident status	Couple	Relationship status Neither Married/ Cohabit	 0 1	 2130 5003	 29.9 70.1	 1681 3960	 29.8 70.2
	Chinhh	Child in the household No Yes	 0 1	 5076 2057	 71.2 28.8	 4282 1358	 75.9 24.1
	gcinhh	Grandchild in the household No Yes	 0 1	 6865 268	 93.3 3.5	 5448 192	 96.6 3.4
		None At least one (partner/children/grandchildren)	 0 1	 1642 5491	 23.0 77.0	 1353 4288	 24.0 76.0
Marital status	dimarr	Married/remarried/separated/legal partner Unmarried/single/divorced/widowed	0 1	4626 2504	64.9 35.1	3689 1948	65.4 34.5
Smoking status	heska	Non-smoker Current smoker	0 1	3651 807	51.2 11.3	3014 547	53.4 9.7
Current alcohol intake (in last 12 months)	scako	None /rarely Frequently /daily	0 1	2645 3431	37.1 48.1	2203 2805	39.1 49.7

Education	fqendm	Age full-time school education completed.					
		Never/≤14 years	0	510	7.1	403	7.1
		15–18 years	1	5181	72.6	4125	73.1
		≥19 years / not yet finished	2	1441	20.2	1111	19.7
Employment status	wpdes	Retired/ unemployed	0	4509	63.2	3865	68.5
		Employed/self-employed	1	2569	36.0	1730	30.7
Self-rated (Subjective) health status	hehelf	'Would you say your health is…'					
		excellent	0	885	12.4	649	11.5
		very good	1	1964	27.5	1636	29.0
		good	2	2206	30.9	1813	32.1
		fair	3	1261	17.7	1066	18.9
		poor	4	583	8.2	477	8.5
Disability		Activities of daily living (ADL) 6 items					
	Headldr	ADL: difficulty in dressing					
	Headlwa	ADL: difficulty in walking					
	headlba	ADL: difficulty in bathing					
	headlea	ADL: difficulty in eating					
	headlbe	ADL: difficulty getting in and out of bed					
	headlwc	ADL: difficulty using toilet					
		No ADL	0	5924	83.0	4681	83.0
		At least one	1	1209	17.0	959	17.0
		Instrumental activities of daily living (IADL) 9 items					
	headlma	IADL: difficulty using map					
	headlda	IADL: difficulty recognising physical danger					
	headlpr	IADL: difficulty preparing a hot meal					
	headlsh	IADL: difficulty shopping for groceries					
	headlph	IADL: difficulty making phone calls					
	headlsp	IADL: difficulty with communication					
	headlme	IADL: difficulty taking medications					
	headlho	IADL: difficulty working around house and garden					
	headlmo	IADL: difficulty managing money					
		No IADL	0	5693	79.8	4511	80.0
		At least one	1	1440	20.2	1129	20.0
Morbidities (Objective health status)		Clinically diagnosed morbidities 11 items					
	hedacbp	High blood pressure diagnosis					
	hedacan	High cholesterol diagnosis					
	hedacmi	Angina diagnosis					
	hedacs	Heart attack diagnosis					
	hedacch	Stroke diagnosis					
	hedac95	Other heart disease diagnosis					
	heacd	Diabetes diagnosis					
	hedbdar	Cancer diagnosis					
	hedbdos	Dementia diagnosis					
	hedbdca	Arthritis diagnosis					
	hedbdde	Osteoporosis diagnosis					
		None	0	104	1.5	84	1.5
		Single morbidity	1	2108	29.6	1731	30.7
		Comorbidity	2	1425	20.0	1259	22.3

		Multimorbidity	3	999	14.0	904	16.0
Subjective chronic illness	heill	Self-reported long-standing illness No Yes	 0 1	 3206 3692	 45.0 51.8	 2553 3087	 43.1 54.7
Wellbeing or quality of life		Control, Autonomy, Self-realisation, Pleasure (CASP) -19 scale 19 items (Often/sometimes/not often/never)					
	Scqola	CASP-19 scale: how often feels age prevents them from doing things they like					
	scqolb	CASP-19 scale: how often feels what happens to them is out of their control					
	scqolc	CASP-19 scale: how often feels free to plan for the future					
	scqold	CASP-19 scale: how often feels left out of things					
	scqole	CASP-19 scale: how often can do the things they want to do					
	scqolf	CASP-19 scale: how often family responsibilities prevents them from doing things					
	scqolg	CASP-19 scale: how often feels they can please themselves what they do					
	scqolh	CASP-19 scale: how often feels their health stops them doing what they want to do					
	scqoli	CASP-19 scale: how often shortage of money stops them doing things					
	scqolj	CASP-19 scale: how often look forward to each day					
	scqolk	CASP-19 scale: how often feels that their life has meaning					
	scqoll	CASP-19 scale: how often enjoys the things they do					
	scqolm	CASP-19 scale: how often enjoys being in the company of others					
	Scqoln	CASP-19 scale: how often looks back on their life with a sense of happiness					
	scqolo	CASP-19 scale: how often feels full of energy these days					
	scqolp	CASP-19 scale: how often chooses to do things they have never done before					
	scqolq	CASP-19 scale: how often feels satisfied with the way their life has turned out					
	scqolr	CASP-19 scale: how often feels that life is full of opportunities					
	scqols	CASP-19 scale: how often feels the future looks good for them					

Informal social care receiving	cahnno	received no informal help with tasks					
	cahnhw	received help with at least one task from husband/wife/partner					
	cahnso	received help with at least one task from son					
	cahnda	received help with at least one task from daughter					
	cahngc	received help with at least one task from grandchild					
	cahnsi	received help with at least one task from sister					
	cahnbr	received help with at least one task from brother					
	cahnor	received help with at least one task from other relative					
	cahnfr	received help with at least one task from friend					
	cahnne	received help with at least one task from neighbour					
		Not at all	0	5837	81.8	4623	82.0
		At least one	1	1296	18.2	1017	18.0
Formal Social care receiving	cahnhc	received help with at least one task from homecare worker/home help/personal assistant					
	cahnnh	received help with at least one task from a member of staff at care/ nursing					
	cahnre	received help with at least one task from a member of the reablement team					
	cahnvo	received help with at least one task voluntary helper					
	cahnwa	received help with at least one task from warden/ sheltered housing manager					
	cahncl	received help with at least one task from a cleaner					
	cahnhm	received help with at least one task from a council handyman					
		received help with at least one task from an other formal helper					
		Not at all	0	6748	94.6	5352	94.9
		At least one	1	385	5.4	288	5.1

4.5 Data analysis

The outcome of the statistical analysis of the first research question was presented in two parts. The exploratory data analysis was applied with the help of the SPSS V.25.0 software package. The Chi-Square statistics were used to test the associations between categorical variables and assess the tests of independence by using a cross-tabulation and producing a bivariate table. The bivariate tables represent the distributions of two categorical variables simultaneously to have an empirical relationship between them.

The null hypothesis for the first research question is that there is no significant relationship between the outcome variables (functional disability by ADL & IADL and clinically diagnosed morbidities grouped as none, single morbidity, comorbidity and multimorbidity) and the predicting or independent variables (BMI, age, gender, marital status, smoking history, alcohol intake history, educational status, employment status and self-rated general health status). Most of the data are dichotomous data, whereas BMI, age, educational status, morbidities, and self-rated health are ordinal data. The degrees of freedom (df) are calculated from number of rows and columns. The total number of participants was 5,640, whereas the number of respondents vary for each nominal data. To conclude the hypothesis with 95% confidence, the *p*-value of the Chi-Square statistic should be less than 0.05 ($p < 0.05$). The results from the exploratory data analysis were visually exhibited on multiple line graphs and on bar diagrams to display counts of data.

Pearson's correlation test was applied to determine the association between the independent and dependent variables and to summarise the data. Bivariate two-tailed correlation matrix tables were created to have more input into exploratory factor analysis and deal with the missing values. Herewith the use of SPSS, missing values are excluded pairwise. Correlation matrix tables showing correlation coefficients between variables with the help of Pearson’s

correlation coefficient (*r*). Each cell in the table shows the linear relationships between two variables.

4.5.1 Exploratory data analysis

Table 4.2 shows the cross-tabulation results, the association of BMI and other socio-demographic covariates with difficulties in daily living by ADL and IADL among older adults. Results from the Chi-square (χ^2) statistical analysis (Table 4.2) reveals that high BMI is statistically significant with individual's difficulty in daily living by ADL, but insignificant with difficulty in daily living by IADL (χ^2 (2) =30.06, $p < 0.01$; and χ^2 (2) =2.81, $p > 0.05$, respectively). A study on older adults by Chen et al. (2019) using the Chinese Longitudinal Healthy Study dataset evaluated that BMI was significantly associated with ADL disabilities among the urban oldest seniors aged 80+years. However, longitudinal studies by Alexandre et al. (2018, 2019) for older adults aged 50 years and over found that individuals with abdominal obesity only had worse trajectories for functional disabilities by IADL. However, the risk of trajectories by ADL disabilities was as same as for an individual without the condition. At the same time, the study used waist circumference to identify the degree of abdominal obesity.

In addition, an individual's increasing age is strongly associated with an individual's difficulty in daily living by both ADL and IADL (χ^2 (3) =199.64, $p < 0.01$; and χ^2 (3) =348.54 $p < 0.01$, respectively). All other socio-demographic, behavioural and socio-economic covariates are strongly associated ($p < 0.05$) with an individual's at least one impairment with either ADL or IADL difficulties with daily living, except their current smoking status. Individuals' current smoking status is insignificant with their IADL difficulties (χ^2 (1) =1.53, $p > 0.05$); however, strongly associated with individual's ADL difficulties (χ^2 (1) =8.21, $p < 0.01$).

It is noticeable that among the participants who reported having at least one ADL and IADL difficulties, almost half of them were obese (49.3% and 43%, respectively), and almost one-

quarter of them were 81+years old (25.5% and 27.7%, respectively) with most of them were females (53.8% and 58.5% respectively) and married/having legal partner (55.8% and 53% respectively). However, the dataset comprised 30.9% more married participants (following the underweight data were filtered out) than unmarried/single/widowed/divorced.

The respondents, who were overweight, reported having minor impairment with at least one ADL (24.9%) and IADL (27.6%) than the normal weight group (25.8% and 29.3%, respectively). Nevertheless, among the reported no impairment with ADLs and IADLs, mostly the normal weight group had reported no impairments with both ADLs (29.7%) and IADLs (29%).

Functional impairment is more prevalent among the 61-70 years of age group, with 33.2% for at least one ADL impairment and 31,5% for at least one IADL impairment among the four age groups. In addition, compared to the 50-60 years age group, older adults over 81+ years are respectively 1.8 times and 2.2 times more prevalent with at least one difficulty with daily living by either ADL or IADL.

Surprisingly, compared to non-smokers or ex-smokers and none or rare alcohol drinkers, current smokers and frequently or daily alcohol drinkers reported having less impairment with at least one ADL or IADL difficulty (respectively 81.1% and 83.3% for non-smokers vs 18.9% and 16.7% for current smokers and respectively 59.6% and 58.4% for none/rarely drinkers vs 40.4% and 41.6% for frequently/daily drinkers). However, the correlation (Table 4.5) analysis shows that current smokers are strongly associated with functional impairment. On the other hand, the individuals with the highest level of education (≥19 years/not yet finished) reported having the least impairment with at least one ADL or IADL among the three education groups (12.2% and 11.9%, respectively). In addition, the individuals who left their formal education between 15-18 year of their age (medium level of education) disclosed having the most

impairment with at least one ADL or IADL among the three education groups (72.8% and 72.2%, respectively).

Not to surprise that the participants who were retired or unemployed at the time of data collection had respectively 7.9 times and 9.9 times more disability with at least one ADL or IADL activity than the participants who were employed (respectively 88.8% and 90% for retired/unemployed vs 11.2% and 9.1% for employed). Moreover, participants with excellent SHS reported having the least impairment, and the participants with fair SHS reported having the most impairment with at least one ADL or IADL (respectively 1.7% and 1.9% for excellent vs 37.2% and 34.4% for fair).

Table 4.2: Bivariate table presentation of exploratory data analysis by cross tabulation, exploring relation between high BMI with functional disability by ADL and IADL among older adults with adjusted other socio-demographic covariates for the study.

Variables	**Disability by difficulties in daily living**									
	ADL				**p-value**	**IADL**				**p-value**
	No		**At least one**			**No**		**At least one**		
BMI	N	**%**	N	%		N	**%**	N	%	
Normal	1389	29.7	248	25.8	0.001	1306	29.0	331	29.3	0.245
Overweight	1431	30.6	239	24.9	χ^2 =30.06	1357	30.1	312	27.6	χ^2 =2.81
Obese	1862	39.8	473	49.3		1848	41.0	486	43.0	
TOTAL	4682	83.0	958	17.0		4511	80.0	1129	20.0	
Respondents	5640					5640				
Age										
50-60	1208	25.8	139	14.5	0.001	1206	26.7	142	12.6	0.001
61-70	1845	39.4	318	33.2	χ^2 =199.64	1807	40.0	356	31.5	χ^2 =348.54
71-80	1156	24.7	257	26.8		1095	24.3	318	28.2	
81+	473	10.1	244	25.5		360	9.0	313	27.7	
TOTAL	4682	83.0	958	17.0		4512	80.0	1129	20.0	
Respondents	5640					5640				
Gender										
Female	2333	49.8	516	53.8	0.027	2189	48.5	660	58.5	0.001
Male	2348	50.2	444	46.3	χ^2 =4.87	2322	51.5	469	41.5	χ^2 =35.64
TOTAL	4681	83.0	959	17.0		4511	80.0	1129	20.0	
Respondents	5640					5640				

Marital status										
Married	3154	67.4	535	55.8	0.001	3091	68.6	598	53.0	0.001
Unmarried/others	1526	32.6	423	44.2	χ^2 =46.88	1418	31.4	530	47.0	χ^2 =96.32
TOTAL	4680	83.0	958	17.0		4509	80.0	1128	20.0	
Respondents	5638					5637				
Smoking										
No	2452	85.5	563	81.1	0.004	2332	85.0	682	83.3	0.216
Yes	416	14.5	131	18.9	χ^2 =8.21	410	15.0	137	16.7	χ^2 =1.53
TOTAL	2868	80.5	694	19.5		2742	77.0	819	23.0	
	3562					3561				
Alcohol										
None/Rarely	1724	41.0	479	59.6	0.001	1659	40.7	544	58.4	0.001
Frequently/Daily	2481	59.0	325	40.4	χ^2 =94.56	2419	59.3	387	41.6	χ^2 =96.93
TOTAL	4205	83.9	804	16.1		4078	81.4	931	18.6	
Respondents	5009					5009				
Education										
Never/≤14	259	5.5	144	15.0	0.001	224	5.0	179	15.8	0.001
15–18	3427	73.2	698	72.8	χ^2 =133.15	3309	73.4	816	72.2	χ^2 =192.78
≥19/ not yet finished	994	21.2	117	12.2		976	21.6	135	11.9	
TOTAL	4680	83.0	959	17.0		4509	80.0	1130	20.0	
Respondents	5639					5639				
Employment										
Retired/unemployed	3023	65.1	842	88.8	0.001	2849	63.6	1016	90.0	0.001
Employed	1624	34.9	106	11.2	χ^2 =208.21	1628	36.4	102	9.1	χ^2 =310.78
TOTAL	4647	83.1	948	16.9		4477	80.0	1118	20.0	
Respondents	5595					5595				
Self-reported general health status					0.001					0.001
Excellent	633	13.5	16	1.7	χ^2 =1171.75	627	13.9	22	1.9	χ^2 =1432.30
Very good	1567	33.5	69	7.2		1540	34.1	96	8.5	
Good	1587	33.9	227	23.6		1549	34.3	265	23.5	
Fair	709	15.1	357	37.2		677	15.0	389	34.4	
Poor	186	4.0	291	30.3		119	2.6	358	31.7	
TOTAL	4682	83.0	960	17.0		4512	80.0	1130	20.0	
Respondents	5642					5642				

Table 4.3 evaluates the association between clinically diagnosed morbidities (no morbidity, single morbidity, comorbidity and multimorbidity) with the independent variables (BMI, age, gender, marital status, smoking history, alcohol intake history, educational status, employment status and self-rated general health status) among obese older adults in England. The bivariate table shows that except participant's smoking status, the participant's BMI, age and other socio-

demographic, behavioural and socio-economic factors are strongly associated with the risk of having clinically diagnosed morbidities.

It is noticeable that participants with high BMI reported having more comorbidity and multimorbidity. Compared to the normal-weight participants, obese participants reported having 12.5%, 24.1% and 18.5% more single morbidity, comorbidity and multimorbidity, respectively. However, participants who were overweight and oldest-old (81+ years) reported having the least single morbidity (29.1% and 10.5% respectively) among the three weight groups and four age groups. Nevertheless, compared to the 50-60 years age group, the oldest-old participants documented having 1.4% and 19.6% more comorbidity and multimorbidity. Whereas, 61-70 years age group reported having the most proportion of single morbidity (39.4%) and comorbidity (36.6%), and 71-80 years age group reported having the most proportion of multimorbidity (37%) among the four age groups with most of the participants were female and married/having legal partner. Female and married participants reported having respectively 4.8% and 25.8% more comorbidity and 13.8% and 10% more multimorbidity than their male and unmarried/single/divorced/widowed counterparts. Although, males and females both reported having the same percentages of single morbidities (50%), individuals who were married documented having 37% more single morbidities than being unmarried/single/divorced/widowed.

Alike the statistical outcome for disability, compared to current smokers, non-smokers participants reported having 68.2%, 70.2% and 71.6% more single morbidities, comorbidity and multimorbidity, respectively. Nevertheless, the non-smokers reported having the maximum no morbidity (91.8%) than current smokers. Unlike the statistical outcome for disability, participants with frequently/daily alcohol drinkers reported having significant numbers of single morbidities and comorbidity (59.8% and 51.6%, respectively) than the

none/rare drinkers. However, participants who drank none/rarely reported having the most multimorbidity's (55%).

Alike the statistical outcome for disability, the individuals who left their formal education between 15-18 year of their age (medium level of education) reported having a significant number of single morbidities, comorbidity, and multimorbidity among the three education groups (74.4%, 75.4 and 73.5% respectively). In addition, the individuals with the highest level of education (≥19 years/not yet finished) reported having the least percentages of multimorbidity's (10.7%), but 15% more single morbidities than those with no education or minimal education (never/ ≤14 years).

Moreover, like the statistical outcome for disability, the participants who were retired or unemployed at the time of data collection reported having 32.6%, 64.4% and 82.4% more single morbidities, comorbidity, and multimorbidity, respectively than those of who were employed. Furthermore, the participants with excellent SHS reported having the least number of comorbidities and multimorbidity's (4.4% and 1.8%, respectively). In addition, the participants with fair SHS reported having the most number (33.1%) of multimorbidity.

Table 4.3: Bivariate table presentation of exploratory data analysis by cross tabulation, exploring relation between high BMI and morbidity, comorbidity and multimorbidity among older adults with adjusted other socio-demographic covariates for the study.

Variables	Morbidities								
	None		Single morbidity		Comorbidity		Multimorbidity		p-value
BMI	N	%	N	%	N	%	N	%	
Normal	31	36.9	506	29.2	303	24.1	238	26.3	0.001
Overweight	31	36.9	503	29.1	346	27.5	262	29.0	χ^2 =26.89
Obese	22	26.2	722	41.7	610	48.5	405	44.8	
TOTAL	84	2.1	1731	43.5	1259	31.6	905	22.7	
Respondents	3979								
Age									
50-60	28	33.3	448	25.9	193	15.3	49	5.4	0.001
61-70	28	33.3	682	39.4	461	36.6	294	32.6	χ^2 =281.82
71-80	20	23.8	419	24.2	396	31.4	334	37.0	
81+	8	9.5	181	10.5	210	16.7	226	25.0	
TOTAL	84	2.1	1730	43.5	1260	31.7	903	22.7	
Respondents	3977								
Gender									
Female	35	41.7	865	50.0	660	52.4	515	56.9	0.002
Male	49	58.3	866	50.0	599	47.6	390	43.1	χ^2 =15.23
TOTAL	84	2.1	1731	43.5	1259	31.6	905	22.7	
Respondents	3979								
Marital status									
Married	59	70.2	1184	68.5	792	62.9	498	55.0	0.001
Unmarried/others	25	29.8	545	31.5	467	37.1	407	45.0	χ^2 =48.40
TOTAL	84	2.1	1729	43.5	1259	31.7	905	22.8	
Respondents	3977								
Smoking									
No	56	91.8	907	84.1	729	85.1	545	85.8	0.363
Yes	5	8.2	171	15.9	128	14.9	90	14.2	χ^2 =3.19
TOTAL	61	2.3	1078	41.0	857	32.6	635	24.1	
Respondents	2631								
Alcohol									0.001
None/rarely	29	42.6	617	40.2	547	48.4	431	55.0	χ^2 =49.05
Frequently/daily	39	57.4	916	59.8	583	51.6	352	45.0	
TOTAL	68	1.9	1533	43.6	1130	32.2	783	22.3	
Respondents	3514								
Education									
Never/ ≤14	5	6.0	87	5.0	107	8.5	143	15.8	0.001
15–18	56	66.7	1287	74.4	948	75.4	664	73.5	χ^2 =121.30
≥19/ not yet finished	23	27.4	355	20.5	203	16.1	97	10.7	
TOTAL	84	2.1	1729	43.5	1258	31.6	904	22.7	

Respondents	3975								
Employment									
Retired/unemployed	47	56.6	1137	66.3	1022	82.2	821	91.2	0.001
Employed	36	43.4	577	33.7	222	17.8	79	8.8	χ^2 =249.43
TOTAL	83	2.1	1714	43.5	1244	31.6	900	22.8	
Respondents	3941								
Self-reported general health status									
Excellent	11	12.9	193	11.1	55	4.4	16	1.8	
Very good	45	52.9	548	31.7	296	23.5	106	11.7	0.001
Good	21	24.7	607	35.1	432	34.3	288	31.8	χ^2 =453.82
Fair	6	7.1	291	16.8	327	26.0	300	33.1	
Poor	2	2.4	92	5.3	149	11.8	195	21.5	
TOTAL	85	2.1	1731	43.5	1259	31.6	905	22.7	
Respondents	3980								

Table 4.4 evaluates the relation between individuals' weight categories by BMI classification with Individuals' disability and morbidity status by their increasing age. The bivariate table demonstrates that the participants in their 50-60 years and 61-70 years age group, their high BMI are strongly associated (χ^2 (2) =74.18, $p < 0.01$; and χ^2 (2) =15.09, $p < 0.05$, respectively) with their clinically diagnosed morbidities. However, the participants in their 71-80 years and 81+ years age group, their high BMI are insignificant (χ^2 (2) =9.47, $p > 0.05$; and χ^2 (2) =7.37, $p > 0.05$, respectively) with their clinically diagnosed morbidities. It is noticeable that for the total population over 50 years, the high BMI is statistically significant with their morbidities and disabilities by ADLs (χ^2 (2) =27.80, $p < 0.01$; and χ^2 (2) =30.01, $p < 0.01$, respectively), but insignificant with their disabilities by IADLs (χ^2 (2) =2.83, $p > 0.05$). The participants in their 50-60 years, 61-70 years and 71-80 years age group, their high BMI is strongly associated with their difficulties in daily living by ADLs, but insignificant in their 81+ years age group (χ^2 (2) =16.20, $p < 0.01$; χ^2 (2) =28.97, $p < 0.01$; χ^2 (2) =12.10, $p > 0.01$; and χ^2 (2) =0.70, $p > 0.05$, respectively). However, the participants in their 61-70 years and 81+ years age group, their high BMI are statistically significant with their difficulties in daily living by IADLs, but

insignificant in their 50-60 years and 71-80 years age group (χ^2 (2) =15.44, $p < 0.01$; χ^2 (2) =8.93, $p < 0.05$; χ^2 (2) =5.56, $p > 0.05$; and χ^2 (2) =0.46, $p > 0.05$, respectively).

Moreover, the table shows that the prevalence of single morbidity is mostly visible among the obese 61-70 years age group (45%). However, the comorbidity and multimorbidity are most visible among the obese 50-60 years age group (69.4% and 70%, respectively). A very similar pattern is observed for disability with ADLs and IADLs by individual's increasing age. The prevalence of disability by ADLs and IADLs is mostly visible among the obese 50-60 years and obese 61-70 years age group, respectively (57.6% and 53.1% respectively). Furthermore, Table 4.4 reveals that for the total population of 50 years and over, the prevalence of clinically diagnosed morbidities for all three categories (single morbidity, and comorbidity and multimorbidity) and disabilities by both ADLs and IADLs are most visible among the obese population.

Table 4.4: Exploratory data analysis by cross tabulation exploring relation between high BMI and morbidity and disability with increasing age for older adults.

Variables		Disability and morbidities controlling by BMI and Age															
Age	BMI	Morbidities								Disabilities							
		None		Single morbidity		Comorbidity		Multimorbidity		ADL				IADL			
		N	%	N	%	N	%	N	%	No		At least one		No		At least one	
										N	%	N	%	N	%	N	%
50-60	Normal	8	29.6	138	30.7	20	10.4	11	22.0	352	29.1	37	26.6	359	29.8	30	21.3
	Overweight	16	59.3	117	26.1	39	20.2	4	8.0	357	29.5	22	15.8	340	28.2	39	27.7
	Obese	3	11.1	194	43.2	134	69.4	35	70.0	500	41.4	80	57.6	507	42.0	72	51.1
TOTAL		27	3.8	449	62.4	193	26.8	50	7.0	1209	89.7	139	10.3	1206	89.5	141	10.5
Respondents		719								1348				1347			
p-value		0.001 χ^2 =74.18								0.001 χ^2 =16.20				0.062 χ^2 =5.56			
61-70	Normal	12	42.9	184	27.0	99	21.5	66	22.4	533	28.9	62	19.4	513	28.4	83	23.3
	Overweight	9	32.1	191	28.0	125	27.2	74	25.2	549	29.8	74	23.2	538	29.8	84	23.6
	Obese	7	25.0	307	45.0	236	51.3	154	52.4	762	41.3	183	57.4	755	41.8	189	53.1
TOTAL		28	1.9	682	46.6	460	31.4	294	20.1	1844	85.3	319	14.7	1806	83.5	356	16.5
Respondents		1464								2163				2162			
p-value		0.020 χ^2 =15.09								0.001 χ^2 =28.97				0.001 χ^2 =15.44			
71-80	Normal	8	40.0	135	32.2	105	26.6	79	23.6	347	30.0	62	24.1	316	28.9	93	29.2
	Overweight	4	20.0	124	29.6	120	30.4	106	31.6	360	31.2	65	25.3	334	30.5	91	28.6
	Obese	8	40.0	160	38.2	170	43.0	150	44.8	448	38.8	130	50.6	444	40.6	134	42.1
TOTAL		20	1.7	419	35.8	395	33.8	335	28.7	1155	81.8	257	18.2	1094	77.5	318	22.5
Respondents		1169								1412				1412			
p-value		0.149 χ^2 =9.47								0.002 χ^2 =12.10				0.796 χ^2 =0.46			
81+	Normal	3	37.5	49	27.2	79	37.6	82	36.3	156	33.0	87	35.5	118	29.2	125	39.8
	Overweight	2	25.0	71	39.4	62	29.5	78	34.5	165	34.9	78	31.8	145	35.9	98	31.2
	Obese	3	37.5	60	33.3	69	32.9	66	29.2	152	32.1	80	32.7	141	34.9	91	29.0
TOTAL		8	1.3	180	28.8	210	33.7	226	36.2	473	65.9	180	34.1	404	56.3	314	43.7
Respondents		624								718				718			
p-value		0.288 χ^2 =7.37								0.683 χ^2 =0.76				0.012 χ^2 =8.93			
Total population of 50+	Normal	31	37.3	506	29.2	303	24.1	238	26.3	1388	29.7	248	25.8	1306	29.0	331	29.3
	Overweight	31	37.3	503	29.2	346	27.5	262	29.0	1431	30.6	239	24.9	1357	30.1	312	27.6
	Obese	21	25.3	721	41.7	609	48.4	405	44.8	1862	39.8	473	49.3	1847	41.0	486	43.0
TOTAL		83	2.1	1730	43.5	1258	31.6	905	22.8	4681	83.0	960	17.0	4510	80.0	1129	20.0
Respondents		3976								5641				5639			
p-value		0.001 χ^2 =27.80								0.001 χ^2 =30.01				0.242 χ^2 =2.83			

Graphical Analysis- Figure 4.2 demonstrates the prevalence of obesity by BMI measurement with increasing age in bar diagrams to explain the association between obesity and age among the older adults of 50 years and over in England. While X-axis represents the four age groups: 50-60, 61-70, 71-80, and 81+, and the Y-axis represents the number of respondents. From the following bar diagrams, it is visible that most of the population were obese for 50–60-year, 61-70 year, and 71–80-year age groups, but there were a greater number of normal weight participants among 81+ year age group. However, headcounts were minimal between normal weight, overweight and obese participants among the 81+ years age group. At the same time, the total number of respondents for this group (81+ years) were also less compared to the respondents in other three age groups.

Moreover, the number of obese respondents were the highest among the 61-70 years of age group and the analysis shows that there are almost the same numbers of overweight and obese respondents in the age group of 81-90.

Figure 4.2: Prevalence of obesity by BMI measurement among older adults (50 to 81+ years old)

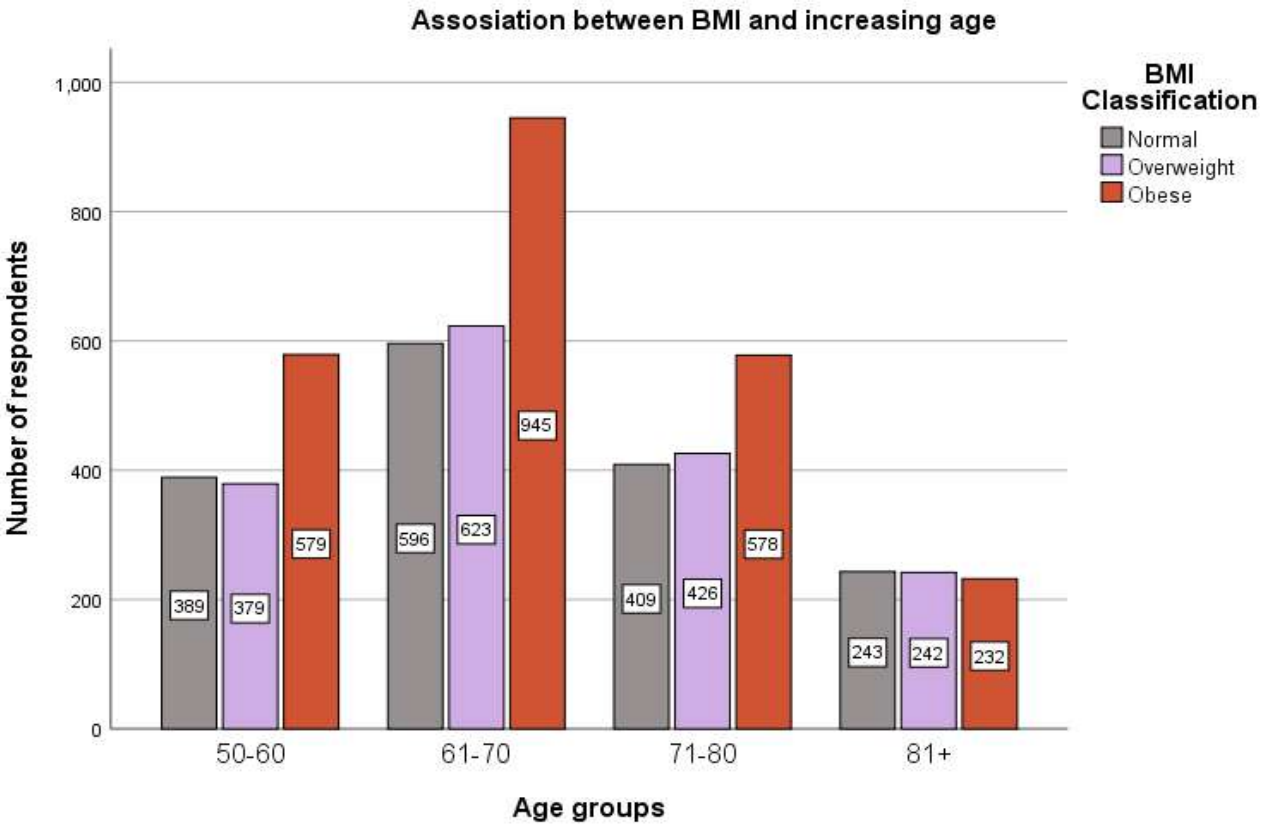
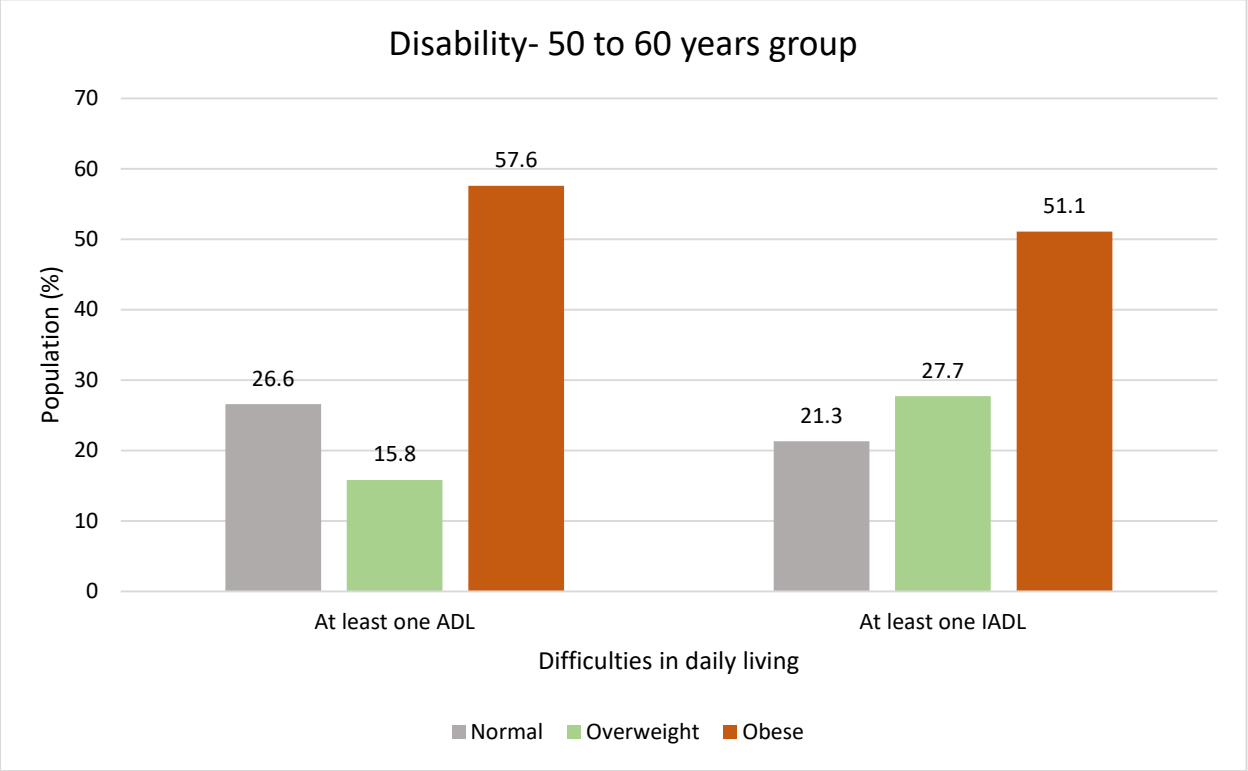


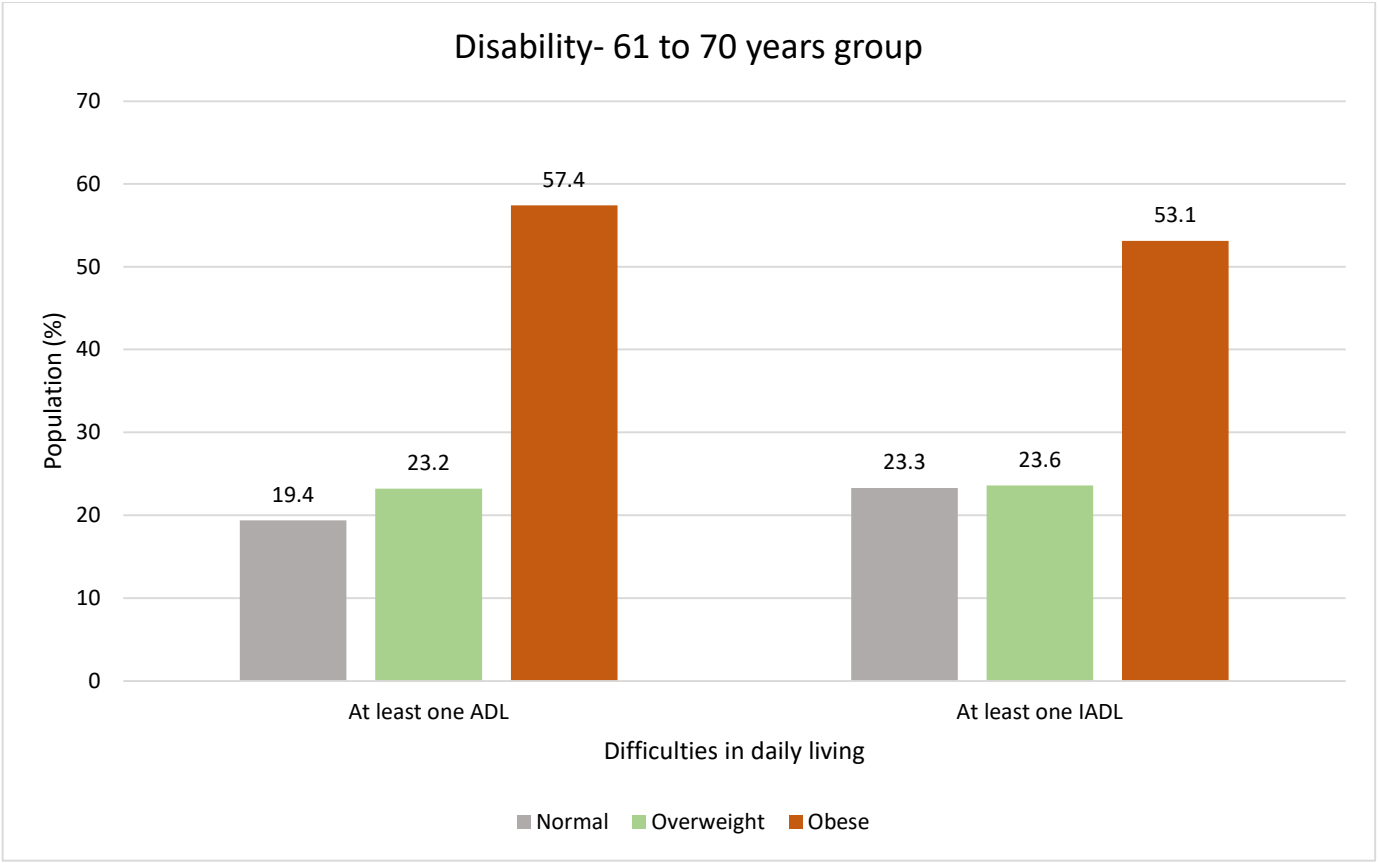
Figure 4.3 exhibits the results of descriptive statistical analysis in four-bar diagrams to explain the prevalence of disability among older adults aged 50 years and over with the effect of high BMI. The X-axis represents the difficulty with daily living by at least one ADL and IADL, and Y-axis represents the percentages of normal, overweight, and obese respondents who have a disability. Four graphs represent the association between BMI and disability among the four age groups (50-60, 61-70, 71-80, and 81+) of older adults.

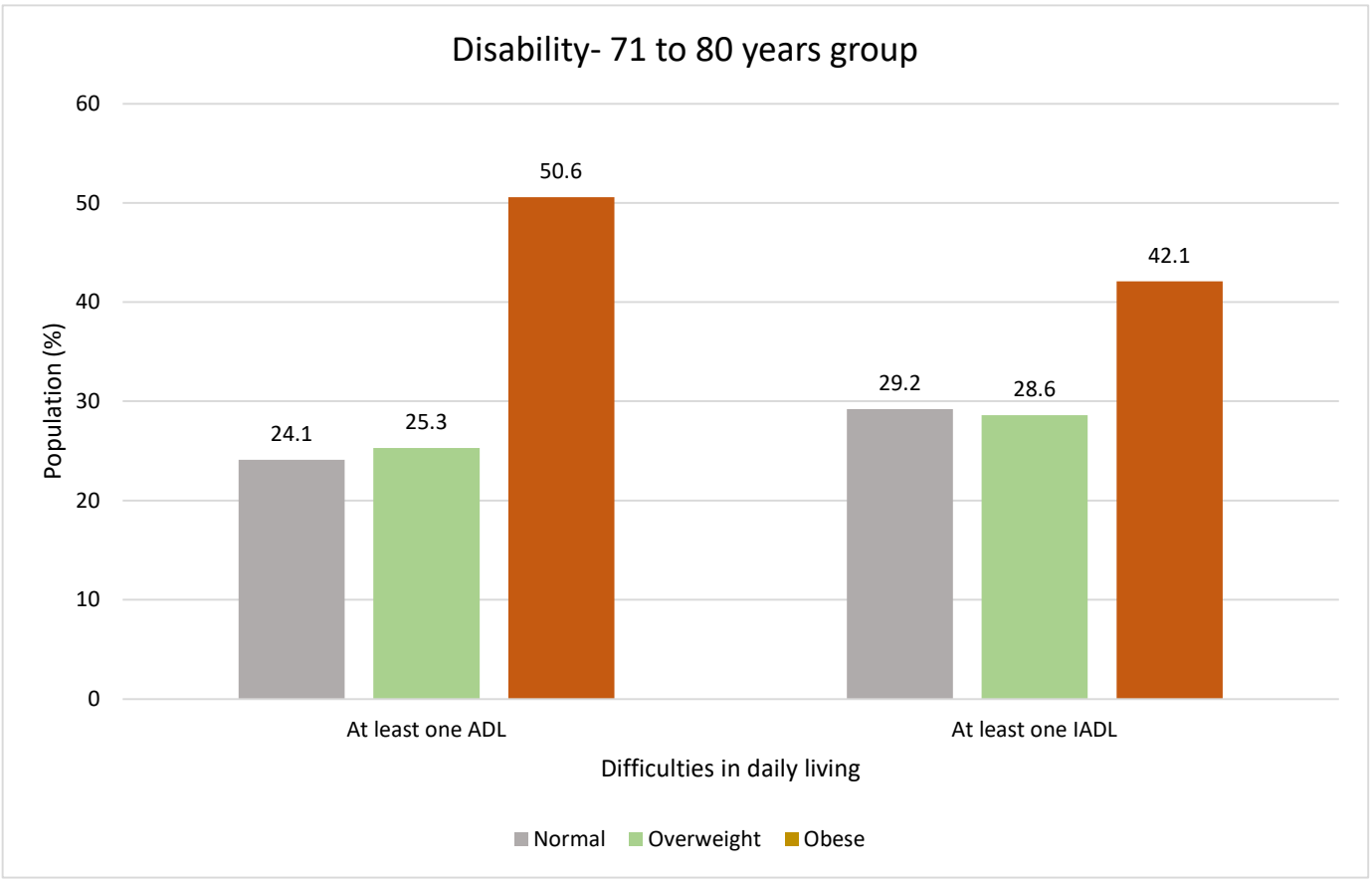
The graphs demonstrate that among the three weight categories, the obese respondents of 50–60-year, 61-70 year, and 71–80-year age groups were holding more percentages of impairment for at least one ADL (57.6%, 57.4% and 50.6%, respectively) and IADL (51.1%, 53.1% and 42.1%, respectively) difficulties. Among the oldest old (81+ year age group) participants,

normal-weight individuals had the most impairments for at least one ADL and IADL difficulties (35.5% and 39.8%, respectively). Whereas overweight individuals had the least impairment with at least one ADL difficulty (31.8%) and obese individuals had the least impairment with at least one IADL difficulty (29%) among the oldest old.

Figure 4.3: Prevalence of disability among older adults (50 to 81+ years old) with the effect of high BMI




Disability- 61 to 70 years group
70
60
50
40
30
20
10
0
Population (%)
19.4
23.2
57.4
23.3
23.6
53.1
At least one ADL
At least one IADL
Difficulties in daily living
Normal
Overweight
Obese


Disability- 71 to 80 years group
60
50
40
30
20
10
0
Population (%)
24.1
25.3
50.6
29.2
28.6
42.1
At least one ADL
At least one IADL
Difficulties in daily living
Normal
Overweight
Obese

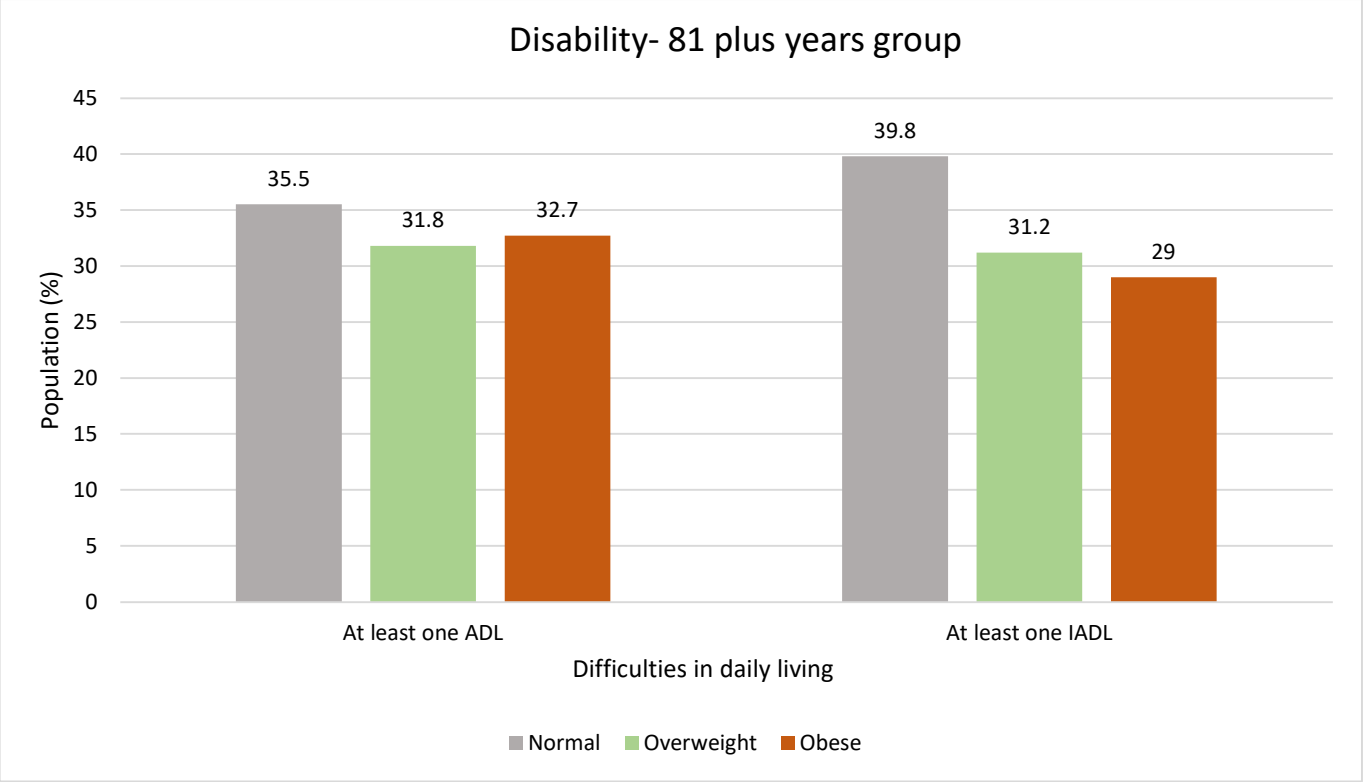
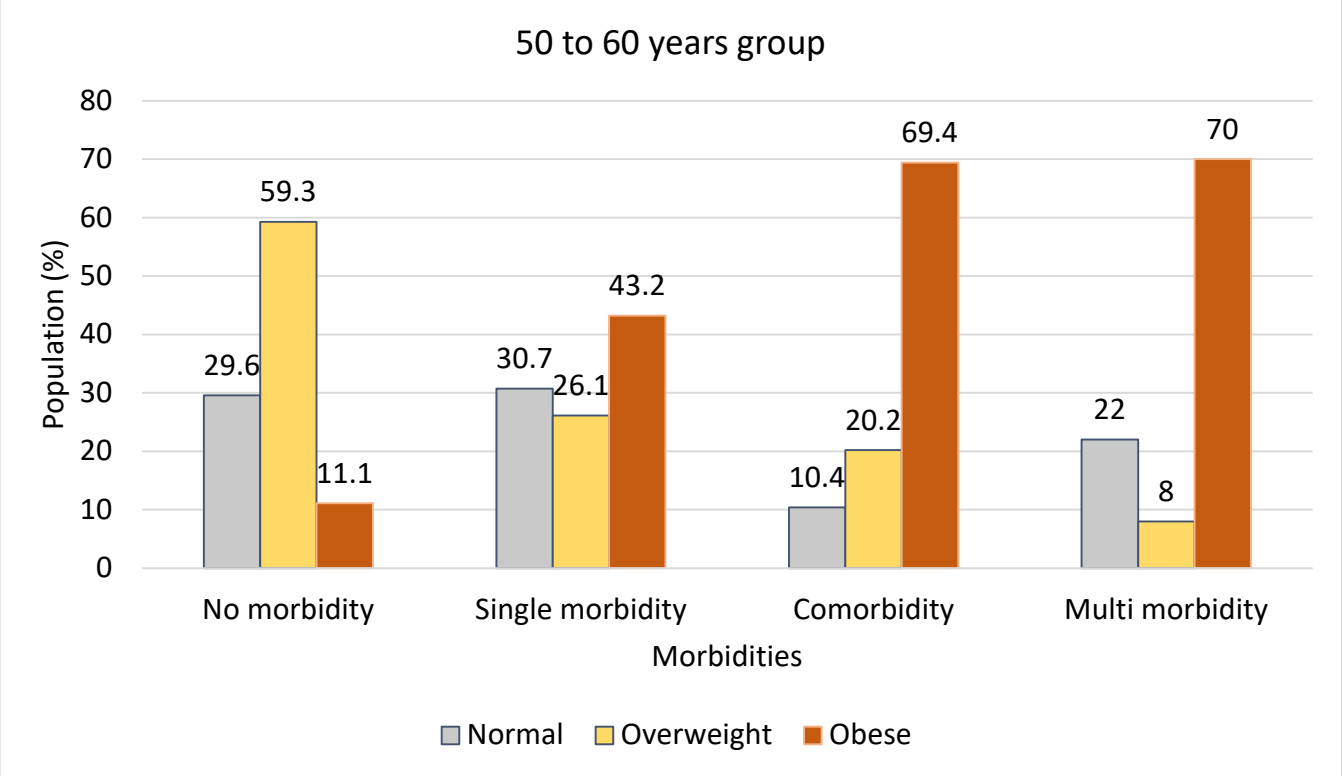


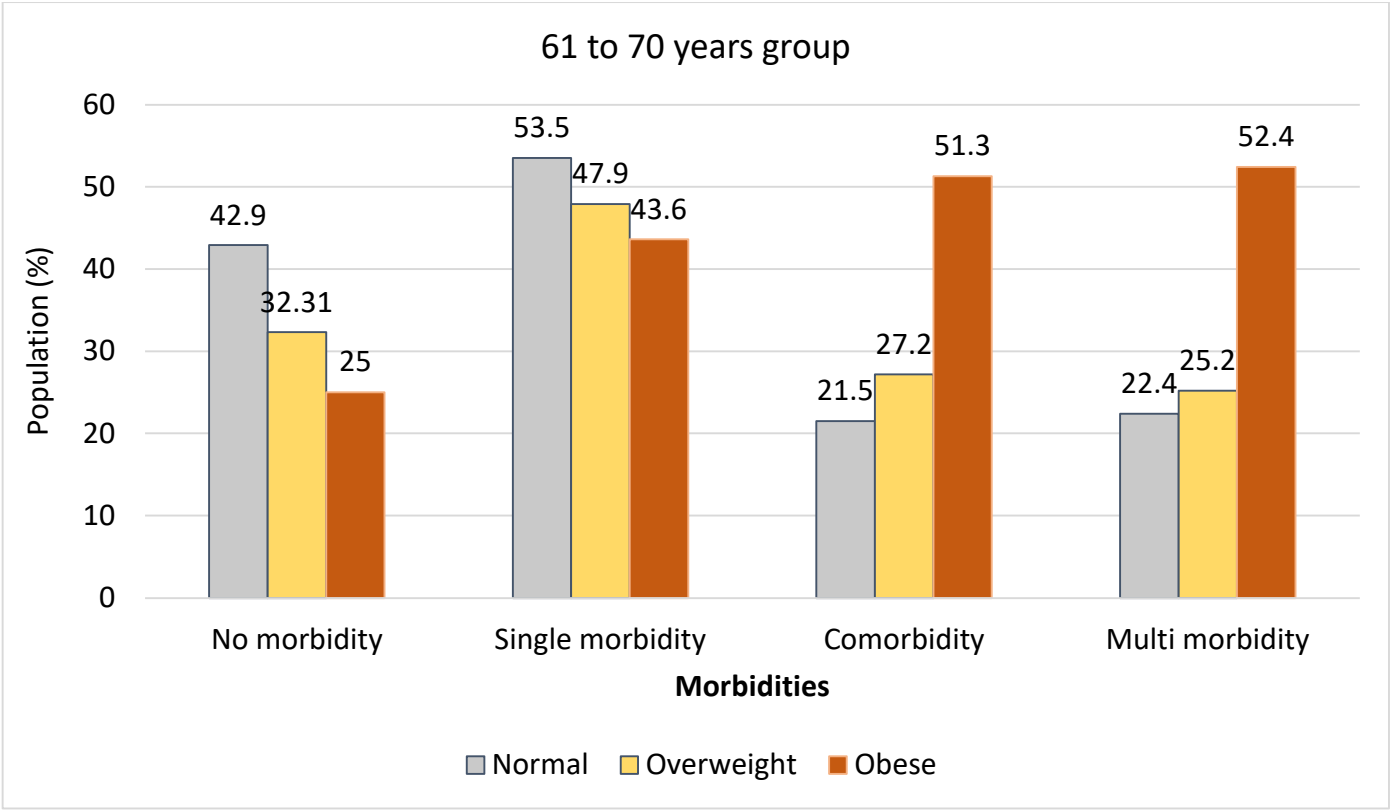
Figure 4.4 exhibits the results of descriptive statistical analysis in four-bar diagrams to explain the prevalence of morbidity among older adults aged 50 years and over with the effect of high BMI. The X-axis represents the four groups of morbidity (none, single morbidity, comorbidity and multimorbidity), and Y-axis represents the percentages of the normal, overweight, and obese populations suffering from either no morbidity or single morbidity, comorbidity or multimorbidity. According to the age groups, four graphs represent the association between BMI and morbidity across the four age groups (50-60, 61-70, 71-80 and 81+) of older adults.

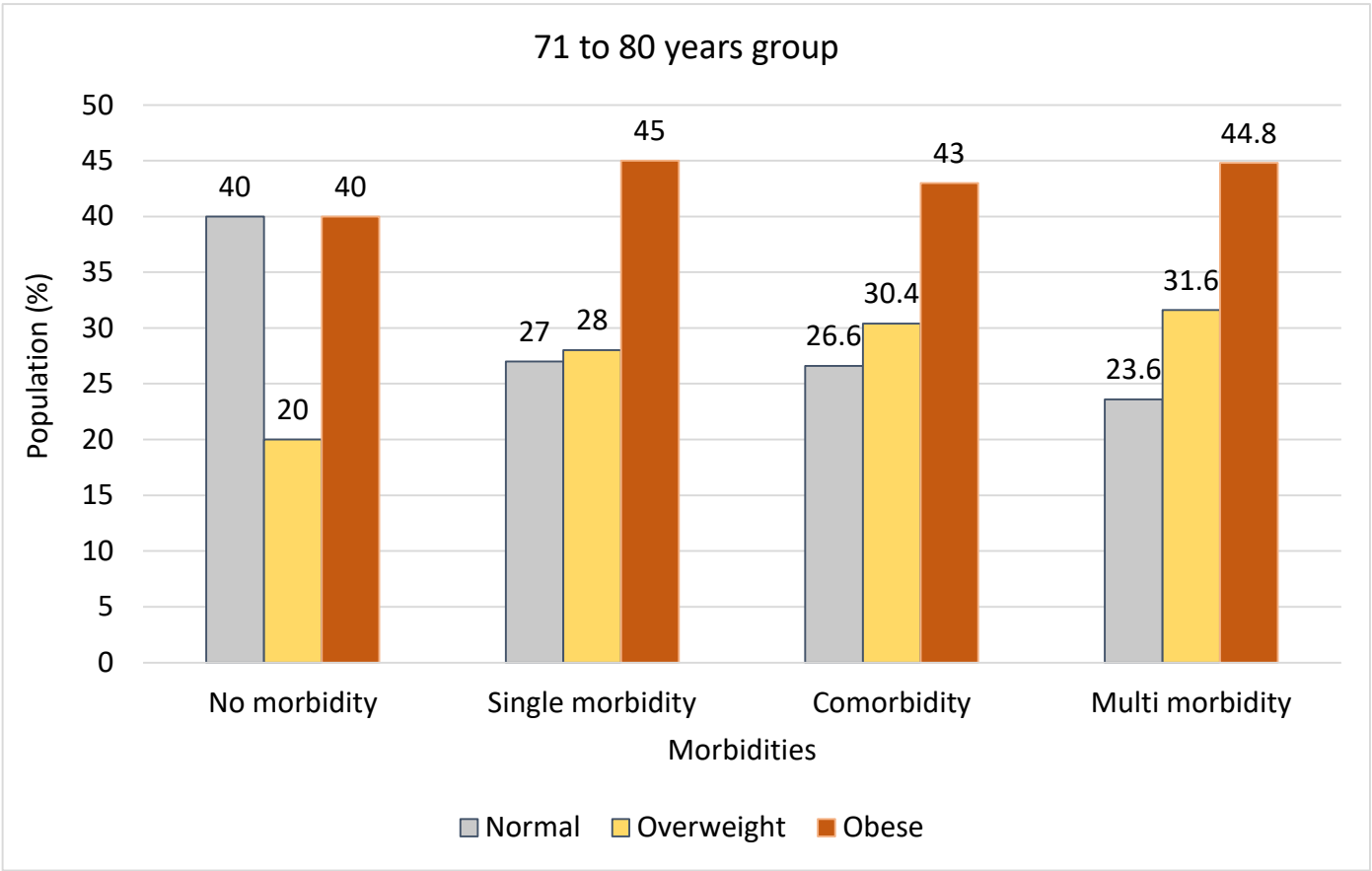
The graphs show that obese respondents of 50–60, 61-70 and 71–80-year age groups held the highest percentages of single morbidity (43.2%, 45% and 38.2%, respectively), comorbidity (69.4%, 51.3% and 43%, respectively) and multimorbidity (70%, 52.4% and 44.8%, respectively), however, for the oldest old, although the single morbidity was most prevalent among the overweight population (39.4%), the comorbidity and multimorbidity among the

normal weight population (37.6% and 36.3%, respectively). At the same time, single morbidity and multimorbidity were the least prevalent for the obese individuals among the oldest old participants (33.3% and 29.2%, respectively), and comorbidity was the least prevalent for the overweight individuals (29.5%). Simultaneously, it is noticeable that the proportions of the obese populations, across four different categories of morbidities from none to multimorbidity, are inclined for the older adults of 50–60, 61-70, and 71–80-year age groups, however, gradually declined for the oldest old.

Figure 4.4: Prevalence of morbidities among older adults (50 to 81+ years old) with the effect of high BMI




61 to 70 years group
Population (%)
60
50
40
30
20
10
0
42.9
32.31
25
53.5
47.9
43.6
21.5
27.2
51.3
22.4
25.2
52.4
No morbidity
Single morbidity
Comorbidity
Multi morbidity
Morbidities
Normal
Overweight
Obese


71 to 80 years group
Population (%)
50
45
40
35
30
25
20
15
10
5
0
40
20
40
27
28
45
26.6
30.4
43
23.6
31.6
44.8
No morbidity
Single morbidity
Comorbidity
Multi morbidity
Morbidities
Normal
Overweight
Obese

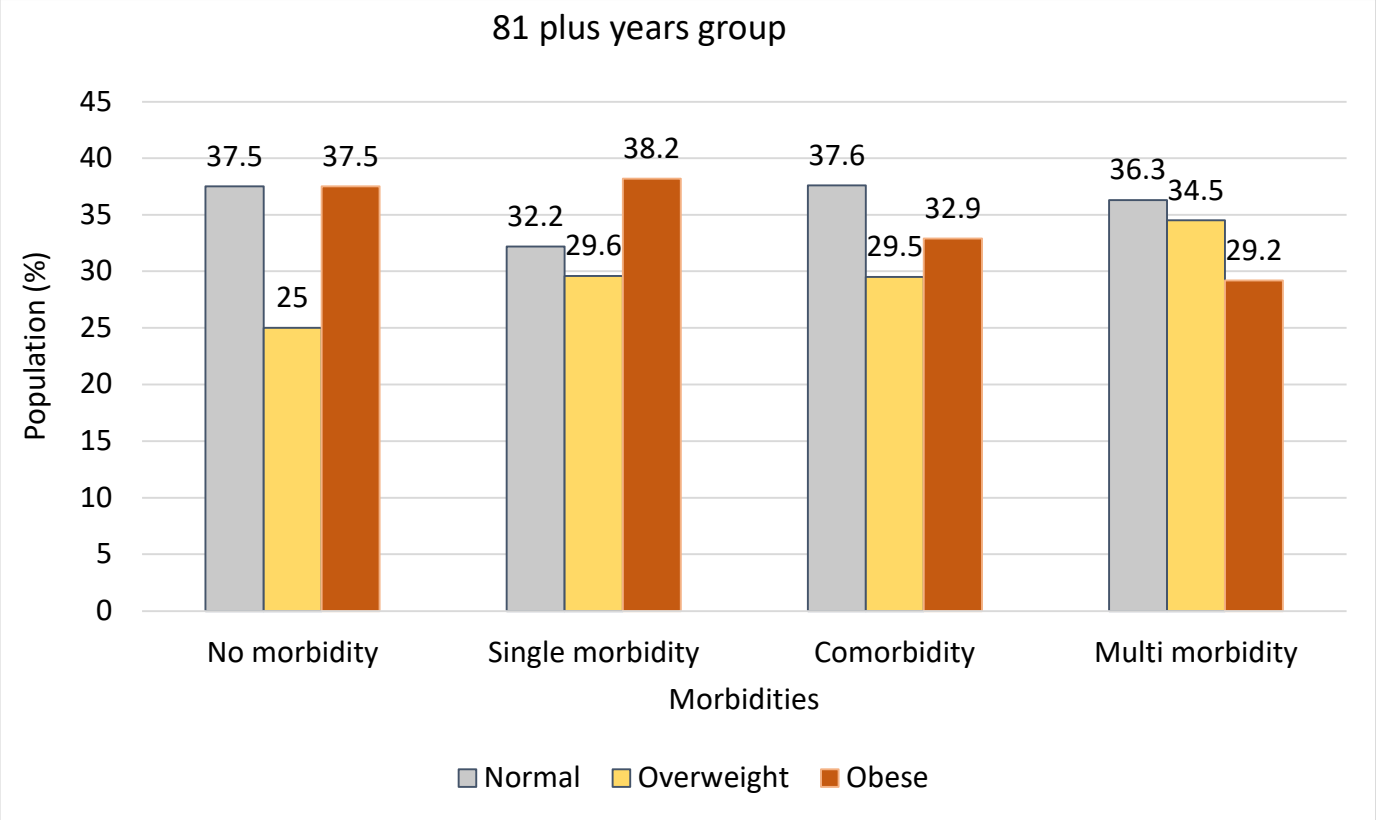
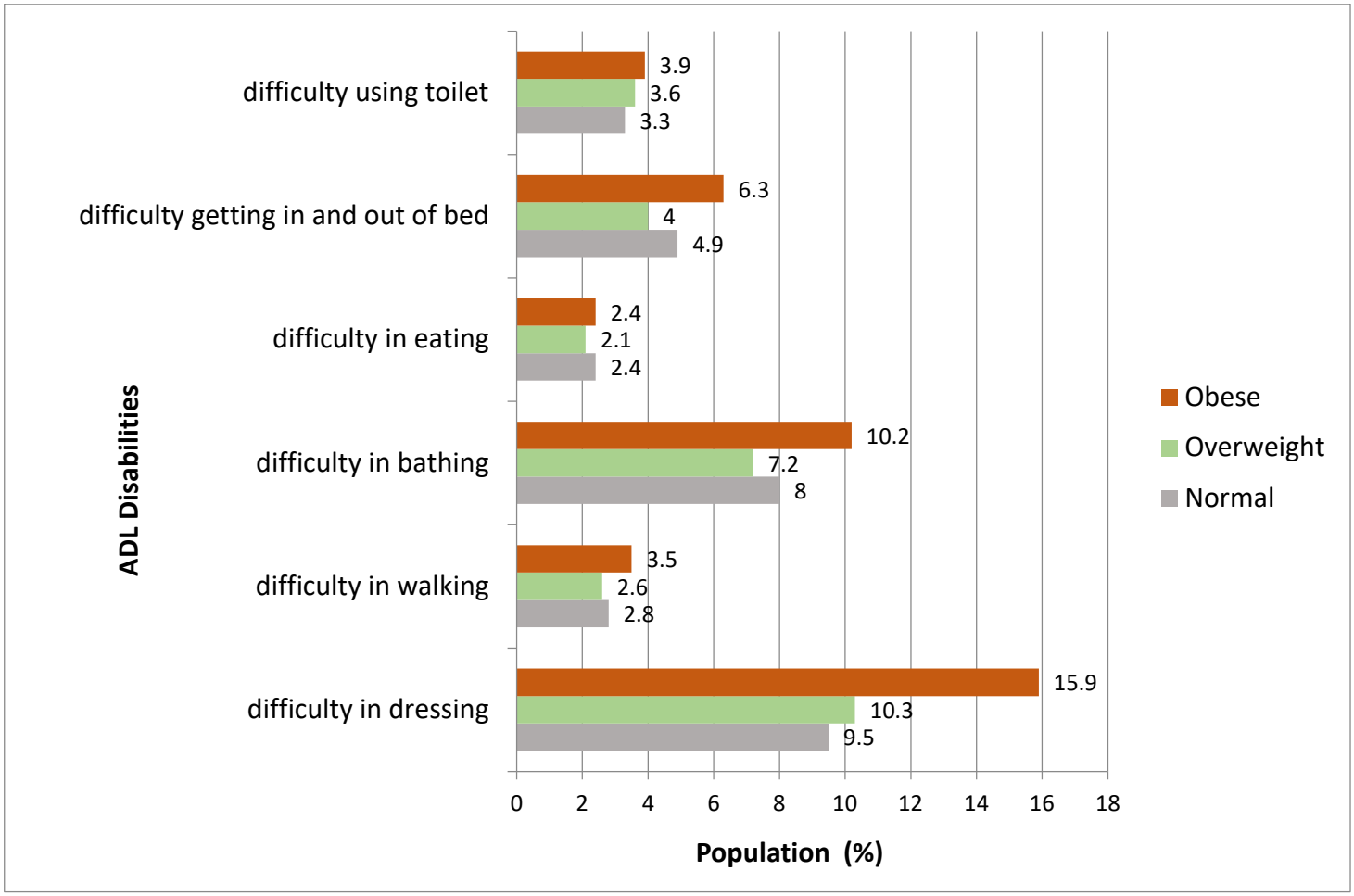


Figure 4.5 demonstrates the results of descriptive statistical analysis in bar diagrams to explain the prevalence of impaired functional activity with each ADL and IADL by high BMI among the older adults. Where X-axis represents the population percentages, and Y-axis represents the difficulty in performing each ADL and IADL activity across three weight groups by BMI classification. The first graph (ADL disabilities) displays that the obese participants were leading and had the most difficulties performing every ADL activity than the overweight and normal-weight groups, except for 'difficulty in eating' where both obese and normal-weight participants held the same percentages of difficulty (2.4%). In addition, the most impairment for 'difficulty in dressing' (ADL) is noticed across the three weight categories.

On the other hand, the second graph (IADL disabilities) displays that although obese respondents had the most difficulties working around the house and garden (16.4%), taking medication (2.4%) and preparing a hot meal (5%), normal weight population had the most

difficulties managing money (3.6%), difficulty with communication (3.9%), shopping for groceries (9.3%) and using map (4.9%) than the rest of the population. Compared to normal weight and obese groups, the overweight population had more difficulties recognising physical danger (1.3%). At the same time, the most impairment for 'difficulty working around house and garden' (IADL) is noticed across the three weight categories.

Figure 4.5: Prevalence of impaired functional activity (ADL & IADL) by the effect of high BMI among the older adults



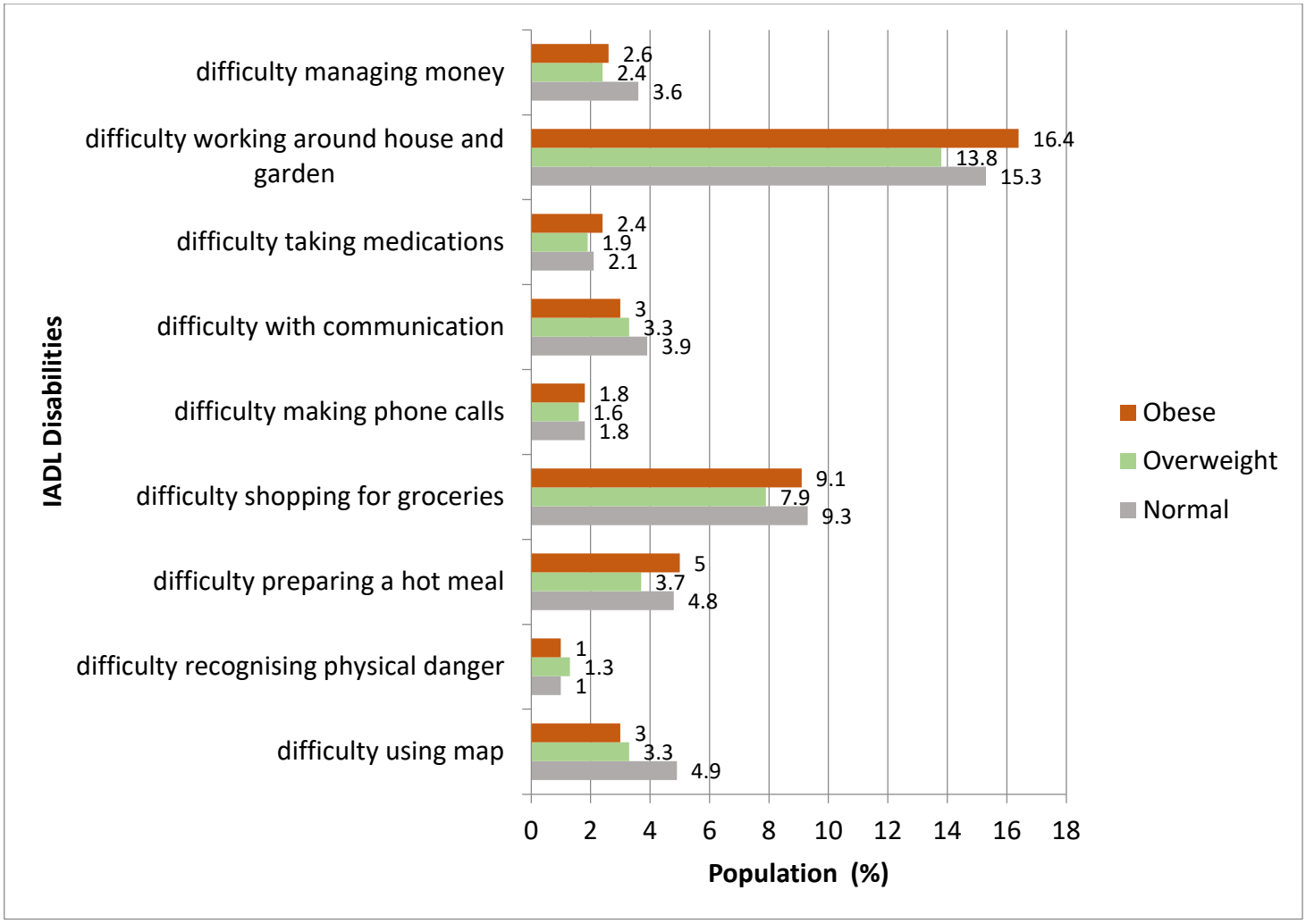


Figure 4.6 shows the results of descriptive statistical analysis in bar diagrams to explain the prevalence of eleven clinically diagnosed morbidities by high BMI among the older adults. Where X-axis denotes the percentage of eleven clinically diagnosed morbidities with the effect of high BMI, and Y-axis denotes the population percentages across the three weight groups. High blood pressure, high cholesterol, heart attack and diabetes were mostly prevalent within the obese population with 97.9%, 96.2%, 97.4% and 80.7%, respectively than their normal and overweight counterparts. At the same time, osteoporosis, other heart disease and angina were most prevalent within the overweight population with 91.8%, 92.2% and 96.8%, respectively.

Figure 4.6: Prevalence of eleven medically diagnosed morbidity by the effect of high BMI among the older adults.

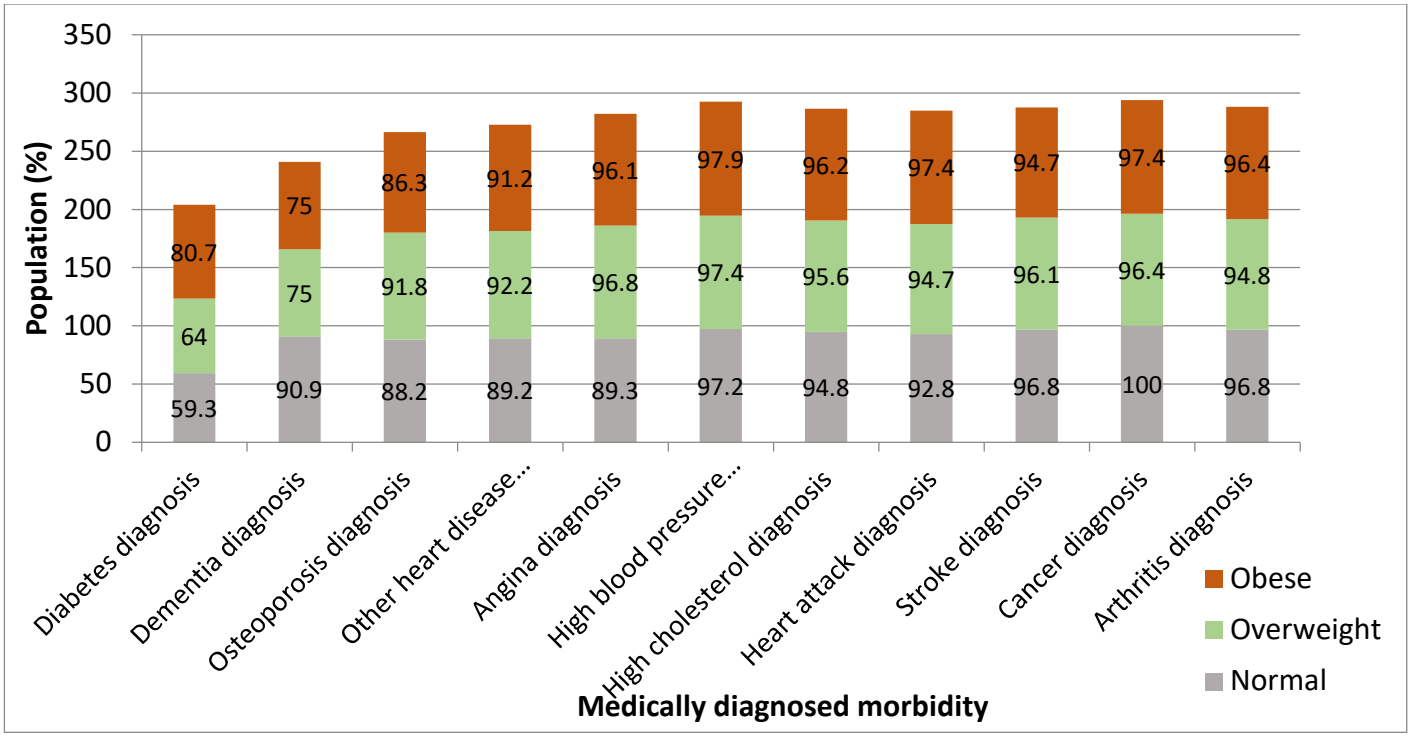
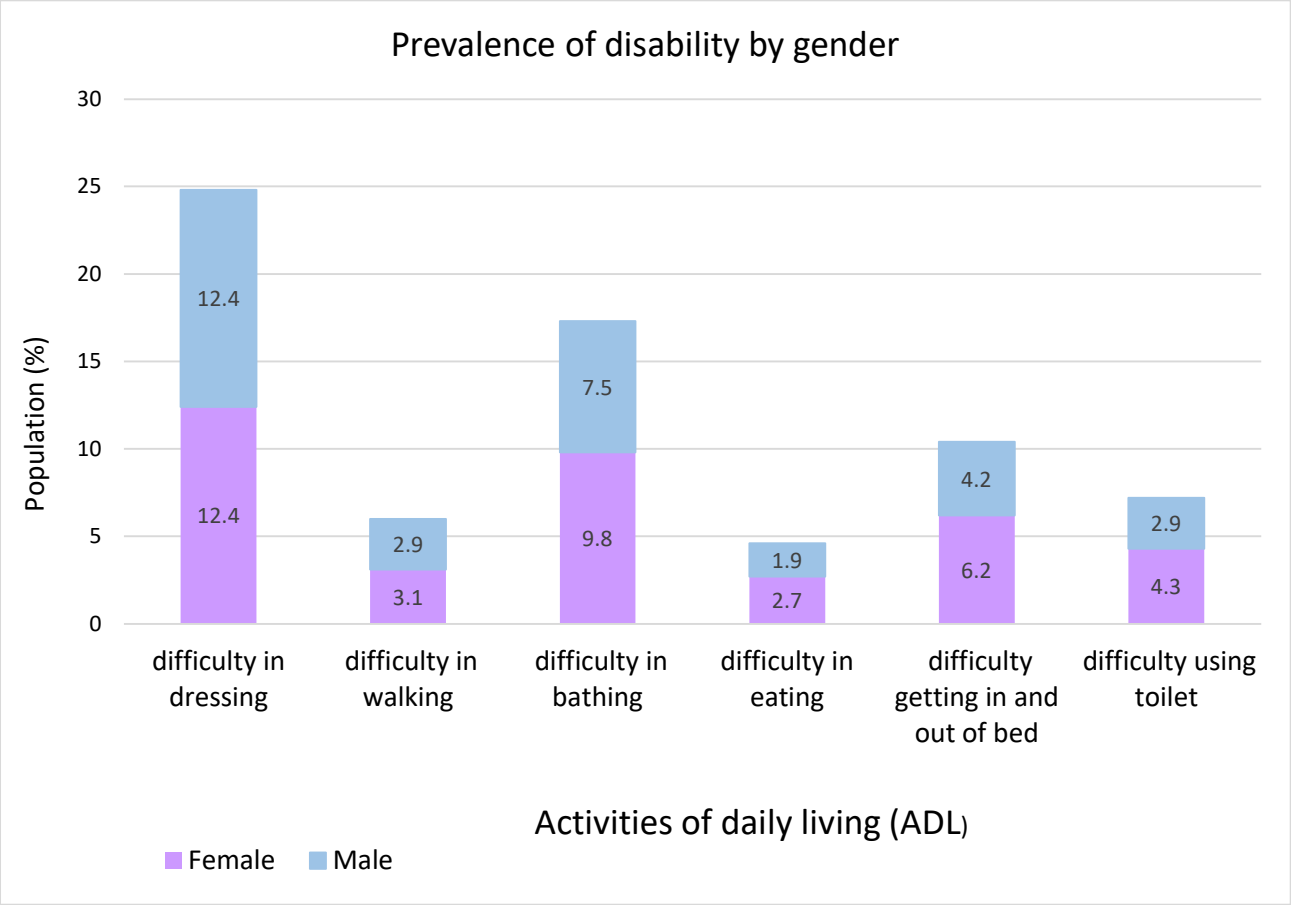


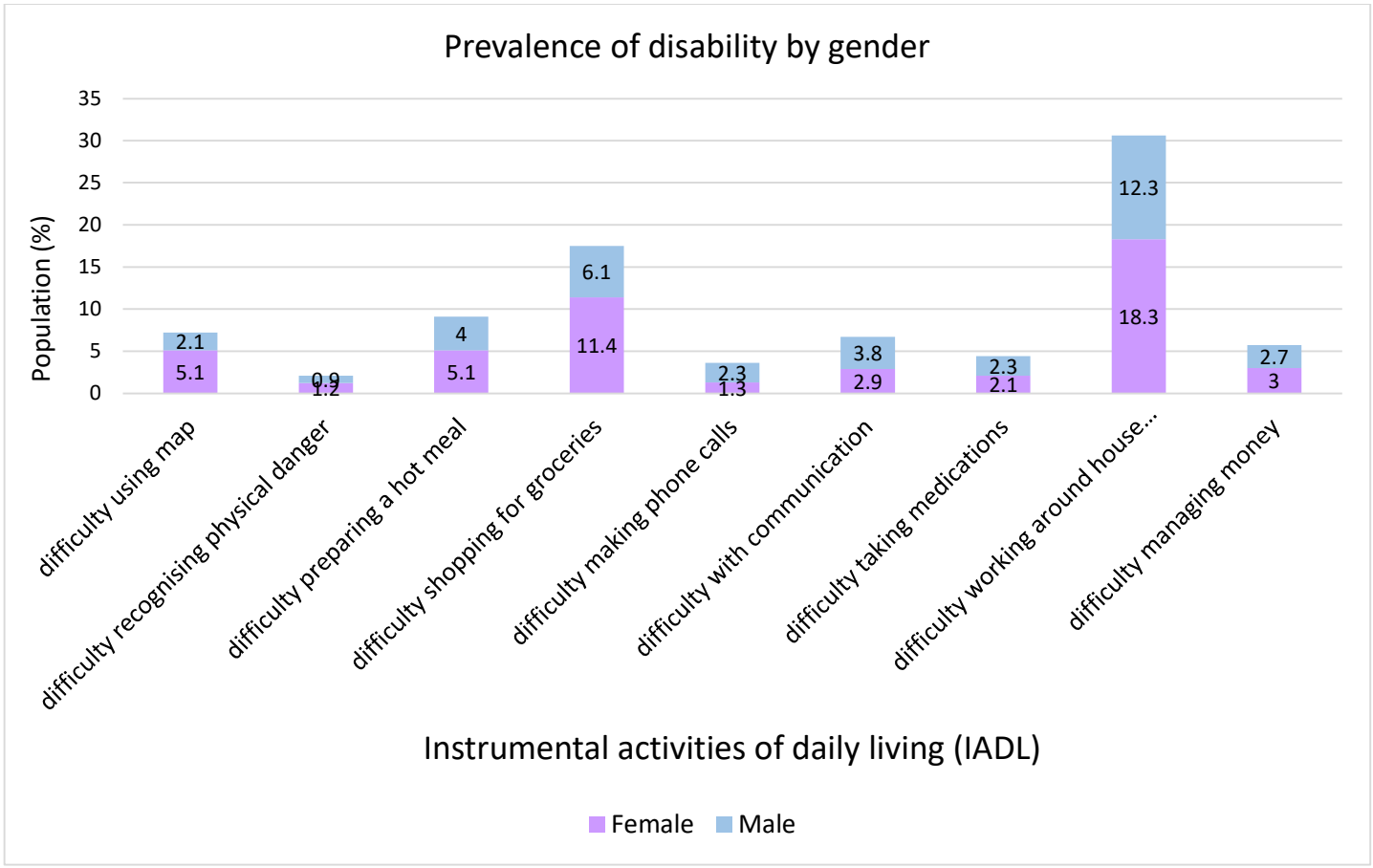
Figure 4.7 shows the results of descriptive statistical analysis in three bar diagrams to explain the prevalence of impaired functional activity (ADL and IADL) and clinically diagnosed morbidities among male and female older adults with the effect of high BMI (graph one (graph1a & 1b) and graph two, respectively). For graph 1a and 1b, the X-axis denotes the difficulty in performing each ADL and IADL activity, respectively by males and females, and Y-axis denotes the population percentages for each activity. Graph 1a and 1b (figure 4.7) reveals that female participants had the higher proportion of impairment with 10 activities out of total 15 ADL and IADL activities than their male counterparts, besides, both males and females had the same amount of difficulty in dressing (12.4%).

For graph 2 (figure 4.7), X-axis denotes the percentages of eleven clinically diagnosed morbidities with high BMI, and Y-axis denotes the population percentages by female and male. Graph 2 reveals that the female participants were more prone to have 6 out of 11 clinically diagnosed morbidities: high blood pressure, high cholesterol, angina, dementia, arthritis, and osteoporosis than male participants. However, heart diseases, stroke, diabetes, and cancer were mostly reported by male participants.

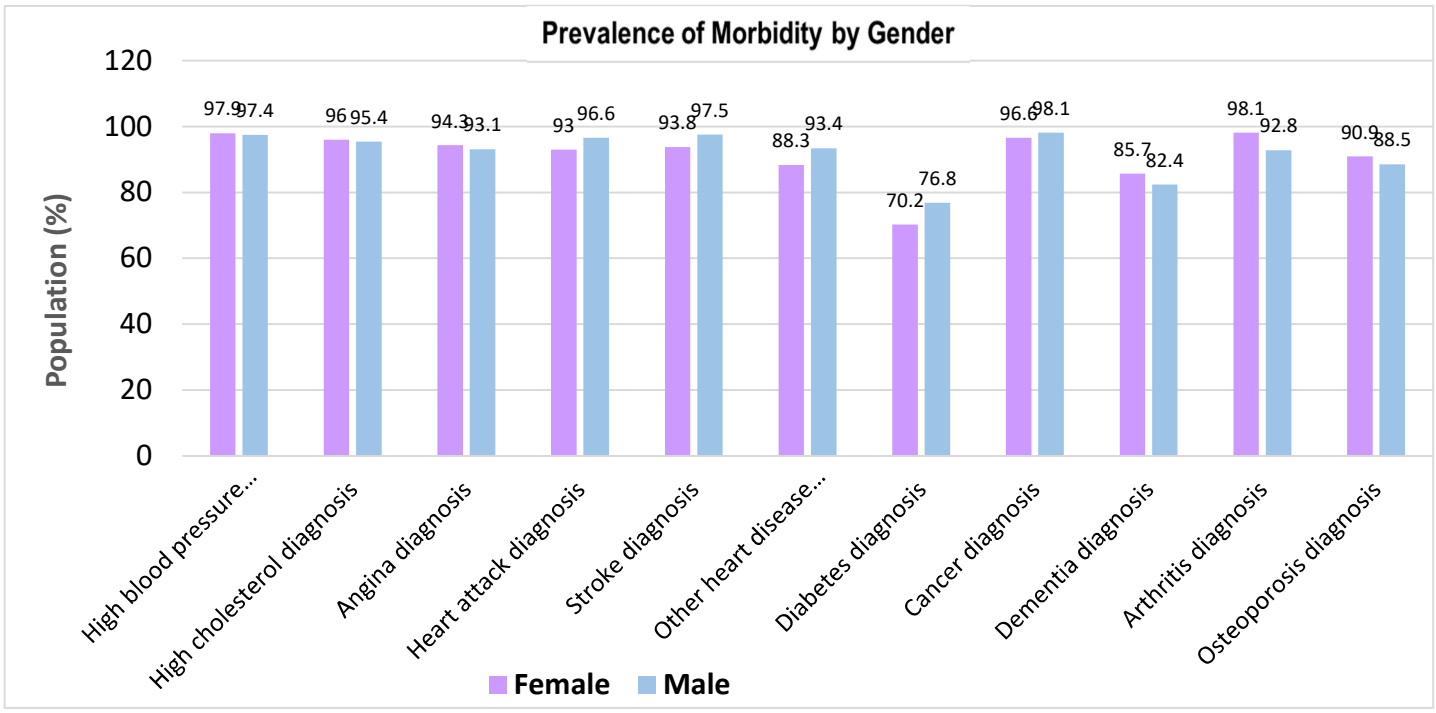
Figure 4.7: Prevalence of impaired functional activity (ADL and IADL) and medically diagnosed morbidity among male and female older adults with the effect of high BMI.



Graph 1a



Graph 1b



Graph 2

4.5.2 Correlation analysis

Pearson's correlation coefficient analysis was performed to evaluate the association between variables. Pearson's correlation coefficient can be denoted as *r* (Akoglu, 2018) and the range of *r* lies between -1 and +1. At the same time, the magnitude of *r* represents how strong the association is between two variables. Therefore, if *r* is close to +1 or -1, then the relation between two variables is strong and if $r = 0$, then there is no linear correlation between the two variables. The bivariate two-tailed test of correlation was run to have better precision, and the missing values are excluded pairwise with the help of SPSS.

Table 4.5 shows the correlation matrix that represents the association between 12 selected variables.

Correlation analysis reveals significant positive correlation between individual's weight (as measured by BMI) and gender ($r = 0.312$**), weight and employment ($r = 0.035$**), weight and self-reported general health ($r = 0.106$**), weight and ADL ($r = 0.060$**) and with weight and morbidity ($r = 0.051$**), where values are in increasing order for weight (normal, overweight, and obese), ADL and morbidity and gender and employment status are dichotomised as female (0), male (1) and unemployed (0), employed (1) (see variables coding at Table 4.1).

The coding for the SHS is in descending order as 0 counts for excellent and one count for poor. Therefore, the result reveals that high BMI is strongly associated with an individual's poor SHS. The findings are consistent with several studies (Svedberg et al., 2006; Hulman et al., 2019).

However, the significant negative correlation is found between weight and age ($r = -0.051$**), weight and marital status ($r = -0.053$**) as well as weight and smoking ($r = -0.100$**), where

values are in increasing order for age (50-60, 61-70, 71-80 and 81+) and the values of marital status and smoking status are dichotomised as married and unmarried/others are 0 and 1 respectively and non-smokers and current smokers are 0 and 1 respectively.

The significant positive correlations are visible between individual's age and marital status, self-reported general health, ADL, IADL and morbidity ($r = 0.128^{**}$, $r = 0.181^{**}$, $r = 0.173^{**}$, $r = 0.231^{**}$ and $r = 0.251^{**}$ respectively). The findings highlight those older adults are significantly at risk of being single/divorced/widowed/unmarried with advancing age. In addition, increasing age is positively and strongly associated with poor subjective general health status, increasing disabilities by at least one ADL and IADL and increasing risk of complex degrees of morbidities. However, age is negatively associated with gender, smoking, alcohol, education, and employment status ($r = -0.055^{**}$, $r = -0.169^{**}$, $r = -0.083^{**}$, $r = -0.263^{**}$ and $r = -0.547^{**}$ respectively). The findings highlight that older adult significantly have less/no smoking and drinking less/no alcohol with advancing age. They are also being less educated/uneducated and significantly more unemployed or retired with advancing age.

Moreover, the significant positive correlation is visible between gender and alcohol intake, education, employment ($r = 0.195^{**}$, $r = 0.066^{**}$ and $r = 0.011^{**}$ respectively). On the other hand, significant negative correlation is visible between gender and marital status, ADL, IADL and morbidity ($r = -0.130^{**}$, $r = -0.029^{*}$, $r = -0.079^{**}$ and $r = -0.060^{**}$ respectively). The results reflect those males are significantly more vulnerable to being frequent/daily alcohol drinkers than female. At the same time, older males are more educated or continuing to have education and more in employments. Nevertheless, females are more prone to have impairments with at least one of the ADLs and IADLs and a more complex degree of morbidities. The findings are supported by several studies (Melzer et al., 2005; Torres et al., 2016; Leal Neto et al., 2016).

Marital status is significantly and positively correlated with smoking, self-reported general health, ADL, IADL, morbidity (r = 0.091**, r = 0.128**, r = 0.091**, r = 0.131** and r = 0.109** respectively) and negatively correlated with alcohol, education, and employment (r = -0.124**, r = -0.116** and r = -0.090** respectively). The results evaluate those unmarried/single/divorced/widowed participants are vulnerable to being smokers and unemployed. In addition, they are less educated/uneducated and significantly prone to have fair/poor SHS, disability with at least one of the ADLs and IADLs and the risk of having a complex degree of morbidities. Whereas married participants are significantly vulnerable with the increased risk of frequent/daily alcohol intake. However, the above exploratory data analysis (Table 4.2) revealed more proportion of married people with ADL and IADL difficulties. Although, Table 4.1 shows that there were 30.9% more married participants than unmarried/single/divorced/widowed (after filtered out the underweight data) in the ELSA wave eight dataset.

A strong positive correlation is visible between smoking and subjective/self-reported health status and ADL (r = 0.122** and r = 0.048** respectively), but a strong negative correlation is visible between smoking and alcohol drinking (r = -0.081**). The results reflect those smokers are significantly vulnerable to having the worst SHS, functional impairments with at least one ADL, but significantly reduced the frequency of alcohol intake. There are several studies to support the findings that smoking is associated with the risk of functional limitations by ADLs (Takashima et al., 2010; Jung et al., 2006) and IADLs (Hayakawa et al., 2010; Hardy et al., 2010) and smokers have poorer SHS compared to non-smokers (Abuladze et al., 2017; Svedberg et al., 2006). Moreover, the existing significant positive correlations of alcohol drinking with education and employment (r = 0.124** and r = 0.073** respectively) evaluate that increased level of education and the individuals with employment drink alcohol more frequently/daily. And there are noticeable negative correlations between alcohol drinking and

SHS, ADL, IADL and morbidity (r = -0.197**, r = -0.138**, r = -0.139** and r = -0.115** respectively).

There is a significant positive correlation between education and employment (*r* = 0.157**), however, there are significant negative correlations between education and self-reported general health, ADL, IADL and morbidity (*r* = -0.189**, *r* = -0.139**, *r* = -0.164** and *r* = -0.161** respectively).

Furthermore, there are significant negative correlations between employment and self-reported general health, ADL, IADL and morbidity (*r* = -0.234**, *r* = -0.193**, *r* = -0.236** and *r* = -0.249** respectively). The positive correlations of self-reported general health with ADL, IADL and morbidity (*r* = 0.420**, *r* = 0.455** and *r* = 0.331** respectively) evaluate those individuals having poor SHS are significantly vulnerable to having increased functional impairment with at least one ADL and IADL difficulties and an increasing degree of complex morbidities. Finally, the visible positive significant correlations of ADL with IADL and morbidity (*r* = 0.548**and *r* = 0.226** respectively) as well as between IADL and morbidity (*r* = 0.254**) reflect those individuals with at least one ADL impairment are significantly at risk of having impairment with at least one IADL and increasing degree of complex morbidities. Similarly, individuals with at least one IADL impairment too are significantly at risk of having an increasing degree of complex morbidities. The findings of correlation analysis are in line with the above cross-tabulation analysis (Table 4.2 and Table 4.3).

Table 4.5: Analysing correlation between all the independent and dependent variables

	1	2	3	4	5	6	7	8	9	10	11	12
1. Weight by BMI	1.00											
2. Age	-.051**	1.00										
3. Gender	.312**	-.055**	1.00									
4. Marital Status	-.053**	.128**	-.130**	1.00								
5. Smoking	-.100**	-.169**	-.026	.091**	1.00							
6. Alcohol	.006	-.083**	.195**	-.124**	-.081**	1.00						
7. Education	.012	-.263**	.066**	-.116**	-.014	.124**	1.00					
8. Employment	.035**	-.547**	.011**	-.090**	.029	.073**	.157**	1.00				
9. Self-reported general health	.106**	.181**	-.019	.128**	.122**	-.197**	-.189**	-.234**	1.00			
10. ADL	.060**	.173**	-.029*	.091**	.048**	-.138**	-.139**	-.193**	.420**	1.00		
11. IADL	.009	.231**	-.079**	.131**	.020	-.139**	-.164**	-.236**	.455**	.548**	1.00	
12. Morbidity	.051**	.251**	-.060**	.109**	-.008	-.115**	-.161**	-.249**	.331**	.226**	.254**	1.00

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

Table 4.6 provides the correlation between all the predictors and the outcome variables by gender: female and male.

The outcome of the analysis reveals that females aged 50 years and over with high BMI are significantly and positively correlated with the increasing risk of having poor SHS, functional impairment with at least one ADL and IADL activity, and increased risk of complex morbidities (r = 0.199**, r = 0.119**, r = 0.088** and r = 0.083** respectively). Moreover, males (50+ years) with high BMI are significantly and positively correlated with the increasing risk of having complex morbidities (r = 0.060**).

In addition, increasing age for both males and females are strongly and positively correlated with the increasing risk of having poor SHS, functional impairment with at least one ADL and

IADL activity and increasing risk of complex morbidities (r = 0.180**, r = 0.203**, r = 0.215** and r = 0.219** respectively for males and r = 0.182**, r = 0.142**, r = 0.239** and r = 0.287** respectively for females). However, the increasing age for both males and females are strongly and negatively correlated with smoking history, alcohol intake, educational status and employment status (r = -0.162**, r = -0.065*, r = -0.243** and r = -0.560** respectively for males and r = 0.179**, r = 0.085**, r = 0.278** and r = 0.530** respectively for females). Therefore, the results reflect that both males and females significantly have less/no smoking and drinking less/no alcohol with advancing age, but they are also less educated/uneducated and, not to surprise, significantly more unemployed or retired. Moreover, it is noticeable that increasing age for females is strongly and positively correlated with their marital status (r = 0.221**).

Furthermore, the results show that for both males and females, being unmarried significantly increases the risk of being smokers, having poor SHS, functional impairment with at least one ADL and IADL activity and increasing risk of complex morbidities (r = 0.114**, r = 0.115**, r = 0.069**, r = 0.074** and r = 0.067** respectively for males and r = 0.062**, r = 0.137**, r = 0.104**, r = 0.160** and r = 0.130** respectively for females). However, for both genders, being unmarried/single/divorced/widowed significantly reduces the frequency of alcohol intake but being more unemployed or retired and less educated/uneducated (r = -0.049**, r = -0.072** and r = -0.098**, respectively for males and r = -0.147**, r = 0.082** and r = -0.119**, respectively for females).

The results also reveal that for both genders, being a smoker significantly increases the risk of having poor SHS (r = 0.152** for males and r = 0.090** for females). In addition, for males, being a smoker significantly increased the risk of having functional impairment with at least one ADL (r = 0.106**). Moreover, older females in employment are significantly more vulnerable to being smokers at the 5% level (r = 0.054*). However, being smokers significantly

reduces the frequency of alcohol intake (r = -0.067** for males and r = -0.087** for females). Alike the correlation results in Table 4.5, for both genders, being more educated significantly adding more risk of frequent/daily alcohol intake (r = 0.109** for males and r = 0.119** for females). Furthermore, older females in employment have a significant risk of increased frequency of alcohol intake (r = 0.072**). Similarly, for both genders, the frequent/daily alcohol drinkers significantly have excellent/better SHS, having fewer/no disabilities by IADL activities and having fewer/no morbidities. For males, although the increased frequency of alcohol intake significantly reduces the risk of having disabilities by ADL (r = -0.131**), but for females, it significantly increases the risk of having disabilities by at least one ADL (r = 0.142**).

Alike the outcome for the total population (Table 4.5), for both genders, an increasing degree of education significantly increases the opportunity of being in employment, having better/excellent SHS, less functional impairment with ADLs and IADLs and no morbidity/fewer complex morbidities. Similarly, both genders, being in employment, significantly increases the chances of reporting excellent/better SHS, less functional impairment with ADLs and IADLs and no morbidity/less degree of complex morbidity. Furthermore, like the outcome for the total population (Table 4.5), for both genders, individuals with poor SHS are significantly more vulnerable to having increased functional impairment with at least one ADL and IADL difficulties and an increasing degree of complex morbidities. Moreover, both females and males with at least one ADL impairment are significantly at risk of having impairment with at least one IADL and an increasing degree of complex morbidities. Similarly, both genders with at least one IADL impairment are significantly at risk of having an increasing degree of complex morbidities. The findings of correlation analysis are in line with the above cross-tabulation analysis (Table 4.2 and Table 4.3).

Table 4.6: Analysing correlation between all the independent and dependent variables by the effect of gender

Female

	1	2	3	4	5	6	7	8	9	10	11
1. Weight by BMI	1.00										
2. Age	-.040*	1.00									
3. Marital Status	-.014	.221**	1.00								
4. Smoking	-.067**	-.179**	.062*	1.00							
5. Alcohol	-.116**	-.085**	-.147**	-.087**	1.00						
6. Education	-.024	-.278**	-.119**	-.009	.119**	1.00					
7. Employment	.002	-.530**	-.082**	.054*	.072**	.143**	1.00				
8. Self-reported general health	.199**	.182**	.137**	.090**	-.242**	-.182**	-.209**	1.00			
9. ADL	.119**	.142**	.104**	-.013	.142**	-.111**	-.173**	.426**	1.00		
10. IADL	.088**	.239**	.160**	-.007	-.160**	-.159**	-.233**	.476**	.566**	1.00	
11. Morbidities	.083**	.287**	.130**	-.019	-.136**	-.164**	-.255**	.337**	.213**	.247**	1.00

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

Male

	1	2	3	4	5	6	7	8	9	10	11
1. Weight by BMI	1.00										
2. Age	-.030	1.00									
3. Marital Status	-.013	.008	1.00								
4. Smoking	-.127**	-.162**	.114**	1.00							
5. Alcohol	.010	-.065**	-.049*	-.067**	1.00						
6. Education	.006	-.243**	-.098**	-.017	.109**	1.00					
7. Employment	.000	-.560**	-.072**	.012	.033	.157**	1.00				
8. Self-reported general health	.027	.180**	.115**	.152**	-.152**	-.195**	-.257**	1.00			
9. ADL	.017	.203**	.069**	.106**	-.131**	-.163**	-.210**	.413**	1.00		
10. IADL	-.033	.215**	.074**	.044	-.088**	-.162**	-.228**	.433**	.525**	1.00	
11. Morbidities	.060**	.219**	.067**	.000	-.069**	-.152**	-.235**	.325**	.239**	.255**	1.00

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

4.6 Summary of the chapter

The chapter highlighted the rationale for choosing the different variables according to the research questions. In addition, it critically evaluated the choice of using different measuring instruments that would be suitable enough to achieve the aim of the study. A model was conceptualised to evaluate the unmet social care needs due to the high BMI level for older adults in England. The study variables from the ELSA wave eight dataset were displayed with wave 8 ID in a Table 4.1 and the frequency and coding of each variable. The statistical analyses were performed to satisfy the first research question of the study. The findings were exhibited with bivariate tables, graphical displaying, and correlation matrix tables.

The statistical analyses explored that the prevalence of overweight and obesity increases with increasing age among older adults aged 50 years and over and 61-70 years age group had the highest prevalence, but the oldest old (aged 81+ years) had the least obesity prevalence by BMI measurement. In addition, high BMI significantly and positively correlated with functional impairments with ADLs, along with poor subjective health status and increasing complex morbidities among older adults. On the other hand, although older adults with advancing age and individuals who were women were significantly vulnerable with the increasing trajectories by both ADLs and IADLs, the prevalence of high BMI was significantly high among men, older adults who were married/living with a partner and employed. However, older adults with high BMI significantly and positively correlated with the hazard of complex morbidities and poor subjective health status regardless of their gender differences. Furthermore, unmarried/single/widowed/divorced individuals with a low level of education and retired/unemployed were significantly vulnerable with the increasing hazards of functional impairments for daily living, complex morbidities, and poor subjective health status regardless of their gender differences. Not to surprise that, current smokers had a significantly high risk of having poor subjective health status and those of male smokers were vulnerable to having

increasing ADL impairments. However, the increasing frequency of alcohol intake significantly and negatively correlated with the risk of functional impairments for daily living, complex morbidities, and poor subjective health status regardless of their gender differences.

Therefore, it is postulated that functional impairments for daily living and complex morbidities are significantly associated with the increasing degree of BMI compared to normal among older adults in England. The second hypothesis (H_0) of the study will be tested in the following chapter regarding the effect of increasing degree of BMI compared to normal among older adults in England.

CHAPTER 5

Linkages between health status and wellbeing of older adults in England

5.1 Introduction

The current chapter deals with one of the research objectives of the thesis. The purpose of the chapter is to report the statistical analysis of a secondary dataset, ELSA Wave eight, to answer the study's second research question. The aim is to explore the association between current health status (subjective and objective) and wellbeing in older adults of 50+ years in England with obesity. The results are based on the selected variables of ELSA. The research question and the hypothesis for this chapter have already been discussed in chapters 2 and 3. The selection of variables for this chapter was discussed in chapter 4.

In this chapter, the strategies of building different regression models are discussed, along with briefly mentioning the considered variables. As a part of the model specification process, the three sets of dependent and independent variables are identified (model A, model B, and model C) from a single ELSA Wave eight dataset that is well supported by the background literature of the study to report on the second research question to fulfil the study objective and to analyse a wide range of affair between the variables. The results of the statistical analyses are presented in tabular forms. The results are discussed against each table. Finally, the chapter is concluded by drawing an overall summary of the results of the second research question to support or reject the null hypothesis (H_0).

5.2 Selection of variables

The dependent variables or the outcome variables of the 2nd research question are drawn from the conceptual framework (as discussed in Chapter 2) of the study, and those are- health status and wellbeing. In this study, the health status is measured by subjective and objective health status (as discussed in Chapter 4). Another outcome variable, wellbeing, is measured by 19 items of "Control Autonomy Self-realisation Pleasure" scale (CASP-19) and all the responses are summed up to have a total score (ranges from 0-57), with higher scores reflect poor wellbeing (as discussed in Chapter 4).

As discussed in chapter 4, an individual's health status and subjective wellbeing depend on socio-demographics, socio-economic and lifestyle or behavioural factors. Moreover, from Chapter 4- Pearson's correlation analysis (Tables 4.5, 4.6 and 4.7), it is also assumed that the chosen predictors have the power to predict and forecast the effect of predictors on outcome variables. Therefore, in addition to BMI, the other factors that may have an independent relation to an individual's health status and subjective wellbeing are age, gender, marital status, smoking, alcohol consumption, level of education, employment status. However, the SHS and clinically diagnosed morbidities have also been considered as the independent variables to predict the association with an individual's poor wellbeing. Description of all the variables used in the study and their summary analysis based on the ELSA dataset are displayed in Table 4.1.

5.3 Model building strategies

Descriptive statistics are used primarily to summarise the prevalence of subjective and objective health status among the respondents. The data are subsequently stratified according to participant demographics, and Pearson's Chi-square (χ^2) tests are performed to test the associations between categorical variables. Multivariate logistic regression models are used to test cross-sectional associations between individuals' high BMI with their subjective and

objective health status and wellbeing independently. The models are also adjusted for potential covariates (as explained above). All p values generated from the models are statistically significant if $p < 0.05$. For each outcome, the odds ratio (OR) and 95% confidence interval (CI) are reported.

A predictive modelling style – regression analysis is used to explore the association between predicting (dependent) and predictor (independent) variables to answer the 2nd research question of the study. According to Frees (2010, p.2-3), “Regression analysis is a method to quantify the association between a variable of interest and explanatory variables", where the variable of interest is the dependent variable, and the explanatory variables are the independent variables. Hence, certain conditions and characteristics are to be determined that best fit each regression model. The selection process of the best-suited regression model to explain the connection between outcome and predictor variables methodically is expressed as model building strategies for regression.

Ray (2015) explored that building a model for regression analysis depends on many assumptions and expectations. Moreover, a well-suited model can forecast trends and prospective values of the subject under investigation. There are various forms of existing regression techniques. However, the suitability of these techniques in building a regression model depends on three considerations (Ray, 2015): characteristic of the target variable, number of predictors and the shape of the regression line.

Multivariate analysis (as the number of predictors >1) is planned to predict the "strength of impact” of multiple predictors concerning the target variable. In addition, it can be used to assess the degree of variation in each independent variable that is required to influence and bring change on the outcome variable. Firstly, based on the dependent and independent variable's characteristics, the nature of multivariate analyses is determined for each set of

selected variables. It is intended to apply a binary logistic regression model to analyse subjective health status (SHS) (model A), where the dependent variable is dichotomous, or binary (0,1) and the independent variables are categorical. At the same time, multinomial or polychotomous logistic regression are predicted to be the best suited to analyse objective health status (model B), as the dependent variable "morbidities" has four value points and polychotomous. Simultaneously, for model C, the multiple linear regression is assumed to be well-fit to analyse the association of individuals' BMI with their poor wellbeing. Here the dependent variable is a continuous scale (individual's poor wellbeing by CASP-19 scale); and the independent variables are categorical. According to Hazra and Gogtay (2017), for a multiple linear regression model, the dependent variable must be continuous, and the independent variables, if categorical, dummy variables need to be included. Therefore, for the model C, all the categorical variables are coded into dummy variables as 0 or 1, where one serves as the presence of a qualitative aspect and 0 signifies the absence.

Lastly, the above-mentioned predicted regression models are verified by assessing the presence of correlation (multicollinearity) between the independent variables.

The difference between the expected value and observed value of a dependent or target variable is determined as residual or error term ϵ, and it must be a random variable. However, Hazra and Gogtay (2016, p.598) argued that “When using a regression equation for prediction, errors in prediction may not be just random but may also be due to inadequacies in the model”. In addition, they examined that the residuals of any linear regression equation should follow a normal distribution to make credible reasoning from the regression analysis. Therefore, to validate a linear regression model, it is essential to review the residual plots. Frees (2010) argued that for linear regression analysis, one of the assumptions is that the error terms (ϵ) are normally distributed. Hence, the residuals are assumed to be normally distributed by examining the resulting linearity in the standard probability plot (P-P) (Ray, 2015). The following P-P plot

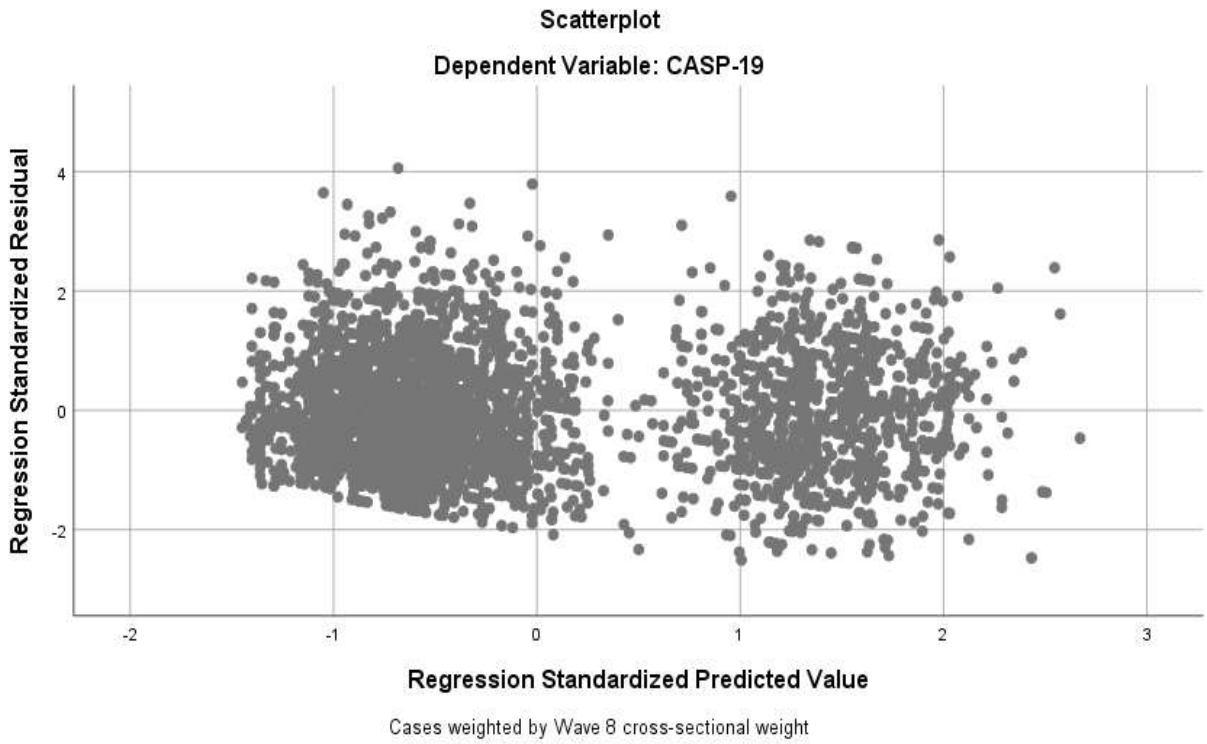
(figure 5.1) for model C (as the dependent variable is continuous) is created with the help of SPSS to test its linearity.

Figure 5.1: Examining resulting linearity in normal probability plot (P-P) for Model C

From the above diagrams of the P-P plot (figure 5.1), it is evident that in model C, the residuals followed a linear line and assumed to be normally distributed, supporting the selection of a multiple linear regression model for model C.

In addition, in the multiple linear regression, residuals are also assumed to be 'homoscedastic', displaying homogeneity of variance or whether the error terms are equally distributed (Hazra and Gogtay, 2017). The homogeneity of variance is tested with the help of the SPSS scatter plot for model C, verifying the assumption of selecting a multiple linear regression model. The data are plotted in a scatter plot, as shown below (figure 5.2).

Figure 5.2: Scatter plot testing the homogeneity of variance for Model C



From the above scatterplot (figure 5.2), it is evident that the residuals are assumed to be homoscedastic for model C to be applied for the multiple linear regression model.

On the contrary, for the logistic regression models, the individual variables do not have to be linearly connected or normally distributed (Hazra and Gogtay, 2017). Therefore, it is intended to apply the logistic regression model for model A and model B to predict an individual's subjective and objective health status, respectively.

According to Frost (2017), model selection for regression analysis can be challenging due to multicollinearity, which results when the predictor variables in a regression equation are highly correlated with each other. Therefore, the absence of multicollinearity for all three regression models was checked by assessing variance inflation factor (VIF) values with the help of SPSS. Having VIF values below five can be generally considered as the absence of multicollinearity

(Dhakal, 2019). The following outcomes of multicollinearity testing by exploring VIF values for model A, model B and model C are documented below (Tables 5.1, 5.2 and 5.3).

Table 5.1:The results of multicollinearity test for Model A

Dependent variable- subjective health status	**Statistics VIF**
BMI Group (normal, overweight & obese)	1.133
Age Group (50-60, 61-70. 71-80 & 81+)	1.522
Gender (female and male)	1.167
Marital status (married and unmarried)	1.041
Current smoking history (not smoker and current smoker)	1.067
Current alcohol intake in last 12 months (never / rarely and frequently / daily)	1.072
Age full-time school education completed (≤14 years /never, 15–18 years and ≥19 years / not yet finished)	1.089
Employment status (un-employed/retired and employed/self-employed	1.410

Table 5.2: The results of multicollinearity test for Model B

Dependent variable- objective health status	**Statistics VIF**
BMI Group (normal, overweight, and obese)	1.132
Age Group (50-60, 61-70. 71-80 and 81+)	1.499
Gender (female and male)	1.157
Marital status (married and unmarried)	1.049
Current smoking history (not smoker and current smoker)	1.075
Current alcohol intake in last 12 months (never / rarely and	1.071

frequently / daily)	
Age full-time school education completed (≤14 years /never, 15–18 years and ≥19 years / not yet finished)	1.089
Employment status (Un-employed/retired and employed/self-employed	1.358

Table 5.3: The results of multicollinearity test for Model C

Dependent variable- subjective health status	**Statistics VIF**
BMI Group (normal, overweight, and obese)	1.144
Age Group (50-60, 61-70. 71-80 and 81+)	1.532
Gender (female and male)	1.163
Marital status (married and unmarried)	1.058
Current smoking history (not smoker and current smoker)	1.095
Current alcohol intake in last 12 months (never / rarely and frequently / daily)	1.088
Age full-time school education completed (≤14 years /never, 15–18 years and ≥19 years / not yet finished)	1.121
Employment status (un-employed/retired and employed/self-employed	1.423
Self-rated health status (SHS) (fair/poor and excellent/very good/ good	1.170
Morbidities (none, single morbidity, comorbidity, multimorbidity)	1.155

Hence all the above results of multicollinearity testing (Tables 5.1, 5.2 and 5.3) supporting the absence of multicollinearity.

In the end, all the regression models are tested to be validated by determining how well a regression model fits the data (Dhakal, 2019). For the logistic regression analysis, models are tested by the parameters Cox and Snell's R^2, Nagelkerke's R^2, and McFadden's −2 log-likelihood (−2LL) statistic with the help of SPSS.

Model A: The binary logistic regression is examining how satisfied a participant is with their current health status with the given independent variables BMI, age, gender, marital status, smoking history, alcohol intake, level of educational status, and employment status.

The following are the model fit testing results to determine model A validity (Table 5.4).

Table 5.4: The result of model fit summary for the outcome variable- Subjective health status (Model A)

Model Summary

Step	-2 log likelihood	Cox& Snell R Square	Nagelkerke R Square
1	3441.922a	0.116	0.163

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than 0.001

Classification Table (The cut value is 0.500)

Observed			Predicted Subjective Health: Fair/poor	Predicted Subjective Health: Excellent/ good	Percentage Correct
Step 1	Subjective health	Fair/poor	239	710	25.2
		Excellent/very good/good	156	2003	92.8
	Overall Percentages				72.1

From the above model fit information in Table 5.4 of model A, R^2 value = 11.6% of variability accounted for by model A. From the classification table, “observed” signifies the number of 0’s (fair/poor) and 1’s (excellent/very good/good) that are observed in the subjective health status (SHS) (dependent variable). At the same time, the "predicted" indicates that these are the predicted values of SHS based on the full binary logistic regression model.

Model B: The multinomial logistic linear regression is examining the health effects of clinically diagnosed morbidities that a participant has with the given independent variables BMI, age, gender, marital status, smoking history, alcohol intake, level of educational status, and employment status.

The following are the model fit testing results to determine Model B validity (Table 5.5).

Table 5.5: The result of model fit summary for the outcome variable- Objective health status (Model B)

Model Fitting Information

Model	Model fitting criteria (-2 Log Likelihood)	Likelihood ratio tests		
		Chi-square	df	Sig.
Intercept only	2348.757			
Final	2030.015	318.742	36	0.001

Pseudo R-square

Cox and Snell	0.131
Nagelkerke	0.145
McFadden	0.061

Case Processing Summary

Variable		N	Marginal percentage
Morbidities	None	44.43	2.0%
	Single morbidity	930.43	40.9%
	Comorbidity	757.92	33.3%
	Multimorbidity	540.97	23.8%
Valid		2273.74	100.0%
Missing		3366.47	
Total		5640.21	
Subpopulation		450[a]	

a. The dependent variable has only one value observed in 203(45.1%) subpopulations.

From the above model fit information in Table 5.5 of model B, R^2 value = 13.1% of variability accounted for by model B. The case processing table of Model B exhibits the number of observations of clinically diagnosed morbidities (objective health status) as divided into four groups- none, single morbidity, comorbidity and multimorbidity, respectively. A marginal percentage represents the proportion of the valid observations for each target variable (none, single morbidity, comorbidity and multimorbidity). Out of about 2274 participants with valid data of clinically diagnosed morbidities, about 44 participants had no morbidities, about 930 respondents had single morbidity, about 758 respondents had comorbidity, and about 541 respondents had multimorbidity. Hence, the marginal percentage of the group (none) is 2.0% and so on for the other groups, as shown above in the case processing summary table of model B (Table 5.5). In addition, about 3366 missing observations were reported in the dataset. Moreover, the combination of all eight predictors (BMI, age, gender, marital status, smoking, alcohol, education, and employment) are considered as one subpopulation of the data. The above table noted that the eight selected predictors appeared in 450 combinations in the dataset, and 203 of these combinations are recorded with the same subgroup of clinically diagnosed morbidities.

Model C: Multiple linear regression will be used to determine participant's wellbeing (CASP-19) with the given independent variables BMI, age, gender, marital status, smoking history, alcohol intake, level of educational status, employment status, and participant's subjective and objective health status. The multiple linear regression model is tested by the value of R, R^2 and adjusted R^2. Moreover, to examine if the overall regression model is a good fit to data, the F-ratio's statistical significance is tested. The following are the model fit testing results to determine model C validity (Table 5.6).

Table 5.6: The result of model fit summary for the outcome variable- Wellbeing (Model C)

Model Summary

(Dependent variable subjective wellbeing by CASP-19)

Model	R	R square	Adjusted R square	Std. error of the estimate
1	0.480a	0.231	0.225	8.30265

a. Predictors: (constant), overweight, overweight, age: 61-70, 71-80, 81+, male/female, married/unmarried, current smoking: yes/no, current alcohol drinker: yes/no, education: 15–18, ≥19/not finished yet, unemployed/employed, self-rated health: poor/fair, excellent/very good/good, morbidities: single morbidity, comorbidity, multimorbidity.

ANOVA

(Dependent variable subjective wellbeing by CASP-19)

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	46574.275	16	2910.892	42.227	.001a
	Residual	155373.932	2254	68.934		
	Total	201948.206	2270			

a. Predictors: (constant), overweight, overweight, age: 61-70, 71-80, 81+, male/female, married/unmarried, current smoking: yes/no, current alcohol drinker: yes/no, education: 15–18, ≥19/not finished yet, unemployed/employed, self-rated health: poor/fair, excellent/very good/good, morbidities: single morbidity, comorbidity, multimorbidity.

From the above model summary table of model C (Table 5.6), R represents the value of multiple correlation coefficient, and a value of 0.480 indicates a high degree of correlation with the dependent variable, that is, poor wellbeing (CASP-19) and supports the fact that BMI can

predict individual's wellbeing strongly with the presence of other predictors. In addition, by the R^2 value, it is noted that BMI can explain 23.1% of the variability in CASP-19 scores and other independent variables. According to Dhakal (2019, p.1449), "High discrepancy between the values of R-squared and Adjusted R Square indicates a poor fit of the model" and "Adjusted R^2 will always be less than or equal to R^2". Hence, from the above Table 5.6, the value of adjusted R^2 indicates a well fit of data. The precision of the model is measured by the standard errors, which is 8.30; however, it is not an ignorable amount provided by the CASP-19 scale (poor wellbeing).

Furthermore, the analysis of variance (ANOVA) in Table 5.6 indicates that the independent variables of model C predict the dependent variable significantly well (p=0.001). Moreover, a large F ratio (42.227) denotes that the variation amid groups means more significant than expected to see by chance. Therefore, the linear regression model (model C) indicates a good fit to the data.

5.4 Analysis based on ELSA cross-sectional data

Table 5.7 shows the results of the bivariate analysis. The null hypothesis for part of the second research question is that there is no statistically significant association between current health status (subjective and objective) and the selected independent variables (BMI, age, gender, marital status, smoking history, alcohol intake history, educational status, employment status and self-rated general health status) among obese older adults in England.

Results from the Chi-square (χ^2) statistical analysis (Table 5.7) reveals that high BMI is statistically significant with an individual's subjective and objective health status (χ^2 (2) =82.73, $p < 0.05$; and χ^2 (2) =26.89, $p < 0.05$, respectively). Except for an individual's gender and smoking status, all other socio-demographic, behavioural and socio-economic covariates are strongly associated ($p < 0.01$) with respondent's both subjective and objective health status.

Although gender is not significantly associated with their SHS (χ^2 (1) =4.46, $p > 0.05$), however, strongly associated with an individual's objective health status (χ^2 (1) =15.23, $p < 0.05$). In contrast, an individual's smoking status is strongly associated with their SHS (χ^2 (1) =60.11, $p < 0.05$), but not strongly connected with their objective health status (χ^2 (1) =3.19, $p > 0.05$).

It is noticeable that about three quarter (72.6%) respondents of the total sample (5640) self-appraised their health status as excellent, very good and good, in which 39.7% were obese, and 10.3% were 81+ years old. At the same time, almost half of the respondents (45.8%) who marked their health status as fair/poor were obese. Consequently, it is noted that about half of the respondents had single morbidity (43.5%), about one quarter (22.7%), and more than a quarter (31.6%) respondent had multimorbidity and comorbidity, respectively. Among them, respectively, 48.5% and 27.5% were obese and overweight with comorbidity and respectively, 44.8% and 29% were obese and overweight with multimorbidity.

However, overweight participants reported a 0.1% smaller number of single morbidities than those with normal weight, and the recorded percentages of no morbidity were similar for both overweight and normal-weight groups.

Simultaneously, the increasing age associated with increased number of single morbidities, comorbidity and multimorbidity. Individuals between the 71–80-years age group recorded the most significant number of multimorbidity, 31.6% and 4.4% higher than the numbers recorded by their 50-60's and 61-70's counterparts, respectively. However, the oldest-old participants (81+ years) reported 1.3 times and 1.5 times lower number of multimorbidity than 61-70 and 71–80-year age groups, respectively. Nevertheless, the oldest old reported a 4.6 times higher number of multimorbidity than their 50–60's counterparts. The most considerable percentage of comorbidity and single morbidities were claimed by the individuals of their 61-70's (36.6%

and 39.4%, respectively). At the same time, the oldest old individuals reported 19.9% and 14.7% lower number of comorbidity and 28.9% and 13.7% lower number of single morbidities than those of their 61-70's and 71-80's counterparts, respectively. However, the recorded number of comorbidities was 1.1 times higher for the oldest old participants than their 50-60's counterparts. Nevertheless, the individuals of their 50-60's claimed to have 15.4% more single morbidities than their oldest-old counterparts. Not surprisingly, individuals of their 50-60's and 61-70's recorded higher percentages of no morbidities (33.3% for both) than the oldest old and those of their 71-80's (9.5% and 23.8% respectively). On the other hand, oldest-old participants mainly reported their SHS as fair and poor (20.2% and 16.8%, respectively). However, for fair SHS, the number reported by oldest-old is 12.7% and 8.9% lower, and for poor SHS, this is 19.1% and 13% lower than the numbers recorded by their 61-70's and 71-80's counterparts, respectively. Individuals of their 50-60's and 61-70's mostly noted their SHS as excellent, very good and good, whereas participants of their 71-80's mostly marked their SHS as fair and poor (29.1% and 29.8%, respectively).

Concurrently, males and females both had documented the exact percentages of single morbidities (50.0%), whereas females took the lead of having more comorbidity (52.4%) and multimorbidity (56.9%) than their male counterparts (47.6% and 43.1%, respectively). Consequently, female participants recorded a 16.6% lower number of no morbidities than their male counterparts. On the other hand, female participants mainly marked their SHS as fair and reasonable (52.2% and 51.4%, respectively), whereas the male participants primarily marked their SHS as excellent (52.2%). However, among the recorded number of poor SHS, the male participants took the lead with a claim of 0.6% more poor SHS than females.

Married or participants with existing partners had considered their SHS primarily as excellent, very good and good (72.8%, 69.8% and 66.6%, respectively), whereas unmarried/single/divorced/widowed participants marked their SHS primarily as poor and fair

(50.5% and 40.6%, respectively). On the other hand, married adults reported respectively 2.2 times, 1.7 times and 1.2 times greater number of single morbidities, comorbidity and multimorbidity than their unmarried/single/divorced/widowed counterparts. Besides, 2.4 times higher percentages of no morbidities were recorded by married participants than their unmarried/single/divorced/widowed counterparts.

Subsequently, individuals who were currently non-smokers mostly noted their SHS as excellent, very good (88.9%), but at the same time, they reported 60.4% and 49% higher number of fair and poor SHS, respectively, than their current smoker counterparts. However, current smokers primarily marked their SHS as poor and fair (25.5% and 19.8%, respectively). On the other hand, participants who were currently non-smokers reported respectively 5.3 times, 5.7 times and six times higher number of single morbidities, comorbidity and multimorbidity than those who were current smokers. However, 83.6% higher number of no morbidities were recorded by the individuals who were currently non-smokers than their current smoker counterparts.

Surprisingly, individuals who drank rarely or no alcohol marked their SHS mostly as poor (62.3%) and fair (56%), whereas the individuals who drank frequently or daily alcohol noted their SHS primarily as excellent, very good and good (71%, 63.6% and 55% respectively). However, frequent or daily drinkers recorded 19.6% and 3.2 % higher number of single morbidities and comorbidity, respectively, than those who drank rarely or no alcohol, although, the number of reported multimorbidity were 10% higher for the rarely or no alcohol drinkers than those of their frequent and daily drinker counterparts. Moreover, the frequent and daily alcohol drinkers reported more percentages of no morbidity than the rare or no alcohol drinker participants (57.4% and 42.6%, respectively).

Not surprisingly individuals with the highest level of education (≥19 years/not yet finished) mainly considered their SHS as excellent, very good and good (31.1%, 22.7% and 20.8%, respectively). However, the percentages are 33.2%, 50.2% and 53.2% lower (for excellent, very good and good, respectively) than those who left their formal education between 15-18 year of their age (medium level of education). Consequently, individuals with no education or minimum education (none/≤14 years) mainly reported their SHS as poor and fair (14.1% and 13%, respectively). However, the percentages are 63.2% and 62.8% lower (for poor and fair, respectively) than those with a medium level of education. Lastly, the individuals with a medium level of education marked their SHS 5.5 times and nine times poorer than those with no education or minimum education and those with the highest level of education, respectively.

On the other hand, the reported number of single morbidities and comorbidity were 15.5% and 7.6% higher, respectively, for the individuals with the highest level of education than those with no education or minimum education. However, the reported number of multimorbidity were 7.6% lower for the individuals with the highest level of education than those with no education or minimum education. Surprisingly, individuals with a medium level of education claimed of having about fifteen times, nine times and five times higher number of single morbidities, comorbidity and multimorbidity, respectively than those with no education or minimum education and about four times, five times and seven times higher (for single morbidities, comorbidity and multimorbidity respectively) than those with the highest level of education. However, the highest number of no morbidities were also reported by the individuals who had a medium level of education.

Interestingly, older adults in employment documented their SHS primarily as excellent, very good and good (47.3%, 38.3% and 31.5%, respectively). However, the percentages are 5.4%, 23.4% and 37% lower (for excellent, very good and good, respectively) than those who were retired or unemployed. Undoubtedly, the retired or unemployed participants marked their SHS

primarily as poor and fair (92.4% and 80.9%, respectively). And the percentages are about twelve times and four times higher, respectively, than those in employment. In addition, the retired or unemployed individuals reported about two times, five times and ten times higher number of single morbidities, comorbidity and multimorbidity, respectively, than those in employment.

Table 5.7: Descriptive statistics to determine subjective and objective health status.

Variables	**Health status**																	
	Self-reported health status										**Morbidities**							
	Excellent		**Very good**		**Good**		**Fair**		**Poor**		**No Morbidity**		**Single morbidity**		**Comorbidity (2 diseases)**		**Multimorbidity (3 + diseases)**	
	N	**%**	N	%	N	**%**	N	%	N	%	N	**%**	N	**%**	N	**%**	N	**%**
BMI																		
Normal	237	36.6	537	32.8	468	25.8	279	26.2	115	24.1	31	36.9	506	29.2	303	24.1	238	26.3
Overweight	217	33.5	491	30.0	518	28.6	311	29.2	132	27.7	31	36.9	503	29.1	346	27.5	262	29.0
Obese	194	29.9	607	37.1	827	45.6	476	44.7	230	48.2	22	26.2	722	41.7	610	48.5	405	44.8
TOTAL	648	11.5	1635	29.0	1813	32.2	1066	18.9	477	8.5	84	2.1	1731	43.5	1259	31.6	905	22.7
Respondents	5639										3979							
P -value	0.001 χ^2 =82.73										0.001 χ^2 =26.89							
Age																		
50-60	228	35.1	445	27.2	402	22.2	190	17.8	83	17.4	28	33.3	448	25.9	193	15.3	49	5.4
61-70	275	42.4	686	41.9	682	37.6	350	32.9	171	35.9	28	33.3	682	39.4	461	36.6	294	32.6
71-80	105	16.2	354	21.6	501	27.6	310	29.1	142	29.8	20	23.8	419	24.2	396	31.4	334	37.0
81+	41	6.3	151	9.2	229	12.6	215	20.2	80	16.8	8	9.5	181	10.5	210	16.7	226	25.0
TOTAL	649	11.5	1636	29.0	1814	32.2	1065	18.9	476	8.4	84	2.1	1730	43.5	1260	31.7	903	22.7
Respondents	5640										3977							
P -value	0.001 χ^2 =220.09										0.001 χ^2 =281.82							
Gender																		
Female	308	47.5	815	49.8	932	51.4	556	52.2	237	49.7	35	41.7	865	50.0	660	52.4	515	56.9
Male	340	52.5	820	50.2	881	48.6	510	47.8	240	50.3	49	58.3	866	50.0	599	47.6	390	43.1
TOTAL	648	11.5	1635	29.0	1813	32.2	1066	18.9	477	8.5	84	2.1	1731	43.5	1259	31.6	905	22.7
Respondents	5639										3979							
P -value	0.348 χ^2 =4.46										0.002 χ^2 =15.23							
Marital status																		
Married	472	72.8	1141	69.8	1208	66.6	633	59.4	235	49.5	59	70.2	1184	68.5	792	62.9	498	55.0
Unmarried/others	176	27.2	494	30.2	605	33.4	432	40.6	240	50.5	25	29.8	545	31.5	467	37.1	407	45.0
TOTAL	648	11.5	1635	29.0	1813	32.2	1065	18.9	475	8.4	84	2.1	1729	43.5	1259	31.7	905	22.8
Respondents	5636										3977							
P -value	0.001 χ^2 =101.01										0.001 χ^2 =48.40							

Current smoker																		
No	289	88.9	853	88.9	1003	86.1	592	80.2	278	74.5	56	91.8	907	84.1	729	85.1	545	85.8
Yes	36	11.1	107	11.1	162	13.9	146	19.8	95	25.5	5	8.2	171	15.9	128	14.9	90	14.2
TOTAL	325	9.1	960	27.0	1165	32.7	738	20.7	373	10.5	61	2.3	1078	41.0	857	32.6	635	24.1
Respondents	3561										2631							
P -value	0.001 χ^2 =60.11										0.363 χ^2 =3.19							
Alcohol																		
None/ Rarely	170	29.0	542	36.4	722	45.0	529	56.0	240	62.3	29	42.6	617	40.2	547	48.4	431	55.0
Frequently/Daily	416	71.0	945	63.6	884	55.0	416	44.0	145	37.7	39	57.4	916	59.8	683	51.6	352	45.0
TOTAL	586	11.7	1487	29.7	1606	32.1	945	18.9	384	7.7	68	1.9	1533	43.6	1130	32.2	783	22.3
Respondents	5009										3514							
P -value	0.001 χ^2 =196.03										0.001 χ^2 =49.05							
Education (left formal education at)																		
None/≤14	30	4.6	72	4.4	94	5.2	139	13.0	67	14.1	5	6.0	87	5.0	107	8.5	143	15.8
15–18	417	64.3	1191	72.9	1341	74.0	808	75.8	368	77.3	56	66.7	1287	74.4	948	75.4	664	73.5
≥19/not yet finished	202	31.1	371	22.7	378	20.8	119	11.2	41	8.6	23	27.4	355	20.5	203	16.1	97	10.7
TOTAL	649	11.5	1634	29.0	1813	32.2	1066	18.9	476	8.4	84	2.1	1729	43.5	1258	31.6	904	22.7
Respondents	5638										3975							
P -value	0.001 χ^2 =246.91										0.001 χ^2 =121.30							
Employment																		
Retired/ unemployed	339	52.7	1001	61.7	1231	68.5	854	80.9	440	92.4	47	56.6	1137	66.3	1022	82.2	821	91.2
Employed	304	47.3	621	38.3	567	31.5	201	19.1	36	7.6	36	43.4	577	33.7	222	17.8	79	8.8
TOTAL	643	11.5	1622	29.0	1798	32.1	1055	18.9	476	8.5	83	2.1	1714	43.5	1244	31.6	900	22.8
Respondents	5594										3941							
P -value	0.001 χ^2 =313.29										0.001 χ^2 =249.42							

The logistic regression models are applied for model A and model B, examining the probability of participant's health status (subjective and objective) of the ELSA dataset. In logistic regression, the effect of each predictor variable is denoted as 'OR' or an odds ratio. This odds ratio can be used testing for statistical significance versus null hypothesis; if the ratio is 1, it signifies no effect of the predictor on the outcome variables. For the present study, with the

help of SPSS, the regression analysis is tested by limiting at 95% of the confidence interval of the odds ratio.

Therefore, the logistic regression equation that is applied here for the t number of predictors:

$$log\left(\frac{p}{1-p}\right) = B + (B_1X_1) + (B_2X_2) + \cdots + (B_tX_t)$$

Where log (p/1-p) represents logit (p), that is the probability of occurrence of the characteristic of interest, X_1, X_2, ……, Xt are the values of predictors, B is the constant termed (y-intercept) and B_1, B_2, …, Bt are the regression coefficients or termed as beta values or the slope of the regression line. In addition, confidence interval (CI) represents a range within where the individual predictor value of the beta coefficient is likely to lie. The direct or 'enter' method is used (via SPSS) to process both logistic regression analyses (model A and model B). Moreover, the exponential beta value or Exp(B) in the SPSS logistic regression output represents the outcome variable's odds ratio (OR). Here the exponential beta value is explained against the reference category of predictors, as the predictors are the categorical variables.

Table 5.8 model A exhibits the outcome of binary logistic regression analysis to predict the strength of the impact of eight predictors independently and jointly on an individual's SHS. In this model, an unadjusted model represents the independent effect of an individual's BMI, age, and other predictors on an individual's SHS. At the same time, the interaction effects (adjusted model) are added to determine whether the effect of the respondent's BMI depends on the values of other predictors in the analysis while predicting the participant's subjective health status.

Firstly, the unadjusted model (Table 5.8) shows that compare to the normal weight individuals, the chance of having better SHS was strongly reduced for obese participants by 27% (OR: 0.73, 95% CI: 0.63-0.84, $p < 0.01$). However, the effect is insignificant for overweight participants

and the odds of having good SHS reduced by 12% for them (OR: 0.88, 95% CI: 0.75-1.03, p > 0.05). The result is in line with the outcome of correlation analysis in chapter 4. Nevertheless, increasing age significantly reduced the chance of having good SHS independently. Compared to the 50–60-year age group, the odds of having good wellbeing reduced by 20%, 46% and 63% for 61–70, 71-80and 81+ years, respectively (OR: 0.80, 95% CI: 0.68-0.95, p < 0.05; OR: 0.54, 95% CI: 0.45-0.64, p < 0.01; and OR: 0.37, 95% CI: 0.30-0.45, p < 0.01, respectively). Interestingly, compared to females and retired or unemployed/retired individuals, the odds of having better SHS were increased by 5% (OR: 1.05, 95% CI: 0.93-1.18, p > 0.05) and 217% (OR: 3.17, 95% CI: 2.71-3.69, p < 0.01) for their males and employed counterparts, respectively. However, the effects are insignificant for males but strongly associated with those who were employed. Nevertheless, compared to the married and non-smokers respondents, being unmarried/single/divorced/widowed and current smokers strongly reduced the odds of having better SHS of 42% (OR: 0.58, 95% CI: 0.52-0.66, p <0.01) and 49% (OR: 0.51, 95% CI: 0.43-0.62, p <0.01), respectively. On the other hand, compared to the none or rare alcohol drinkers, the odds of having better SHS significantly increased by 115% (OR: 2.15, 95% CI: 1.89-2.44, p <0.01) for their frequently or daily drinker counterparts. Finally, being highly educated strongly increased the chance of an individual's better SHS. Compared to the individuals with no education or minimum education (/≤14 years), having the highest education (≥19 years/ not yet finished) and finishing education between 15-18 years strongly increased the odds of having better SHS by 522% (OR: 6.22, 95% CI: 4.81-8.05, p <0.01) and 163% (OR: 2.63, 95% CI: 2.14-3.24, p <0.01) respectively.

The adjusted model (Table 5.8) shows that compare to the normal weight individuals, the chance of having better SHS was significantly reduced for both of their obese and overweight counterparts by 36% and 27%, respectively (OR: 0.64, 95% CI: 0.52-0.80, p < 0.01; OR: 0.73, 95% CI: 0.58-0.91, p < 0.05, respectively). Unlike the unadjusted model, compared to the 50–

60-year age group, increasing age significantly increased the chance of having better SHS by 65%, 53% and 45% for those of their 61-70's, 71–80's and 81+years, respectively (OR: 1.65, 95% CI: 1.26-2.14, $p < 0.01$; OR: 1.53, 95% CI: 1.14-2.04, $p < 0.05$; and OR: 1.45, 95% CI: 1.02-2.08, $p < 0.05$, respectively).

In contrast to the unadjusted model, compared to females, the odds of having a better SHS were insignificantly reduced by 13% (OR: 0.87, 95% CI: 0.73-1.04, $p > 0.05$) for those of males. Alike the unadjusted model, compared to the retired or unemployed individuals, the odds of having better SHS were significantly increased by 256% (OR: 3.56, 95% CI: 2.76-4.61, $p < 0.01$) for those in employment. Moreover, compared to the married and non-smokers respondents, being unmarried/single/divorced/widowed and current smokers strongly reduced the odds of having better SHS of 29% and 52%, respectively (OR: 0.71, 95% CI: 0.60-0.85, $p <0.01$, and OR: 0.48, 95% CI: 0.38-0.60, $p <0.01$, respectively).

At the same time, compared to the none or rare alcohol drinkers, the odds of having better SHS significantly increased by 80% (OR: 1.80, 95% CI: 1.52-2.13, $p <0.01$) for their frequent or daily drinker counterparts. Finally, like the unadjusted model, compared to the individuals with no education or minimum education (/≤14 years), having the highest education (≥19 years/ not yet finished) and finishing education between 15-18 years significantly increased the odds of having better SHS by 301% (OR: 4.01, 95% CI: 2.72-5.91, $p <0.01$) and 95% (OR: 1.95, 95% CI: 1.42-2.68, $p <0.01$), respectively.

Table 5.8: Binary Logistic Regression determining subjective health status (Model A)

Variable	Unadjusted model						Adjusted model					
	B	S.E.	Sig.	Exp (B) (OR)	95% C.I. for Exp (B)		B	S.E.	Sig.	Exp (B) (OR)	95% C.I. for Exp(B)	
					Lower	Upper					Lower	Upper
BMI												
Normal	Ref											
Overweight	-0.13	0.08	0.10	0.88	0.75	1.03	-0.32	0.11	0.01	0.73	0.58	0.91
Obese	-0.31	0.07	0.001	0.73	0.63	0.84	-0.44	0.10	0.001	0.64	0.52	0.80
Age												
50-60	Ref											
61-70	-0.22	0.08	0.01	0.80	0.68	0.95	0.50	0.14	0.001	1.65	1.26	2.14
71-80	-0.62	0.09	0.001	0.54	0.45	0.64	0.42	0.15	0.01	1.53	1.14	2.04
81+	-1.01	0.11	0.001	0.37	0.30	0.45	0.37	0.18	0.04	1.45	1.02	2.08
Gender												
Female	Ref											
Male	0.05	0.06	0.41	1.05	0.93	1.18	-0.14	0.09	0.12	0.87	0.73	1.04
Marital status												
Married	Ref											
Unmarried/others	-0.54	0.06	0.001	0.58	0.52	0.66	-0.34	0.09	0.001	0.71	0.60	0.85
Smoking												
No	Ref											
Yes	-0.67	0.10	0.001	0.51	0.43	0.62	-0.74	0.11	0.001	0.48	0.38	0.60
Alcohol												
Never/Rarely	Ref											
Frequently /Daily	0.76	0.07	0.001	2.15	1.89	2.44	0.59	0.09	0.001	1.80	1.52	2.13
Education (left formal education at)												
Never/ ≤14	Ref											
15–18	0.97	0.11	0.001	2.63	2.14	3.24	0.67	0.16	0.001	1.95	1.42	2.68
≥19/ not yet finished	1.83	0.13	0.001	6.22	4.81	8.05	1.39	0.20	0.001	4.01	2.72	5.91
Employment												
Retired/ unemployed	Ref											
Employed	1.15	0.08	0.001	3.17	2.72	3.69	1.27	0.13	0.001	3.56	2.76	4.61
Constant							-0.26	0.23	.0.26	0.77		

(Subjective health status coding: fair/poor (0) and excellent/very good/good (1))

Table 5.9 model B demonstrates the multinomial logistic regression to predict the strength of the impact of eight predictors on objective health status by clinically diagnosed morbidities grouped as none, single morbidity, comorbidity, and multimorbidity, where no morbidity (none) is considered as the reference group. Therefore, each parameter of clinically diagnosed

morbidities (single morbidity, comorbidity and multimorbidity) estimation are relative to the referent group (no morbidity). The model was adjusted for individual's BMI, age, and other covariates of the study.

Model B (Table 5.9) evaluates that compared to the normal-weight individuals, the risk of having single morbidity than no morbidity was significantly increased by 165% (OR: 2.65, 95% CI: 1.22-5.77, $p < 0.05$) for obese participants. At the same time, the risk of having single morbidity is not significant for overweight at 5% level, but the risk is still high for the overweight's and increased by 97% than their normal-weight counterparts (OR: 1.97, 95% CI: 0.90-4.34, $p > 0.05$).

Surprisingly, compare to the 50–60-year age group, increasing age reduced the risk of having single morbidity than having no morbidity by 39%, 44% and 16% for those of their 61–70's, 71-80's and 81+ years, respectively (OR: 0.61, 95% CI: 0.24-1.54, $p > 0.05$; OR: 0.56, 95% CI: 0.19-1.67, $p > 0.05$; and OR: 0.84, 95% CI: 0.19-3.64, $p > 0.05$, respectively); whereas the effects of age are insignificant, predicting the risk of single morbidity when the model is controlled for BMI and other variables.

On the other hand, compared to females, married, and being retired or unemployed, the odds of having single morbidity than having no morbidity were reduced by 60%, 44% and 30% for those of males, unmarried/single/divorced/widowed and in employment, respectively (OR: 0.40, 95% CI: 0.20-0.80, $p < 0.05$; OR: 0.56, 95% CI: 0.30-1.06, $p > 0.05$; and OR: 0.70, 95% CI: 0.32-1.52, $p > 0.05$, respectively), where gender significantly predicting the risk of single morbidity, but marital status and employment status are insignificant at 5% level. Nevertheless, compared to the individuals who were current non-smokers and none or rare alcohol drinkers, the hazard of having single morbidity than no morbidity was increased by 548% and 28% for their current smokers and frequent or daily drinker counterparts, respectively (OR: 6.48, 95%

CI: 1.30-32.39, $p < 0.05$, and OR: 1.28, 95% CI: 0.68-2.40, $p > 0.05$, respectively). Smoking status strongly predicts the hazard of having single morbidity, but alcohol drinking status is insignificant at a 5% level. Finally, compared to the individuals with no education or minimum education (/≤14 year), having higher education insignificantly reduced the risk of single morbidity than no morbidity by 52% and 32% for those finishing educations between the age of 15-18 years and having the highest education (≥19 years/ not yet finished), respectively (OR: 0.48, 95% CI: 0.08-3.00, $p > 0.05$, and OR: 0.68, 95% CI: 0.09-4.85, $p > 0.05$, respectively).

Alike the predictive risk of single morbidity, compared to normal weight, the risk of having comorbidity than no morbidity was strongly increased for obese participants and insignificantly increased for overweight by 304% and 116%, respectively (OR: 4.04, 95% CI: 1.85-8.85, $p < 0.01$, and OR: 2.16, 95% CI: 0.97-4.80, $p > 0.05$, respectively).

Unlike the predictive risk of single morbidity, compared to the 50–60-year age group, the risk of comorbidity than no morbidity increased for the oldest old (aged 81+ years) by 10% (OR: 1.10, 95% CI: 0.25-4.78, $p > 0.05$). However, alike predicting risk of single morbidity, the hazard of having comorbidity reduced for those of 61-70's and 71–80-years by 43% and 36%, respectively than their 50–60years counterparts (OR: 0.57, 95% CI: 0.22-1.45, $p > 0.05$, and OR: 0.64, 95% CI: 0.21-1.94, $p > 0.05$, respectively). The effects of age are insignificant predicting comorbidity when the model is controlled for BMI and other variables. Moreover, compared to females, married, and being retired or unemployed, the odds of having comorbidity than having no morbidity were reduced by 59%, 30% and 99% for those were males, unmarried/single/divorced/widowed and in employment, respectively (OR: 0.41, 95% CI: 0.20-0.81, $p < 0.05$; OR: 0.70, 95% CI: 0.37-1.32, $p > 0.05$; and OR: 0.01, 95% CI: 0.17-0.81, $p < 0.05$, respectively), where individual's gender and employment status significantly predicting the risk of comorbidity, but marital status is insignificant at 5% level.

Nevertheless, compared to the current non-smokers and none or rare alcohol drinkers, the hazard of having comorbidity than no morbidity was increased by 475% and 1% for their current smokers and frequent or daily drinker counterparts, respectively (OR: 5.75, 95% CI: 1.14-28.87, $p < 0.05$, and OR: 1.01, 95% CI: 0.54-1.92, $p > 0.05$, respectively). Smoking status strongly predicts the hazard of comorbidity, but alcohol drinking status is insignificant at a 5% level. Finally, like the predictive risk of single morbidity, compared to the individuals with no education or minimum education (/≤14 year), those with higher education insignificantly reduced the risk of comorbidity than no morbidity by 52% and 51% for having medium education and the highest education, respectively (OR: 0.48, 95% CI: 0.08-3.03, $p > 0.05$, and OR: 0.49, 95% CI: 0.07-3.50, $p > 0.05$, respectively).

On the other hand, high BMI strongly associated with the increased risk of multimorbidity while other variables are held constant. Compared to normal weight, the risk of having multimorbidity than no morbidity was increased by 132% and 342% for being overweight and obese, respectively (OR: 2.32, 95% CI: 1.03-5.22, $p < 0.05$, and OR: 4.42, 95% CI: 1.99-9.80, $p < 0.01$, respectively).

Moreover, compared to the 50–60-year age group, the hazard of multimorbidity than no morbidity increased with age by 115%, 220% and 414% for individuals of 61–70, 71-80 and 81+ year age groups, respectively (OR: 2.15, 95% CI: 0.75-6.12, $p > 0.05$; OR: 3.20, 95% CI: 0.99-10.98, $p = 0.05$; and OR: 5.14, 95% CI: 1.10-24.08, $p < 0.05$, respectively). The oldest old (aged 81 years and over) strongly predicts the risk of multimorbidity at a 5% level, but other age groups are insignificant.

Alike the predictive risk of single morbidity and comorbidity, compared to females, married, and retired or unemployed, the odds of having multimorbidity than having no morbidity were reduced by 63%, 16% and 79% for those who were male, unmarried and in employment

respectively (OR: 0.37, 95% CI: 0.18-0.74, $p < 0.05$; OR: 0.84, 95% CI: 0.44-1.61, $p > 0.05$; and OR: 0.21, 95% CI: 0.09-0.49, $p < 0.01$, respectively). An individual's gender and employment status significantly predict the risk of multimorbidity, but marital status is insignificant at a 5% level. Nevertheless, compared to the non-smokers, the odds of having multimorbidity than no morbidity was significantly increased by 602% for those who were current smokers (OR: 7.02, 95% CI: 1.39-35.56, $p < 0.05$).

Unlike the predictive risk of single morbidity and comorbidity, compared to none or rare alcohol drinkers, the odds of having multimorbidity than having no morbidity was reduced by 8% for frequently or daily alcohol drinkers (OR: 0.92, 95% CI: 0.-1.76, $p > 0.05$). The association is not significant. Furthermore, like the predictive risk of single morbidity and comorbidity, compare to the individuals with no education or minimum education (/≤14 years), having higher education insignificantly reduced the risk of multimorbidity than no morbidity by 81% and 85% for finishing education between 15-18 years and having the highest education (≥19years/ not yet finished), respectively (OR: 0.29, 95% CI: 0.05-1.85, $p > 0.05$, and OR: 0.24, 95% CI: 0.03-1.71, $p > 0.05$, respectively).

Table 5.9: Multinomial Regression determining objective health status (adjusted Model B)

	Single Morbidity vs no morbidity					Comorbidity vs no morbidity					Multimorbidity vs no morbidity				
Variable	**B**	**Sig.**	**Exp (B) (OR)**	**95% C.I. for Exp(B)**		**B**	**Sig.**	**Exp (B) (OR)**	**95% C.I. for Exp(B)**		**B**	**Sig.**	**Exp (B) (OR)**	**95% C.I. for Exp(B)**	
				Lower	Upper				Lower	Upper				Lower	Upper
BMI															
Normal	Ref														
Overweight	0.68	0.09	1.97	0.90	4.34	0.77	0.06	2.16	0.97	4.80	0.84	0.04	2.32	1.03	5.22
Obese	0.98	0.01	2.65	1.22	5.77	1.40	0.001	4.04	1.85	8.85	1.49	0.001	4.42	1.99	9.80
Age Group															
50-60	Ref														
61-70	-0.49	0.30	0.61	0.24	1.54	-0.57	0.23	0.57	0.22	1.45	0.77	0.15	2.15	0.75	6.12
71-80	-0.58	0.30	0.56	0.19	1.67	-0.45	0.43	0.64	0.21	1.94	1.19	0.05	3.20	0.99	10.98
81+	-0.18	0.82	0.84	0.19	3.64	0.09	0.90	1.10	0.25	4.78	1.64	0.04	5.14	1.10	24.08
Gender															
Female	Ref														
Male	-0.92	0.01	0.40	0.20	0.80	-0.90	0.01	0.41	0.20	0.81	-1.00	0.01	0.37	0.18	0.74
Marital status															
Married	Ref														
Unmarried/others	-0.58	0.07	0.56	0.30	1.06	-0.36	0.27	0.70	0.37	1.32	-0.17	0.60	0.84	0.44	1.61
Smoking															
No	Ref														
Yes	1.87	0.02	6.48	1.30	32.39	1.75	0.03	5.75	1.14	28.87	1.95	0.02	7.02	1.39	35.56
Alcohol															
Never/Rarely	Ref														
Frequently /Daily	0.25	0.45	1.28	0.68	2.40	0.01	0.97	1.01	0.54	1.92	-0.08	0.81	0.92	0.48	1.76
Education															
Never/ ≤14	Ref														
15–18	-0.75	0.43	0.48	0.08	3.00	-0.73	0.44	0.48	0.08	3.03	-1.22	0.19	0.29	0.05	1.85
≥19/ not yet finished	-0.39	0.70	0.68	0.09	4.85	-0.72	0.47	0.49	0.07	3.50	-1.44	0.15	0.24	0.03	1.71
Employment															
Retired/ unemployed	Ref														
Employed	-0.36	0.37	0.70	0.32	1.52	-1.00	0.01	0.01	0.17	0.81	-1.55	0.001	0.21	0.09	0.49
Intercept	4.08	0.00 1				3.88	0.001				2.62	0.02			

(Objective health status coding: no morbidity (0), single morbidity (1), comorbidity (2) and multimorbidity (3))

Table 5.10 displays the results of multiple linear regression analysis to predict the strength of the impact of ten predictors independently and jointly on an individual's subjective wellbeing. In this model, an unadjusted model represents the independent effect of an individual's BMI,

age, and other predictors on an individual's wellbeing. In addition, the interaction effects (adjusted model) are added to determine whether the effect of respondent's BMI depends on the values of other predictors while predicting participant's wellbeing.

Moreover, unadjusted and adjusted multiple linear regression analysis models estimate the model coefficients (unstandardised or standardised) whether these coefficients are equal to 0 in a sample, where the coefficients are statistically significantly ≠ 0 if the probability (p) < 0.05. The mathematical equation that is applied to predict the multiple linear regression model is:

$$Y = \beta 0 + (\beta 1 X1 + \beta 2\, X2 + \cdots + \beta n Xn) + \epsilon.$$

Where, "Y" denoting the target variable, that is respondent's poor wellbeing by CASP-19 score, "β_0" and "β_1 to β_n" are the constants represent the intercept of the line on Y-axis and the slope of the line respectively and "ϵ" denoting the standard error. In addition, X_1, X_2…Xn represents the number of predictors.

From Table 5.10, firstly, the unadjusted model shows that an individual's poor wellbeing increases with an individual's increasing degree of BMI. Compared to the normal weight individuals, on average every 1 kg/m2 increase in BMI for overweight and obese participants, we expect an increased risk of poor wellbeing of 0.39 and 1.27, respectively (B: 0.39, 95% CI: -0.28 to 1.05, p > 0.05, and B: 1.27, 95% CI: 0.66 to 1.88, p < 0.01, respectively), where the risk is significant for the obese individuals but insignificant for the individuals who were overweight. At the same time, compared to 50–60-year age group, every 1-year increase of age in average for the participants of 61-70 and 71–80-year age groups, we expect a reduced risk of poor wellbeing of 1.43 and 0.32 respectively (B: -1.43, 95% CI: -2.10 to -0.77, p < 0.01) and B: -0.32, 95% CI: -1.04 to 0.41, p > 0.05, respectively). Nevertheless, the risk of having poor wellbeing was strongly increased by 1.85 for the oldest old (aged 81+ year) adults (B:

1.85, 95% CI: 0.96 to 2.74, $p < 0.01$). Likewise, compared to females, married individuals and non-smokers, the average risk of poor wellbeing was higher by 0.17 units, 2.82 units and 3.18 units for those who were males, unmarried/single/divorced/widowed and current smokers, respectively (B: 0.17, 95% CI: -0.33 to 0.68, $p < 0.05$; B: 2.82, 95% CI: 2.30 to 3.36, $p < 0.01$; and B: 3.18, 95% CI: 2.27 to 4.10, $p < 0.01$, respectively). Compared to never or rare alcohol drinkers and retired or unemployed participants, the average risk of poor wellbeing was strongly reduced by 3.11 units and 1.86 units for their frequent or daily drinker and employed counterparts, respectively (B: -3.11, 95% CI: -3.61 to -2.60, $p < 0.01$, and B: -1.86, 95% CI: -2.42 to -1.31, $p < 0.01$, respectively). Assuredly, being highly educated strongly reduced the risk of an individual's poor wellbeing. Compared to the individuals with no education or minimum education (/≤14 years), having the highest education (≥19 years/ not yet finished) and finishing education between 15-18 years significantly lower the average risk of poor wellbeing by 5.03 units and 2.57 units, respectively (B: -5.03, 95% CI: -6.16 to -3.90, $p < 0.01$, and B: -2.57, 95% CI: -3.59 to -1.54, $p < 0.01$, respectively). Undoubtedly, individuals with excellent/very good/good SHS significantly reduced the risk of poor wellbeing by 8.79 units (B: -8.79, 95% CI: -9.30 to -8.27, $p < 0.01$) compared to those who reported their SHS as fair or poor. Finally, it is noted that compare to the individuals with no morbidities, the average risk of poor wellbeing was higher by 0.79 units, 2.85 units and 4.70 units for those with single morbidity, comorbidity and multimorbidity, respectively (B: 0.79, 95% CI: -1.43 to 3.01, $p > 0.05$; B: 2.85, 95% CI: 0.61 to 5.09, $p < 0.05$, and B: 4.70, 95% CI: 2.44 to 6.96, $p < 0.01$, respectively). However, the risk of having poor wellbeing was significant for those with comorbidity and multimorbidity but insignificant for those with single morbidity.

The adjusted model (Table 5.10) evaluates that compared to the normal weight individuals, on average, every 1 kg/m2 increase in BMI for overweight and obese participants, we expect an increased risk of poor wellbeing of 0.22 units and 0.98 units respectively (B: 0.22, 95% CI: -

0.7328 to 1.18, $p > 0.05$, and B: 0.98, 95% CI: 0.08 to 1.89, $p < 0.05$, respectively), while other variables held constant. The risk of having poor wellbeing was significantly higher for an obese individual, but the risk was insignificant for overweight individuals.

Paradoxically, increasing age strongly reduced the risk of having poor wellbeing when the model is adjusted for BMI and other variables. Likewise, in the unadjusted model, when compared to 50–60-year age group, every 1-year increase of age in average for the participants of 61-70 and 71–80-year age groups, we expect a reduced risk of poor wellbeing of 3.76 units and 3.93 units, respectively (B: -3.76, 95% CI: -4.89 to -2.62, $p < 0.01$, and B: -3.93, 95% CI: -5.22 to -2.63, $p < 0.01$, respectively). Unlike the unadjusted model, the average risk of poor wellbeing was significantly lower by 3.26 units for the oldest old (aged 81+ years) adults (B: -3.26, 95% CI: -4.81 to -1.72, $p < 0.01$. In addition, compared to females, males insignificantly reduced the average risk of poor wellbeing by 0.07 units ($p > 0.05$, B: -0.07, 95% CI: -0.81 to 0.68) with the effect of other variables.

Alike the unadjusted model, compared to married individuals and non-smokers, the hazard of poor wellbeing was significantly higher by 1.51 units and 1.28 units for those who were unmarried/single/divorced/widowed and current smokers, respectively (B: 1.51, 95% CI: 0.78 to 2.52, $p < 0.01$, and B: 1.28, 95% CI: 0.27 to 2.30, $p < 0.05$, respectively).

Moreover, compared to never or rare alcohol drinkers and retired or unemployed participants, the average risk of poor wellbeing was strongly reduced by 1.00 units and 1.30 units for their frequent or daily drinkers and employed counterparts, respectively (B: -1.00, 95% CI: -1.71 to -0.28, $p < 0.05$, and B: -1.30, 95% CI: -2.33 to -0.27, $p < 0.05$, respectively). However, unlike the independent relation between an individual's level of education and the risk of having poor wellbeing, being highly educated insignificantly increased the risk of an individual's poor wellbeing with the presence of BMI, age, and other predictors. Compared to the individuals

with no education or minimum education (/≤14 years), having the highest education (≥19 years/ not yet finished) and finishing education between 15-18 years increased the average risk of poor wellbeing by 0.29 units and 0.45 units, respectively (B: 0.29, 95% CI: -1.31 to 1.90, $p > 0.05$, and B: 0.45, 95% CI: -0.93 to 1.82, $p > 0.05$, respectively). Likewise, the unadjusted model, individuals with excellent/very good/good SHS significantly reduced the hazard of poor wellbeing by 7.73 units (B: -7.73, 95% CI: -8.51 to -6.97, $p < 0.01$) compared to those who reported their SHS as fair or poor. Finally, it is noted that, unlike the unadjusted model, compare to the individuals with no morbidities, the average risk of poor wellbeing was insignificantly lower by 0.60 units for those with single morbidity (B: -0.60, 95% CI: -3.12 to 1.91, $p > 0.05$) while other variables held constant. Like the unadjusted model, the hazard of poor wellbeing was insignificantly higher by 0.15 units and 0.63 units for the individuals with comorbidity and multimorbidity, respectively (B: 0.15, 95% CI: -2.38 to 2.69, $p < 0.05$, and B: 0.63, 95% CI: -1.95 to 3.21, $p > 0.05$, respectively).

Table 5.10: Linear regression determining individuals' subjective wellbeing (Model C)

Variable	Unadjusted						Adjusted					
	Unstandardized Coefficients		Standardized Coefficients	Sig. (*p*-value)	95% C.I. for B		Unstandardized Coefficients		Standardized Coefficients	Sig. (*p*-value)	95% C.I. for B	
	B	S.E.	Beta		Lower	Upper	B	S.E.	Beta		Lower	Upper
BMI												
Normal	Ref											
Overweight	0.39	0.34	0.02	0.26	-0.28	1.05	0.22	0.49	0.01	0.65	-0.73	1.18
Obese	1.27	0.31	0.07	0.001	0.66	1.88	0.98	0.46	0.05	0.03	0.08	1.89
Age												
50-60	Ref											
61-70	-1.43	0.34	-0.08	0.001	-2.10	-0.77	-3.76	0.58	-0.19	0.001	-4.89	-2.62
71-80	-0.32	0.37	-0.02	0.39	-1.04	0.41	-3.93	0.66	-0.19	0.001	-5.22	-2.63
81+	1.85	0.45	0.07	.001	0.96	2.74	-3.26	0.79	-0.13	0.001	-4.81	-1.72
Gender												
Female	Ref											
Male	0.17	0.26	0.01	0.50	-0.33	0.68	-0.07	0.38	-0.01	0.87	-0.81	0.68
Marital status												
Married	Ref											
Unmarried/others	2.82	0.27	0.15	0.001	2.30	3.36	1.51	0.38	0.08	0.001	0.78	2.52
Smoking												
No	Ref											
Yes	3.18	0.47	0.12	0.001	2.27	4.10	1.28	0.52	0.05	0.01	0.27	2.30
Alcohol												
Never/Rarely	Ref											
Frequently /Daily	-3.11	0.26	-0.17	0.001	-3.61	-2.60	-1.00	0.37	-0.05	0.01	-1.71	-0.28
Education (left formal education at)												
Never/≤14	Ref											
15–18	-2.57	0.52	-0.12	0.001	-3.59	-1.54	0.45	0.70	0.02	0.53	-0.93	1.82
≥19/ not yet finished	-5.03	0.58	-0.22	0.001	-6.16	-3.90	0.29	0.82	0.01	0.72	-1.31	1.90
Employment												
Retired/ unemployed	Ref											
Employed	-1.86	0.28	-0.09	0.001	-2.42	-1.31	-1.30	-0.06	-0.06	0.01	-2.33	-0.27
Self- rated health status												
Fair/ Poor	Ref											
Excellent/ Good	-8.79	0.26	-0.42	0.001	-9.30	-8.27	-7.73	0.39	-0.40	0.001	-8.51	-6.97
Morbidities												
None	Ref											
Single morbidity	0.79	1.13	0.04	0.49	-1.43	3.01	-0.60	1.28	-0.03	0.64	-3.12	1.91
Comorbidity	2.85	1.14	0.14	0.01	0.61	5.09	0.15	1.29	0.01	0.91	-2.38	2.69
Multimorbidity	4.70	1.15	0.21	0.001	2.44	6.96	0.63	1.32	0.03	0.63	-1.95	3.21
Constant							43.29	1.62		.001	40.13	46.46

(Subjective wellbeing by CASP-19 scale, with higher scores reflect poor wellbeing)

5.5 Summary of the chapter

The chapter highlighted the rationale for choosing the different models to analyse the association between varieties of study variables selected according to the re-evaluated measuring instruments (discussed in chapter 4) to answer the second research question and achieve the goal of the study. In addition, it critically discussed the strategies of building different regression models that would be suitable enough to predict the study's outcome under the influence of different predictors. The statistical analyses were performed to satisfy the second research question of the study. The findings were exhibited with bivariate table and the outcome tables of multivariate logistic regression analysis.

The statistical analyses explored those older adults (aged 50 years and over) who were overweight and obese were progressively vulnerable to increasing odds of poor subjective and objective health status and poor wellbeing in an adjusted model compared to their normal-weight counterparts. In addition, obesity by BMI classification strongly predicted the participant's SHS, complex morbidities and poor wellbeing. On the other hand, compared to the 50-60 years age group, increasing age increased the odds of multimorbidity and only for the oldest old, increased the odds of comorbidity, whereas increasing age reduced the odds of single morbidity in an adjusted model. Surprisingly, increasing age reduced the odds of poor SHS and poor wellbeing among older adults. In addition, participants who were female, unmarried/single/widowed/divorced, low level of education, retired/unemployed and current smokers were progressively vulnerable to increased odds of complex morbidities. Whereas participants who were male, unmarried/single/widowed/divorced, low level of education, retired/unemployed and current smokers were progressively vulnerable to increasing odds of poor SHS and poor wellbeing. Moreover, although the increasing frequency of alcohol increased the odds of single morbidity and comorbidity, it reduced the odds of multimorbidity, poor SHS and poor wellbeing among older adults. Finally, although older adult's good SHS

significantly reduced the odds of poor wellbeing, the effect of objective health status (except single morbidity) concerning comorbidity and multimorbidity; however, were insignificant.

Therefore, the findings revealed the fact that older adults who were overweight and obese increased the risk of poor SHS, complex morbidities, and poor wellbeing than their normal-weight counterparts, with obesity as a strong predictor. The third hypothesis (H_0) of the study will be tested in the following chapter regarding the social care need due to the high BMI level among older adults in England.

CHAPTER 6

Association between body mass index (BMI) and social care needs in older adults

6.1 Introduction

The chapter will address the third research question of the PhD project. It aims to examine the association between BMI and social care needs among older adults (50+ years) in England. The analysis is based on the selected variables of the ELSA wave 8 data set. The research question and related hypotheses have already been discussed in chapter 2 and chapter 3. Variables used in this chapter have also been discussed in chapter 4.

This chapter will focus on building multivariate statistical models to determine key factors associated with BMI and social care needs in older adults. The statistical analysis results will be displayed in tabular forms with a note of discussion for each table. Finally, to accept or reject the null hypothesis (H_0), the overall summary of the results will be highlighted at the end.

6.2 Variables and the model selection

The dependent variables of the 3rd research question are drawn from the conceptual framework (as discussed in chapter 2) of the study, and the established theoretical backgrounds support that well. Those are the amount of informal social care received (unpaid) and the amount of formal social care received (by state-provided home help service and privately paid received). Respectively, six and eight different sources of informal and formal care providers are identified from the ELSA data set. The definition of social care need, the sources of care by

informal and formal support, data collection method, and coding of the variables are discussed in Chapters 2 and 4.

As discussed in Chapter 2 (2.12) and Chapter 4 (p.119), the increasing level of BMI, individual's socio-demographic, socio-economic lifestyle or behavioural factors, physical and mental health have an association with the amount of social care received. These are- age, gender, marital status, co-residence status, smoking, alcohol consumption, employment status, level of education, self-reported general health, ADL and IADL disability, and limiting long-standing illness and wellbeing by CASP-19 scale.

The self-reported health status is grouped into excellent, very good, good, fair, and poor (as explained in chapter 4) for exploratory data analysis and as fair/poor (0) and excellent/very good/good (1) for regression analysis. Description of all variables used in the study and their summary analysis based on the ELSA dataset are displayed in Table 4.1.

It is intended to apply exploratory data analysis to test the associations between categorical variables using Chi-square (χ^2) statistics. In addition, binary logistic regression analyses to predict the individual association and the "strength of impact" of multiple predictors concerning the outcome variables are applied. While the outcome variables are- informal social care received and formal social care received are dichotomous (0,1), it is justified to apply a binary logistic regression model to separately explore the association between the predictors and each outcome variable. The absence of multicollinearity for the regression models is checked by assessing variance inflation factor (VIF) values with the help of SPSS, where VIF results are found below five. Hence the models are considered as absent of multicollinearity (Dhakal, 2019). The results of the multicollinearity test are displayed in Table 6.1.

Table 6.1: The results of the multicollinearity test

Predictors for the dependent variables	Statistics VIF
BMI Group (normal, overweight and obese)	1.145
Age Group (50-60, 61-70. 71-80 and 81+)	1.595
Gender (female and male)	1.159
Marital status (married and unmarried)	2.418
Cohabiting status (none and at least one)	2.467
Current smoking history (not smoker and current smoker)	1.086
Current alcohol intake in last 12 months (never / rarely and frequently / daily)	1.101
Age, full-time school education completed (≤14 years /never, 15–18 years and ≥19 years / not yet finished)	1.118
Employment status (Un-employed/retired and employed/self-employed	1.480
ADL disability (none and at least one)	1.548
IADL disability (none and at least one)	1.593
Self-rated health status (fair/poor and excellent/very good/good)	1.605
Self-reported long-standing illness (no and yes)	1.298
Poor wellbeing by CASP19	1.368

The regression models are also tested to be validated by determining how well a regression model fits the data as demonstrated in Table 6.2 (for informal care received) and Table 6.3 (for formal care received).

Table 6.2: Model fit summary for the outcome variable- Informal care received.

Model Summary

Step	-2 log likelihood	Cox& Snell R Square	Nagelkerke R Square
1	1635.240a	0.361	0.580

a. Estimation terminated at iteration number 6 because parameter estimates changed by less than 0.001.

Classification Table (The cut value is 0.500)

Predicted Informal care received.

Observed			None	At least one	Percentage Correct
Step 1	Informal care received	None	2368	135	94.6
		At least one	213	380	64.0
	Overall Percentages				88.7

From the above model fit 'summary table' (Table 6.2), R^2 value =36.1% of variability accounted for by the model.

Table 6. 3: Model fit summary for the outcome variable- Formal care received.

Model Summary

Step	-2 log likelihood	Cox& Snell R Square	Nagelkerke R Square
1	885.207a	0.118	0.349

a. Estimation terminated at iteration number 8 because parameter estimates changed by less than 0.001.

Classification Table (The cut value is 0.500)

Predicted Formal care received.

Observed			None	At least one	Percentage Correct
Step 1	Formal care received	None	2918	16	99.5
		At least one	147	15	9.5
	Overall Percentages				94.7

From the above model fit 'summary table' (Table 6.3), R^2 value = 11.8% of variability accounted for by the model.

6.3 Analysis based on ELSA Cross-sectional data

Table 6.4 presents the result of descriptive statistics displayed on a bivariate table. The null hypothesis for part of the third research question is that there is no statistically significant

association between social care (either informal or formal) receiving and the increasing degree of BMI among obese older adults in England. All selected independent variables (BMI, age, gender, marital status, cohabiting status, smoking history, alcohol intake history, educational status, employment status, disability, subjective health status (SHS) and self-rated long-standing illness) are controlled for both models.

Results from the Chi-square (χ^2) statistical analysis (Table 6.4) shows that an individual's BMI is statistically significantly associated with both informal and formal social care received (χ^2 (4) =23.30, $p < 0.05$; and χ^2 (2) =15.16, $p < 0.05$, respectively). Except for an individual's smoking status, all other socio-demographic, behavioural, socio-economic and health and wellbeing covariates are strongly associated ($p < 0.01$) with both the informal and formal social care received.

Among the five weight groups depending on the high BMI, the most informal and formal care support were received by the obese participants, that is 43% and 41.2% respectively, out of all informal and formal support received.

In addition, individuals with moderate obesity received the most informal and formal social care (21.2% and 20.6%, respectively) among the three obese groups, as shown in Table 6.4. Moreover, it is found in Table 6.4 that overweight individuals received about 2.5 times and two times more informal and formal social care support, respectively, than their normal-weight counterparts. For the oldest old, receipt of informal and formal care support was respectively 3.3 times and 9.3 times more than the participants aged 50–60-years.

In addition, females received 27.8% and 29.4% more informal and formal care support, respectively than male participants. Nizalova et al. (2018) also evaluated those females are more likely to use social care from any sources in the future than males. Moreover, married and participants with at least one co-resident tend to receive more informal care support (54.9%

and 64.9% respectively), but less formal support (36.3% and 43.1% respectively) than the unmarried/single/widowed/divorced and the participants with no co-residents.

Interestingly, current non-smokers and none or rare alcohol drinkers received 67.6% and 22.6% more informal and 74.6% and 13.4 % more formal care support, respectively than current smokers and frequent or daily drinkers. In addition, it is noticeable that older adults with the highest level of education (≥19 years/not yet finished) and in employment received the least informal (10.3% and 7.2%, respectively) and formal (12.5% and 3.5%, respectively) social care than their less educated and unemployed counterparts, whereas participants with a medium level of education (finished formal education between 15-18 year) received the maximum social care support, both informal and formal, among the three education groups. Not surprisingly individuals with at least one ADL and IADL disability received respectively 1.5 times and 2.8 times more informal care and 1.4 times and 4.1 times more formal care support than the individuals with no ADL and IADL disabilities.

Finally, participants with fair or poor SHS and with long-standing illness acquired a large proportion of both informal (66.3% and 90%, respectively) and formal social care (62% and 88.6%, respectively) support than the participants with excellent/very good/good health status and no long-standing illness.

Table 6.4: Cross-tabulation to determine social care received.

Variables	Social care received							
	Informal				Formal			
	None		At least one		None		At least one	
BMI	N	%	N	%	N	%	N	%
Normal	1345	29.1	292	28.7	1536	28.7	100	34.7
Overweight	1382	29.9	287	28.2	1600	29.9	69	24.0
Moderate obesity	1048	22.7	215	21.2	1204	22.5	59	20.6
Severe obesity	557	12.1	117	11.5	645	12.1	28	9.8
Morbid obesity	283	6.1	105	10.3	356	6.7	31	10.8
TOTAL	4615	82.0	1016	18.0	5341	94.9	287	5.1
Respondents	5631				5631			
P -value	0.001 χ^2 =23.30				0.004 χ^2 =15.16			
Age								
50-60	1246	27.0	101	9.9	1333	24.9	14	4.9
61-70	1876	40.6	287	28.2	2106	39.3	57	19.8
71-80	1115	24.1	298	29.3	1327	24.8	86	29.9
81+	386	8.3	331	32.5	586	10.9	131	45.5
TOTAL	4623	82.0	1017	18.0	5352	94.9	288	5.1
Respondents	5640				5640			
P -value	0.001 χ^2 =527.20				0.001 χ^2 =332.46			
Gender								
Female	2199	47.6	650	63.9	2662	49.7	187	64.7
Male	2424	52.4	367	36.1	2690	50.3	102	35.3
TOTAL	4623	82.0	1017	18.0	5352	94.9	289	5.1
Respondents	5640				5641			
P -value	0.001 χ^2 =89.11				0.001 χ^2 =24.57			
Marital status								
Married	3131	67.8	558	54.9	3584	67.0	105	36.3
Unmarried/others	1490	32.2	458	45.1	1764	33.0	184	63.7
TOTAL	4621	82.0	1016	18.0	5348	94.9	289	5.1
Respondents	5637				5637			
P -value	0.001 χ^2 =60.67				0.001 χ^2 =114.14			
Co-residents								
None	995	21.5	357	35.1	1189	22.2	164	56.9
At least one	3628	78.5	660	64.9	4163	77.8	124	43.1
TOTAL	4623	82.0	1017	18.0	5352	94.9	288	5.1
Respondents	5640				5640			
P -value	0.001 χ^2 =84.36				0.001 χ^2 =180.762			
Smoking								
No	2408	84.8	607	83.8	2836	84.5	178	87.3

Yes	430	15.2	117	16.2	521	15.5	26	12.7
TOTAL	2838	79.7	724	20.3	3357	94.3	204	5.7
Respondents	3562				3561			
P -value	0.502 χ^2 =0.45				0.286 χ^2 =1.14			
Alcohol								
None/Rarely	1687	40.5	516	61.3	2072	43.4	131	56.7
Frequently/Daily	2480	59.5	326	38.7	2705	56.6	100	43.3
TOTAL	4167	83.2	842	16.8	4777	95.4	231	4.6
Respondents	5009				5008			
P -value	0.001 χ^2 =122.98				0.001 χ^2 =15.90			
Education								
Never/≤14	213	4.6	190	18.7	331	6.2	71	24.7
15–18	3403	73.6	722	71.0	3944	73.7	181	62.8
≥19/ not yet finished	1006	21.8	105	10.3	1075	20.1	36	12.5
TOTAL	4622	82.0	1017	18.0	5350	94.9	288	5.1
Respondents	5639				5638			
P -value	0.001 χ^2 =287.21				0.001 χ^2 =143.11			
Employment								
Retired/unemployed	2929	63.9	937	92.8	3587	67.6	279	96.5
Employed	1657	36.1	73	7.2	1720	32.4	10	3.5
TOTAL	4586	82.0	1010	18.0	5307	94.8	289	5.2
Respondents	5596				5596			
P -value	0.001 χ^2 =323.77				0.001 χ^2 =107.55			
ADL disability								
None	4267	92.3	414	40.7	4562	85.2	119	41.3
At least one	356	7.7	603	59.3	790	14.8	169	58.7
TOTAL	4623	82.0	1018	18.0	5352	94.9	288	5.1
Respondents	5640				5640			
P -value	0.001 χ^2 =1572.25				0.001 χ^2 =373.55			
IADL disability								
None	4245	91.8	266	26.1	4454	83.2	57	19.7
At least one	378	8.2	752	73.9	898	16.8	232	80.3
TOTAL	4623	82.0	1018	18.0	5352	94.9	289	5.1
Respondents	5641							
P -value	0.001 χ^2 =2247.54				0.001 χ^2 =1572.25			
Self-rated general health status								
Excellent	630	13.6	18	1.8	645	12.1	3	1.0
Very good	1563	33.8	72	7.1	1605	30.0	30	10.5
Good	1560	33.8	253	24.9	1737	32.5	76	26.5
Fair	702	15.2	364	35.8	967	18.1	98	34.1

Poor	167	3.6	310	30.5	397	7.4	80	27.9
TOTAL	4622	82.0	1017	18.0	5351	94.9	287	5.1
Respondents	5639				5638			
P -value	0.001 χ^2 =1226.59				0.001 χ^2 =232.60			
Self-reported long-standing illness								
No	2451	53.0	102	10.0	2520	47.1	33	11.4
Yes	2171	47.0	916	90.0	2831	52.9	256	88.6
TOTAL	4622	82.0	1018	18.0	5351	94.9	289	5.1
Respondents	5640				5640			
P -value	0.001 χ^2 =622.87				0.001 χ^2 =140.85			

Table 6.5 displays the outcome of binary logistic regression analysis to predict the strength of the impact of thirteen predictors independently and jointly for individual's demand of informal social care support. Here the unadjusted model represents the sole effect of an independent variable such as BMI, age, and other predictors determining the amount of informal social care support. However, in the adjusted model, selected independent variables are considered together to predict the effect of BMI on the amount of informal social care support received.

Firstly, all variables except overweight, moderate, and severe obesity and individual's smoking status are significant at the 5% level in the unadjusted models. Compared to the normal-weight individuals, the demand for informal social care was strongly associated with the individuals who were morbidly obese, and the receipt of informal care was increased by 71% (OR: 1.71, 95% CI: 1.32-2.21) for them. The overweight, moderate, and severe obese respondents insignificantly reduced the demand of informal care by 4% (OR: 0.96, 95%CI: 0.80-1.15), 5% (OR: 0.95, 95%CI: 0.78-1.15), and 3% (OR: 0.97, 95%CI: 0.77-1.23) respectively. Although, according to Copley et al. (2017), BMI is positively associated with the self-reported need for social care in an unadjusted model, this does not explain if BMI is positively associated with the receipt of social care.

Nonetheless, increasing age is strongly associated with the demand for informal care independently. Compared to the 50–60-year age group, the odds of receiving informal care increased about 2, 3 and 11 for 61–70-year, 71-80 year and 81+ year groups respectively (OR: 1.89, 95%CI: 1.49-2.39, $p < 0.01$; OR: 3.29, 95% CI: 2.59-4.18, $p < 0.01$; and OR: 10.58, 95%CI: 8.23-13.58, $p < 0.01$, respectively). Interestingly, older adults who were male, had positive co-residence status and employed significantly reduced the odds of receiving informal care support by 48% (OR: 0.52, 95%CI: 0.45-0.59, $p < 0.01$), 49% (OR: 0.51, 95% CI: 0.44-0.59, $p < 0.01$) and 86% (OR: 0.14, 95% CI: 0.11-0.18, $p < 0.01$), respectively than their females, having no co-residents and retired or unemployed counterparts. However, compared to married, unmarried/single/widowed/divorced independently strongly increased the odds of receiving informal care support by 72% (OR: 1.72, 95% CI: 1.50-1.98, $p <0.01$). In addition, compared to the non-smokers, the odds of receiving informal care support increased by 9% for the current smokers (OR: 1.09, 95% CI: 0.87-1.36, $p > 0.05$). The odds of receiving informal care significantly decreased by 57% (OR: 0.43, 95%CI: 0.37-0.50, $p <0.01$) for the frequently or daily alcohol drinkers than their none or rare alcohol intake counterparts. Moreover, individuals with a high level of education strongly reduced the amount of informal social care received. Compared to the individuals with the minimum level of education (never/ ≤ 14year), the odds of receiving informal care significantly reduced by 88% (OR: 0.12, 95%CI: 0.09-0.15, $p <0.01$) and 76% (OR: 0.24, 95% CI: 0.19-0.29, $p <0.01$) for having the highest education (≥19 years/ not yet finished) and a medium level of education (finishing education between 15-18 year), respectively. Undoubtedly, individuals with at least one ADL and IADL disability, self-rated long-standing illness and poor wellbeing were strongly associated with the increased demand of receiving informal care support. Compared to the individuals with no ADL and IADL disabilities and no long-standing illness, disabled individuals with at least one ADL and IADL and having long-standing illness significantly increased the odds of receiving informal

care of 17.4, 31.9 and 10.2 times respectively (OR: 17.44, 95%CI: 14.78-20.58, p <0.01; OR: 31.87, 95% CI: 26.75-37.98, p <0.01; and OR: 10.22, 95% CI: 8.26-12.65, p <0.01, respectively). In addition, respondents who had poor wellbeing significantly increased the odds of receiving informal care by 9% (OR: 1.09, 95% CI: 1.08-1.09, p <0.01). Finally, compare to the individuals who reported their health status as fair or poor, individuals with excellent/very good/good health status significantly reduced the odds of receiving informal social care by 88% (OR: 0.12, 95%CI: 0.10-0.14, p <0.01).

The adjusted model evaluates that compared to the normal weight participants, being overweight, moderate, severe, and morbidly obese increased the odds of receiving informal care by 19%, 45%, 0.01% and 42%, respectively (OR: 1.19, 95% CI: 0.84-1.68, p > 0.05; OR: 1.45, 95% CI: 1.10-2.11, p = 0.05; OR: 1.01, 95% CI: 0.64-1.59, p > 0.05; and OR: 1.42, 95% CI: 0.86-2.35, p > 0.05, respectively).

Nevertheless, compare to the 50–60-year age group, the odds of receiving informal care strongly increased by 163% and 437% for 71-80 year and 81+ year cohorts, respectively (OR: 2.63, 95% CI: 1.56-4.44, p < 0.01; and OR: 5.37, 95% CI: 3.00-9.63, p < 0.01, respectively), while only 56% increased for 61-70 year (OR: 1.56, 95% CI: 0.95-2.55, p > 0.05). Likewise, the unadjusted model, older adults who were male, had positive co-residence status and employed reduced the odds of receiving informal care support by 53% (OR: 0.47, 95% CI: 0.35-0.62), 13% (OR: 0.87, 95% CI: 0.54-1.40) and 31% (OR: 0.69, 95% CI: 0.43-1.10) than their respective counterparts, respectively, although the associations are insignificant for an individual's co-residence and employment status, significant with their gender.

Unlike the unadjusted model, compared to married, unmarried/single/widowed/divorced significantly reduced the odds of receiving informal care support of 41% (OR: 0.59, 95%CI: 0.37-0.91, p < 0.05). Like the unadjusted model, compared to the non-smokers, the odds of

receiving informal care support insignificantly increased by 23% for the current smokers (OR: 1.23, 95%CI: 0.85-1.78, $p > 0.05$). Moreover, compared to the none or rare alcohol drinkers, the odds of receiving informal care insignificantly decreased by 13% (OR: 0.87, 95% CI: 0.67-1.13, $p > 0.05$) for the frequently or daily alcohol drinkers. In addition, older adults with a high level of education strongly reduced informal social care support receipt. Compared to the individuals with a minimum level of education, having the highest education and medium level of education significantly reduced the odds of receiving informal care by 55% (OR: 0.45, 95% CI: 0.26-0.79) and 41% (OR: 0.59, 95% CI: 0.38-0.90) respectively. Moreover, individuals having at least one ADL and IADL disability and self-rated long-standing illness were significantly associated with the increased number of receiving informal care support when the model is adjusted for BMI, age, and other variables. Compared to the individuals with no ADL and IADL disability and no long-standing illness, disabled with at least one ADL and IADL and having long-standing illness significantly increased the odds of receiving informal care by 280%, 734% and 185%, respectively (OR: 3.80, 95% CI: 2.85-5.07, $p <0.01$; OR: 8.34, 95% CI: 6.35-10.95, $p <0.01$; and OR: 2.85, 95% CI: 1.99-4.06, $p <0.01$, respectively). The respondents who had poor wellbeing insignificantly increased the odds of receiving informal care by 0.01% (OR: 1.01, 95% CI: 1.00-1.03, $p <0.01$). Nevertheless, compared to the individuals who reported their health status as fair or poor, individuals with excellent/very good/good health status significantly reduced the odds of receiving informal social care by 48% (OR: 0.52, 95% CI: 0.39-0.70, $p <0.01$).

Table 6.5: Determining informal social care receiving.

Variable	Unadjusted						Adjusted					
	B	S.E.	Sig.	Exp (B) (OR)	95% C.I. for Exp(B)		B	S.E.	Sig.	Exp (B) (OR)	95% C.I. for Exp(B)	
					Lower	Upper					Lower	Upper
BMI												
Normal	Ref											
Overweight	-0.04	0.09	0.64	0.96	0.80	1.15	0.17	0.18	0.33	1.19	0.84	1.68
Moderate obesity	-0.06	0.10	0.57	0.95	0.78	1.15	0.37	0.19	0.05	1.45	1.10	2.11
Severe obesity	-0.03	0.12	0.82	0.97	0.77	1.23	0.01	0.23	0.98	1.01	0.64	1.59
Morbid obesity	0.54	0.13	0.001	1.71	1.32	2.21	0.35	0.26	0.18	1.42	0.86	2.35
Age												
50-60	Ref											
61-70	0.64	0.12	0.001	1.89	1.49	2.40	0.44	0.25	0.08	1.56	0.95	2.55
71-80	1.19	0.12	0.001	3.29	2.59	4.18	0.97	0.27	0.001	2.63	1.56	4.44
81+	2.36	0.13	0.001	10.58	8.23	13.59	1.68	0.30	0.001	5.37	3.00	9.63
Gender												
Female	Ref											
Male	-0.66	0.07	0.001	0.52	0.45	0.59	-0.76	0.14	0.001	0.47	0.35	0.62
Marital status												
Married	Ref											
Unmarried/others	0.54	0.07	0.001	1.72	1.50	1.98	-0.54	0.23	0.02	0.59	0.37	0.91
Co-residence												
None	Ref											
At least one	-0.68	0.08	0.001	0.51	0.44	0.59	-0.14	0.24	0.56	0.87	0.54	1.40
Smoking												
No	Ref											
Yes	0.08	0.11	0.47	1.09	0.87	1.36	0.21	0.19	0.27	1.23	0.85	1.78
Alcohol												
Never/Rarely	Ref											
Frequently /Daily	-0.84	0.08	0.001	0.43	0.37	0.50	-0.14	0.13	0.31	0.87	0.67	1.13
Education												
Never/≤14	Ref											
15–18	-1.44	0.11	0.001	0.24	0.19	0.29	-0.53	0.22	0.02	0.59	0.38	0.90
≥19/ not yet finished	-2.15	0.14	0.001	0.12	0.09	0.15	-0.79	0.28	0.01	0.45	0.26	0.79
Employment												
Retired/ unemployed	Ref											
Employed	-1.98	0.13	0.001	0.14	0.11	0.18	-0.37	0.24	0.12	0.69	0.43	1.10
ADL disability												
None	Ref											
At least one	2.86	0.08	0.001	17.44	14.78	20.58	1.34	0.15	0.001	3.80	2.85	5.07
IADL disability												
None	Ref											
At least one	3.46	0.09	0.001	31.87	26.75	37.98	2.12	0.14	0.001	8.34	6.35	10.95

Self-rated general health status Fair/Poor Excellent/very good/Good	Ref -2.14	0.08	0.001	0.12	0.10	0.14	-0.65	0.15	0.001	0.52	0.39	0.70
Self-reported long-standing illness No Yes	Ref 2.32	0.11	0.001	10.22	8.26	12.65	1.05	0.18	0.001	2.85	1.99	4.06
Poor wellbeing by CASP-19 scale	0.08	0.00	0.001	1.09	1.08	1.09	0.01	0.01	0.13	1.01	1.00	1.03
Constant							-3.14	0.57	0.001	0.04		

(Informal social care coding: none (0) and at least one (1))

Table 6.6 displays the result of binary logistic regression examining the association between the formal social care received with increasing degree of BMI both independently and with the effect of age and other predictors.

Firstly, the unadjusted model shows that except for individuals' obesity status and smoking status, all other variables are significant at the 5% level in the unadjusted models. Older adults who were morbidly obese, independently increased the amount of formal social care received by 35% (OR: 1.35, 95%CI: 0.89-2.04, $p > 0.05$) than their normal weight counterparts. However, the numbers were significantly reduced by 34% (OR: 0.66, 95%CI: 0.48-0.91, $p < 0.05$) for overweight participants and reduced by 26% and 33% for moderate and severe obese participants, respectively (OR: 0.74, 95% CI: 0.54-1.04, $p > 0.05$; and OR: 0.67, 95% CI: 0.44-1.03, $p > 0.05$, respectively). Nonetheless, compare to 50-60-year age group increasing age strongly associated with the receipt of formal care independently. Compared to the 50–60-year age group, the odds of receiving formal care increased about 2.5, 6 and 20.5 for 61–70-year, 71-80 year and 81+ year age groups respectively (OR: 2.51, 95% CI: 1.40-4.48, $p < 0.01$; OR: 5.96, 95% CI: 3.40-10.46, $p < 0.01$; and OR: 20.55, 95% CI: 11.83-35.67, $p < 0.01$,

respectively). Anyhow, as similar as the informal care receipt, older adults who were male, had positive co-residence status and employed significantly reduced the odds of receiving formal care support by 46% (OR: 0.54, 95% CI: 0.42-0.69, p < 0.01), 93% (OR: 0.22, 95% CI: 0.17-0.28, p < 0.01) and 78% (OR: 0.07, 95% CI: 0.04-0.14, p < 0.01) than their respective counterparts, respectively. Moreover, it is noted that, compare to married, being unmarried/single/widowed/divorced independently strongly increased the odds of receiving formal care support of 257% (OR: 3.57, 95% CI: 2.79-4.57, p <0.01). In addition, older adults who were current smokers and had the increasing frequency of alcohol intake reduced the odds of receiving formal care support by 21% and 41%, respectively (OR: 0.79, 95% CI: 0.52-1.20, p > 0.05; and OR: 0.59, 95% CI: 0.45-0.77, p <0.01, respectively) than their non-smokers and the none or rare alcohol drinkers' counterparts. Compared to the individuals with the minimum level of education, having the highest education and medium level of education significantly reduced the odds of receiving informal care by 84% (OR: 0.16, 95% CI: 0.10-0.24, p <0.01) and 79% (OR: 0.21, 95% CI: 0.16-0.29, p <0.01), respectively. Unquestionably like the informal care receipt, an individual's disability by at least one ADL and IADL and self-rated long-standing illness were strongly associated with the increased number of receiving formal care support. Compared to the individuals with no ADL and IADL disability and no long-standing illness, disabled with at least one ADL and IADL and having long-standing illness significantly increased the odds of receiving formal care by 7.3, 20.4 and 7.1, respectively (OR: 8.25, 95% CI: 6.45-10.57, p <0.01; OR: 20.37, 95% CI: 15.09-27.49, p <0.01; and OR: 7.12, 95% CI: 4.91-10.33, p <0.01, respectively). In addition, older adults with poor wellbeing were significantly associated with the increased number of formal care receipts by 0.08% (OR: 1.08, 95% CI: 1.06-1.09, p <0.01). Nonetheless, compared to the individuals who reported their health status as fair or poor, the odds of receiving formal social care significantly reduced by

79% (OR: 0.21, 95% CI: 0.17-0.27, p <0.01) for the individuals with excellent/very good/good health status.

The adjusted model shows that older adults with moderate and morbid obesity increased the odds of formal social care receipt by 21% and 101%, respectively (OR: 1.21, 95% CI: 0.72-2.03, p > 0.05; and OR: 2.01, 95% CI: 1.08-3.71, p <0.05, respectively) than their normal-weight counterparts, although the association was insignificant with moderate obesity and significant with morbid obesity. However, like the unadjusted model, the amount of formal care received was reduced by 32% and 15% for the overweight and severe obese participants, respectively (OR: 0.68, 95% CI: 0.41-1.12, p > 0.05; and OR: 0.85, 95% CI: 0.45-1.63, p > 0.05, respectively), although the effects were insignificant.

Nevertheless, compared to the 50–60-year age group, the odds of receiving formal care insignificantly increased by 135% for 61-70 year (OR: 2.35, 95% CI: 0.90-6.12, p > 0.05), but strongly increased by 378% and 670% for 71-80 year and 81+ year age groups, respectively (OR: 4.78, 95% CI: 1.82-12.52, p < 0.01; and OR: 7.70, 95% CI: 2.82-21.06, p < 0.01, respectively). Likewise, in the unadjusted model, older males, had positive co-residence status and employed reduced the odds of receiving formal care support by 26%, 69% and 27%, respectively (OR: 0.74, 95%CI: 0.50-1.10, p > 0.05; OR: 0.31, 95%CI: 0.15-0.64, p <0.01; and OR: 0.73, 95%CI: 0.31-1.76, p > 0.05, respectively) than their females, having no co-residents and retired or unemployed counterparts, respectively. Although the effects were insignificant with gender and employment status, it was significant with individual's co-residence status.

Unlike the unadjusted model, unmarried/single/widowed/divorced individuals insignificantly reduced the odds of receiving formal care support of 29% (OR: 0.71, 95% CI: 0.34-1.49, p > 0.05) than their married counterparts.

Alike the unadjusted model, compared to the non-smokers, the odds of receiving formal care support insignificantly reduced by 23% for the current smokers (OR: 0.77, 95%CI: 0.43-1.38, $p > 0.05$). Nevertheless, compared to the none or rare alcohol drinkers, the odds of receiving formal care support insignificantly increased by 39% for the frequently or daily alcohol drinkers (OR: 1.39, 95% CI: 0.95-2.02, $p > 0.05$). Moreover, in contrast to the independent relation of education with formal social care, compared to the individuals with the minimum level of education, having the highest education insignificantly increased the odds of receiving formal care by 32% (OR: 1.32, 95% CI: 0.67-2.61, $p > 0.05$) with the effect of BMI, age, and other covariates. However, finishing education between 15-18 year insignificantly reduced the odds of receiving formal care by 20% (OR: 0.80, 95% CI: 0.47-1.35, $p > 0.05$). Furthermore, alike the unadjusted model of formal care, individual's IADL disability, and self-rated long-standing illness were strongly associated with the increasing number of receiving formal care support when the model is adjusted for BMI, age and other variables. However, the associations were insignificant with ADL disability and an individual's poor wellbeing status. Compared to the individuals with no disability with ADL and IADL and no long-standing illness, being disabled with at least one ADL and IADL and having long-standing illness increased the odds of receiving formal care of 40%, 641%, and 91%, respectively (OR: 1.40, 95% CI: 0.92-2.12, $p > 0.05$; OR: 7.41, 95% CI: 4.62-11.88, $p < 0.01$; and OR: 1.91, 95% CI: 1.08-3.37, $p < 0.05$, respectively).

On the other hand, the older adults who had poor wellbeing increased the odds of receiving formal care by 0.02% (OR: 1.02, 95%CI: 1.00-1.04, $p > 0.05$). In addition, compared to the individuals who reported their health status as fair or poor, individuals with excellent/very good/good health status insignificantly reduced the odds of receiving formal social care support by 20% (OR: 0.80, 95% CI: 0.52-1.26, $p > 0.05$).

Table 6.6: Determinants of receiving formal social care

Variable	Unadjusted						Adjusted					
	B	S.E.	Sig.	Exp (B) (OR)	95% C.I. for Exp(B)		B	S.E.	Sig.	Exp (B) (OR)	95% C.I. for Exp(B)	
					Lower	Upper					Lower	Upper
BMI												
Normal	Ref											
Overweight	-0.41	0.16	0.01	0.66	0.48	0.91	-0.38	0.26	0.13	0.68	0.41	1.12
Moderate obesity	-0.30	0.17	0.08	0.74	0.54	1.04	0.19	0.26	0.47	1.21	0.72	2.03
Severe obesity	-0.39	0.22	0.07	0.67	0.44	1.03	-0.16	0.33	0.63	0.85	0.45	1.63
Morbid obesity	0.30	0.21	0.16	1.35	0.89	2.04	0.70	0.31	0.03	2.01	1.08	3.71
Age												
50-60	Ref											
61-70	0.92	0.30	0.002	2.51	1.40	4.48	0.85	0.49	0.08	2.35	0.90	6.12
71-80	1.79	0.29	0.001	5.96	3.40	10.46	1.56	0.49	0.001	4.78	1.82	12.52
81+	3.02	0.28	0.001	20.55	11.83	35.67	2.04	0.51	0.001	7.70	2.82	21.06
Gender												
Female	Ref											
Male	-0.62	0.13	0.001	0.54	0.42	0.69	-0.30	0.20	0.13	0.74	0.50	1.10
Marital status												
Married	Ref											
Unmarried/others	1.27	0.13	0.001	3.57	2.79	4.56	-0.34	0.38	0.37	0.71	0.34	1.49
Co-residence												
None	Ref											
At least one	-1.53	0.12	0.001	0.22	0.17	0.28	-1.19	0.37	0.002	0.31	0.15	0.64
Smoking												
No	Ref											
Yes	-0.24	0.22	0.27	0.79	0.52	1.21	-0.26	0.30	0.37	0.77	0.43	1.38
Alcohol												
Never/Rarely	Ref											
Frequently /Daily	-0.53	0.14	0.001	0.59	0.45	0.77	0.33	0.19	0.09	1.39	0.95	2.02
Education												
Never/≤14	Ref											
15–18	-1.55	0.15	0.001	0.21	0.16	0.29	-0.23	0.26	0.40	0.80	0.47	1.35
≥19/ not yet finished	-1.86	0.21	0.001	0.16	0.10	0.24	0.28	0.35	0.42	1.32	0.67	2.61
Employment												
Retired/ unemployed	Ref											
Employed	-2.63	0.33	0.001	0.07	0.04	0.14	-0.31	0.45	0.49	0.73	0.31	1.76
ADL disability												
None	Ref											
At least one	2.11	0.13	0.001	8.25	6.45	10.57	0.34	0.21	0.12	1.40	0.92	2.12
IADL disability												
None	Ref											
At least one	3.01	0.15	0.001	20.37		27.49	2.00	0.24	0.001	7.41	4.62	11.88

					15.09							
Self-rated general health status												
Fair/Poor	Ref											
Excellent/very good/Good	-1.56	0.13	0.001	0.21	0.16	0.27	-0.22	0.23	0.34	0.80	0.52	1.26
Self-reported long-standing illness												
No	Ref											
Yes	1.96	0.19	0.001	7.12	4.91	10.33	0.65	0.29	0.03	1.91	1.08	3.37
Poor wellbeing by CASP-19 scale	0.07	0.01	0.001	1.08	1.06	1.09	0.02	0.01	0.09	1.02	1.00	1.04
Constant							-5.31	0.91	0.001	0.005		

(Formal social care coding: none (0) and at least one (1))

6.4 Summary of the chapter

The chapter highlighted the rationale for choosing the multivariate logistic regression models to analyse the association between varieties of study variables selected according to the re-evaluated measuring instruments (discussed in chapter 4) to answer the third research question and achieve the goal of the study. The statistical analyses were performed to satisfy the third research question of the study. The findings were exhibited with bivariate table and the outcome tables of multivariate regression analysis.

The statistical analyses have explored those older adults (aged 50 years and over) who are overweight and obese are positively associated with increasing self-reported receipt of informal social care support in an adjusted model. However, the self-reported receipt of formal care by state-provided home help service and privately paid for care varies according to the BMI categories. While moderate and morbid obesity increases the odds of formal care receipt, overweight and severe obesity reduces the odds of formal care receipt. Besides, morbid obesity is strongly and positively associated with formal care support receipt at a 5% level. Nevertheless, increasing age compared to 50-60 years strongly increases the odds of formal

care receipt. However, although increasing age for 71-80 years and the oldest old positively increases the odds of informal care receipt, 61-70 years of age group reduces the odds of informal care receipt. In addition, the older adults who are male, unmarried/single/widowed/divorced, have at least one co-resident, employed and have better SHS reduces the odds of informal and formal care receipt than their respective counterparts.

Furthermore, the older adults with functional impairment with at least one ADL and IADL, self-reported long-standing illness and poor wellbeing increases the odds of informal and formal care receipt. However, current smokers increase the odds of informal care receipt but reduces the odds of formal care receipt, whereas the increasing frequency of alcohol intake reduces the odds of informal care receipt but increases the odds of formal care receipt. Finally, although the increasing level of education reduces the odds of informal care receipt, the highest level of education increases the odds of formal care receipt compared to the basic level of education. However, a medium level of education reduces the odds of formal care receipt.

The number of difficulties by ADLs and IADLs, individual's self-rates health status and long-standing illness are the strongest predictors of receiving informal care support. However, for the receipt of formal care, an individual's disability by IADLs than ADLs and long-standing illness are the strongest predictors.

Therefore, the analyses demonstrate the fact that older adults who are overweight and obese are the receipts of increasing number of informal social care. Moreover, the moderate and morbidly obese participants are the receipts of increasing number of formal care than their normal-weight counterparts, with morbid obesity a strong predictor for formal care receipt. The fourth hypothesis (H_0) of the study will be tested in the following chapter regarding the unmet care needs for social care and support by BMI among older adults in England.

CHAPTER 7

Exploring unmet social care needs of older adults by BMI

7.1 Introduction

This chapter deals with the final research objective of the study, and the research question that was developed to achieve the goal is: What are the unmet social care needs of obese older adults? The 'unmet care need' for the present study is defined and discussed in Chapter 4 (p.121). In addition to evaluate the unmet care need among overweight and obese older adults, a framework has also been constructed and presented in Chapter 4 (See Figure 4.1).

From the previous analyses, it is established that obesity in older adults is positively associated with poor subjective and objective health status and wellbeing, while controlling for several socio-demographic, socio-economic and lifestyle and behavioural factors. Consequently, demand for receiving informal and formal social care support is expected to increase among older people with obesity. Therefore, exploring the unmet needs of social care or unmet expectations of individuals with high BMI (compared to normal weight) is an important area to study to ensure that social care services can meet the needs of obese older adults (See discussion in Chapter 2, p.66-69 and Chapter 4, p.121).

The full research methodology is discussed in Chapter 3. This chapter presents a critical evaluation of primary qualitative data analysis and submits the main findings of the qualitative interview data. In addition, participant's demographic profile is also briefly highlighted. Finally, the chapter is concluded by presenting a summary of the results of the fourth research question.

7.2 Data analysis

Data analysis is a systematic process that occurs throughout the research process rather than as an independent exercise to be carried out after data collection (Etherington, 2004). To fulfil the purpose of this research, it was essential to comprehend the way people represent themselves through their experience and the life stories that they create (supported by life course theory of obesity, as discussed in Chapter 2). Therefore, the narrative analysis was perceived as the perfect approach to reporting human experience and action, where a description of events was compiled through qualitative interviews. "Because people give meaning to their lives through the stories they tell" (Oliver, 1998, p. 244). However, not all stories are narratives, "a narrative refers to the wider accounts of social life that are drawn upon to tell a story" (Wong and Breheny, 2018, p. 246). Hence, this approach permits insight into individual beliefs, judgements and social situation and allows the researcher to understand the stories in the study context. However, revealing the truth is not the purpose of narrative analysis, instead researchers should recognise that there are possibilities of variation of truths (Holstein and Miller, 2007), that can be directed by participant's background and their socio-demographic or socio-economic conditions (Gergen, 1985). Certain types of queries, for example, 'What is the aim of the narration?' or 'Why is the respondent telling a story in this specific way?' and developing an interpersonal relationship and rapport between interviewer and interviewees, backed up a narrator for a narrative to be unfolded (Gilbert, 2008).

Among the four most common approaches of narrative analysis, structural analysis is the best suited, in which the primary focus is the way a story is built or presented (Holloway and Freshwater, 2007). On the other hand, the central focus of narrative, thematic analysis is on content within a passage, while dialogic or performance analysis focuses on the dialogic process between speaker and listener (Reissman, 2004), and visual narrative analysis combines images into the narrative analysis (Butina, 2015).

7.2.1 Structural narrative analysis procedures

Structural narrative analysis is a method of qualitative analysis that applies a structure to analysing qualitative interview data (Herz et al., 2015). Morrill et al. (2000, p. 534–535) explains that stories can be distinguished according to the four elements of focus, plot structure (for example, if the narratives disclose successively), dramatic tension (how the prime disagreement of the story is signified), dramatic resolution (how the prime battle of the story is solved), and predominant outcomes (how the story surfaces) (Schutt, 2009). For the current study, the central plot that is the individual's 'unmet care needs for social care and support', is gradually unfolded through the narratives' structure. This focus on the story's plot allows a researcher to understand 'how' and 'why' of the story (Ahmed and Rogers, 2017). However, the structural narrative analysis has some limitations. Ahmed and Rogers (2017, p.2) argues that structural narrative analysis can become "…more focused on the intellect of the researcher than on the lives of the 'researched'". This was an aspect that was reflected on through the reflective diary and it is considered that "knowledge itself is contextual and perspective ridden, shaped by researchers and participants" (Ahmed and Rogers, 2017, p. 2).

Each narrative is structured with the five common chapters in the chronological move towards the unmet care need. While every participant's life journey and stories are different, outlining a story with five common chapters provides a sequence. Since "Narratives do not speak for themselves or have unanalysed merit; they require interpretation when used as data in social research" (Riessman, 2005, p. 2). Each narrative started with the character introduction which was followed by life in terms of disability, health status and life satisfaction, existing care and support, concluding the interview with whether the interviewee wants to add anything more for their own care and support and finally, the results of unmet social care/support needs. The structural narrative analysis process involves analysing the transcription verbatim along with

the digitalised field notes and reflective diary entry for one participant at a time. Each participant is presented separately to obtain an individual perception of the lived experience.

7.3 Research findings

Research findings are discussed under three headings: participant background profile, a summary of the narrative discussion, and interpretation of the narrative. Specific cases are purposefully selected for narratives according to the study objective. After reading all the transcripts several times, the interviews that answered the research question and provided the maximum information related to the study objective are chosen. The discussion of 'unmet care need' is framed around the framework (Figure: 4.1); the detailed description of the framework is presented in Chapter 4.

If the participants' reported 'unmet needs' are solely connected to the adverse effects of the COVID-19 pandemic, those participants are excluded from the narratives. Such as, unemployment/financial hardship (for example, *due to COVID company is closed […] we both* (partner too) *lost our jobs […] worried about money*) or social isolation/ loneliness (for example, *I am a very social person, due to COVID* (pandemic), *I feel terrible […] wish to see my family and friends […] I had a very good social gathering before COVID*). In addition, two participants are excluded from the narratives as their 'unmet needs' are not related to the study objectives, for example, a high school teacher mentioned, *students taunt me […] due to my accent […] wish less racism* and another interviewee mentioned that *I feel I am not in the right place […] I don't feel socially safe […] I am here to make money*. In the narratives, symbols like: *(.)* represents pauses and *[…]* represents omitted materials in the conversation, and italic words indicate the direct quotes from participants' talk, the exact way they told their narratives.

7.3.1 Participant profile

Table 7.1 outlines each participant's demographic and background information and anthropometric height and weight measurements, calculated BMI, and assigned weight category. Table 7.2 provides the percentage prevalence of key background characteristics of the participants. Participant's demographical details, including their gender, age, ethnicity, marital status, or existing partner, are obtained (Table 7.1). Participant's weight category is assigned according to the WHO BMI classification, as discussed in Chapter 4 (p.120) under social care need. Table 7.2 shows more male than female participants in the sample (54.5% vs 45.5%), and the participants are mainly in the 50-60 years age group (63.6%). There are no participants aged 81 years and over in selected 33 participants cohort; this may be due to the current pandemic and this age group physically isolating at home. The participants are also predominantly white British (66.7%) and married or having an existing partner (75.8%). There are many participants who are obese (45.5%).

Table 7.1: Anonymised demographic details of each participant

Interviewees by case number	Age	Gender	Ethnicity	Marital status/existing partner	Height (m)	Weight (kg)	BMI (kg/m2)	Weight status (WHO categorised)
1	78	Male	British	Yes	1.71	76	26	Overweight
2	50	Female	Indian/ Mauritian	Yes	1.65	115	42.4	Class III obesity
3	66	Male	Bulgarian	Yes	1.75	57	18.5	Normal
4	50	Male	Russian	Yes	1.70	60	23.2	Normal
5	60	Male	British	Yes	1.78	78	24.6	Normal
6	60	Female	British	No	1.54	56	23.6	Normal
7	57	Male	Pakistani	No	1.80	105	32.4	Class I obesity
8	58	Male	Indian	Yes	1.73	74	24.7	Normal
9	53	Female	African	Yes	1.60	102	39.8	Class II obesity
10	52	Female	British	No	1.60	102	39.8	Class II obesity
11	61	Female	British	Yes	1.55	105	43.7	Class III obesity
12	57	Female	Indian	Yes	1.52	79	26	Overweight
13	63	Male	British	Yes	1.75	87	28.4	Overweight
14	51	Male	Spanish	Yes	1.82	131	39.6	Class II obesity
15	75	Male	Greek	Yes	1.85	100	29.2	Overweight
16	58	Female	British	Yes	1.77	105	33.5	Class I obesity
17	59	Male	Pakistani	Yes	1.61	67	25.8	Overweight
18	62	Female	British	Yes	1.58	91	36.5	Class II obesity
19	66	Male	British	Yes	1.91	102	28	Overweight
20	52	Female	British	Yes	1.65	112	41.1	Class III obesity
21	73	Male	British	No	1.71	96	32.8	Class I obesity
22	55	Female	British	Yes	1.70	78	27	Overweight
23	54	Female	British	Yes	1.62	77	29.3	Overweight
24	69	Male	British	Yes	1.68	87	30.8	Class I obesity
25	60	Male	British	No	1.67	83	29.8	Overweight
26	69	Male	British	No	1.73	80	26.7	Overweight
27	52	Female	British	Yes	1.52	67	29	Overweight
28	63	Female	Italian	No	1.46	71	33.3	Class I obesity
29	56	Female	British	No	1.65	78	28.6	Overweight
30	57	Male	British	Yes	1.76	95	30.7	Class I obesity

31	74	Male	British	Yes	1.76	97	31.3	Class I obesity
32	53	Female	British	Yes	1.61	93	35.9	Class II obesity
33	55	Male	British	Yes	1.79	85	26.5	Overweight

Table 7.2: Background characteristics of the 33 participants

Variables	Number of participants	Percentages
Age group		
50-60	21	63.6
61-70	8	24.2
71-80	4	12.1
81+	None	None
Gender		
Female	15	45.5
Male	18	54.5
Ethnicity		
White British	22	66.7
Other	11	36.3
Marital status		
Married/existing partner	25	75.8
Unmarried/others	8	24.2
BMI groups		
Normal weight	5	15.2
Overweight	13	39.4
Moderately obese	7	21.2
Severely obese	5	15.2
Morbidly obese	3	9.1

7.3.2 Key outcome of narrative analysis

A summary of 10 older adults (aged 50+ years), where each of them experienced 'unmet care need', is presented below. All names in the narratives are pseudonyms. The unmet care needs for each participant are in bold.

#Case number 2:

Sunita (50 years, female, morbidly obese, positive cohabitation)

Sunita is a 50-year-old female, lives with her husband. She is from an Indian/ Mauritian ethnic background and is morbidly obese (BMI= 42.4kg/m2).

Life in terms of disability, health status and life satisfaction: Sunita faces difficulty with several tasks in daily living, such as using the toilet, including getting up or down, preparing a hot meal, working around the house and garden, and climbing stairs due to her painful back and joints. However, she does not use any kind of mobility aids, and according to her, *I don't think I am that old.* She considers her health status as 'fair', however, does not consider that she has any type of chronic illness or mental impairment (health status):

Generally, if you are good, you don't need medication, you don't […] you don't be in pain every time you wake up in the morning […] it just basically depends on the days, some days are good, but most days are like on a scale of 1 to 10 (higher indicates better health status), I would just call it like 5 and sometimes lower than this [...] it just depends on how you spend the night and […] I don't sleep […], so it just depends really.

She feels safe in her own home and on a scale of 0 to 10 (higher indicates safer), she marks it 9. But she does not like being staying on her own (safety in the home):

Well, if I remove the panic attack […], you know when you are ill (.) sometimes you feel you don't want to be alone […] because I was always surrounded by all my family […] especially if you are not feeling well. You start thinking of the worst (.) you know, so it just depends (.) so what I think about at home, if I am well surrounded, then it is a good 9, but if I am alone, I always panic (.) so I would say 4 (.) so depends on the time when he (husband) comes back home (.) I feel safe (.) I feel happy.

Sunita considers herself 'unsatisfied' in terms of her overall life satisfaction, this is mainly due to the COVID-19 pandemic that has worsened the work situation and lets her be socially isolated. However, if not for the pandemic, she would have considered her life satisfaction as 'partially satisfied' (life satisfaction):

Because of my health (.) fully satisfied would be someone, who does not need any support (.) you know they can rely on themselves, so they can do whatever they want in a way, but with my health and what is going on around (.) plus the pandemic makes worse.

Existing care and support: She has installed a speciality toilet (housing adaptation). She gets a "lot of support" from her husband, and she considers herself "very lucky". However, she feels her needs are 'usually met', though the amount of time her husband spends with her is not enough (care and support / unmet need):

He is the type of person who understands one word; you know if you say 5 words together, then the problem is (.) he doesn't have ears (giggles) […]. Still, he has to work […] because you know there is no flexibility from work; you know if you have support from a work (.) that's what the problem is at the moment […]. Still, they are not giving any support from his end to be able to provide the care that I need (.), so in a way, that's where the problem is (.), and you can't lose your job, especially of this time […], so he doesn't have the support needed to be able to

support me […] sometimes I do need somebody to be around during the day (.) then either I have to go to a hospital or call a friend.

Sunita is 'very satisfied' with how she presents herself in terms of her appearance and cleanliness. She is not so happy about the food and drink she gets at home (care and support):

"he (husband) *doesn't know how to cook […] because he always thinks that I need to lose weight and gives me healthy food (.) I can't really follow healthy diet".*

However, the way her husband treats her make her feel excellent about herself.

Concluding the interview with whether the interviewee wants to add anything more for his/her own care and support: Sunita wishes (unmet need): "*may be having someone to speak to (.) having someone to listen (.) and may be having a priority to access to a facility (.) you know when you are on your own and you don't have help (.) you need to call a place like hospital or book something […] for your own medication or something, you have to stay on the phone and at the same time you have to look after yourself (.) so for these things […] having a priority […] like giving a number […] and the third thing I believe that's more important is may be somebody like (.) more like a health care support or assistant just for cooking (.) not cooking, but food or […] may be just someone can come and see me (.) may be for an hour just to say hello (.) if I am not well, just to say (.) can I call an ambulance? (.) The person doesn't have to come with me but at least help me to get access to all the facilities […] may be a carer with compassion".*

The result on unmet social care/support needs: From the above narrative, it is identified that Sunita feels vulnerable because her primary carer (her husband) is unable to spend the amount of time (**carer's time**) she feels is needed. **Loneliness** is one of the significant unmet needs that Sunita has experienced and sometimes that triggers panic attack (**lack of emotional**

support). The lack of safety in her own home is another concern likely associated to being alone in the house when her husband is at work and her family are not around. Moreover, Sunita **lacks the self-confidence to access existing social care services,** as she does not consider herself old enough to access certain types of support (mobility aids) and desires to have a more accessible support service. Furthermore, the foods she gets in everyday life does not match with her wishes (**unmet want**).

#Case number 27:

Lucy (52 years, female, overweight, positive cohabitation)

Lucy is a 52-year-old female, lives with her husband and is in fulltime employment. Her children are all grown up and have moved away. Lucy is from a white British ethnic background and is overweight (BMI= 29 kg/m2).

Life in terms of disability, health status and life satisfaction: Lucy experiences several challenges for daily living, such as difficulty in walking, cutting up foods, getting in and out of bed, shopping for groceries, gets confused sometimes taking medications, working around the house and garden. However, she does not use any walking stick or any type of aid for moving. Lucy states her health status as 'fair', as she suffers from several conditions: osteoarthritis, erythromelalgia, and vitamin deficiency (the list is long) and, according to her, walking gives her pain (health status):

pain is what I struggle with the most because that (exercise machine) all seem to cause pain […] most of the time I am fairly good (.) I am quite a sort of up bit and happy.

Lucy feels very safe in her own home, even when her husband is not at home (safety in the home).

Lucy is 'fully satisfied' with her life overall (life satisfaction)

[…] there are people far worse than me.

Existing care and support: Lucy's husband takes care of her besides being in full-time employment. Moreover, Lucy's husband is very supportive, as she says, *looks after me well*. Currently, he (husband) does not receive any care allowances. But taking care and support from her husband makes Lucy 'partially satisfied' (care and support):

Sometimes I feel guilty (.) because I think he (Lucy's husband) was working hard as well, then he comes back home, he does the dinner […] washing, ironing, gardening (chuckles) he does everything. Although I have recently said to him (.) can you not do it? If you leave something for me (.) so that I don't become a vegetable (stressed the word) (.) sitting on the sofa doing nothing! (Long pause) *He says he does it because he doesn't like to see me in pain*.

Moreover, she considers her needs are 'usually met' and the amount of time her husband spends with her is not enough, as she informs, I *wish it could be more* (care and support):

I think I get by quite well (.) I think the only time I struggle mainly […] if I am going out and walking […] if I want to go to the shop […], I get put off […] I think you know (.) I got to walk from the car to the shop […] or going to the car park […] I have toyed with (.) may be applying for a badge thing (disability badge) then I get put off […] because then I think I can still walk, but (.) there are a lot of people out there that are more deserving of it […] I just think to myself […] at what point (.) do I give into that or (.) people are going to look at me (.) and think she doesn't need that.

However, Lucy is 'fully satisfied' with her appearance, cleanliness, maintaining personal hygiene and the food and drinks she gets in everyday life.

But she considers that the help and support she receives from her husband makes her feel 'poor' (with a chuckle) about herself. She said that it makes her feel "*bit guilty, lazy, a burden (.) I know that doesn't make any sense […] yeah, I feel burden! (.) and then I think 'right (.) stop thinking about that, move onto the next.*

Concluding the interview with whether the interviewee wants to add anything more for his/her own care and support: Lucy wishes (unmet need):

I only need help with (.) maybe with that […] badge thing (disable badge), but that's about it […] I am not going to start going down (.) using frames and walking sticks (.) because then, that just draws attention to it (.) and I think 'no' (chuckles).

The result on unmet social care/support needs: From the above narrative, it is noted that Lucy perceives herself as a burden and feels guilty (**lack of emotional support**) for the support and care she receives from her husband; besides, she desires for more of his (husband) time (**carer's time**). Moreover, Lucy is reluctant to request help and **hesitant to accept having unmet needs,** as she compares herself with others around her and feels appreciative of what she has. "*These attitudes led some participants to deny or minimise their needs for care and support, and/or to normalise challenging situations*" (Dunatchik et al., 2017, p. 23). She puts a high value on her independence as an important part of her self-esteem. In addition, Lucy is afraid of being **socially discriminated** against. Therefore, she gives more importance to other's perception of herself than her needs.

#Case number 30:

David (57 years, male, moderately obese, positive cohabitation)

David is a 57-year-old male, who lives with his wife. He is from a white British ethnic background and is moderately obese (BMI= 30.7 kg/m2).

Life in terms of disability, health status and life satisfaction: David faces difficulty with almost all the activities of daily living. However, except with few activities that he considers himself capable of, such as communication, making phone calls and recognising physical danger. In addition, David uses several supporting aids that help him be independent, such as a walking stick, walker, wheelchair, and personal alarm for a fall. He suffers from several health conditions, including urinary incontinence, painful back due to lumbar decompression surgery. David considers his health status as 'poor' and is 'unsatisfied' in his overall life satisfaction (life satisfaction):

I have depression […] I wasn't like this before (.) it's just too much suffering […] my wife changes my nappy (.) I can't help (.) makes me frustrated and depressed.

David considers that he is not very safe in his own home and scored 5 (on a Likert scale of 0 to 10, where 10 is the safest). He also feels that *medication makes me drowsy (.) that I always feel weakness.*

Existing care and support: David had several housing adaptations. Currently, he is getting disability allowance and housing allowance. He sees his wife as his primary carer. David is concerned that his wife does not get any government allowances because she is from abroad (care and support):

We applied for LA (Local Authority) allowances (.) we meet all the criteria, still (.) it's a long fight […] we need to sort out her (wife) immigration first […] she deserves it (.) lawyer is fighting the case.

However, David is 'fully satisfied' with the care and support he receives from his wife in terms of his appearance, cleanliness and the food and drink he gets in everyday life. He says, *she is wonderful* (.) *she is always there*. The way his wife treats him makes him feel excellent about himself. But he considers his needs are 'sometimes met' (care and support):

I wish to walk normally again (.) I start panicking with people […] don't like to mix with people (agitated).

Concluding the interview with whether the interviewee wants to add anything more for his/her own care and support: David expresses his worry about his wife's immigration. Since that would enable them to apply for the LA allowances. He concludes the interview with (unmet need):

it would be helpful if I could have some economic support.

The result on unmet social care/support needs: From the above narrative, it is noted that David is frustrated with his current situation and feels guilty about taking help from his wife (**lack of emotional support**). David expresses his **social anxiety** (mixing with others), along with **financial hardship**. However, he yearns to walk again, and it is apparent that he misses socialising. David judges having a **lack of safety in his own home**.

#Case number 3:

Ivan (66 years, male, normal weight, positive cohabitation)

Ivan is a married 67-year-old male who lives with his wife, son, and daughter in law. Ivan is from a white Bulgarian ethnic background and is normal-weight (BMI= 18.5 kg/m2).

Life in terms of disability, health status and life satisfaction: Despite having a normal weight, Ivan encounters several challenges in daily living, such as difficulty in dressing, walking, getting in and out of bed, using the toilet and taking medication. He considers his health as 'fair'. Ivan is a bowel cancer patient and had to go through a couple of surgeries but still suffers from severe pain and discomfort. Although he does not like to use any mobility aids and does not consider having any chronic illness or mental impairment (health status):

Because of all this pain (.) I am getting severely; I am actually not getting any care […]. I was calling into the GP […] but was not able to get through (.) to get me some actual physical help.

Existing care and support: Ivan's wife is the main person who looks after him. And Ivan is happy for the time she stays with him. Moreover, Ivan is satisfied with the food and drink that he gets every day and happy with his appearance and cleanliness. However, taking support from his wife makes him upset, he is ‘unsatisfied’ with this and considers himself a burden. The way he is cared for or treated by his wife makes him feel 'poor' about himself (life experience / care and support):

Obviously, my wife is caring (.) looks after me well […] but there are a lot of things that she is not enough (.) such as the medication, such as (.) knowing actually what the issue is with me (.) to manage it properly […] I need someone who has the knowledge to manage (.) someone who will stop me feeling embarrassed with my life (.) I was a very independent person […] in

my culture, the husband should take care of his wife (.) not the other way round […] my wife is not well, she has osteoporosis.

His needs are not met fully, mainly due to the pain, which marks it as 'sometimes met'. According to him, *I need help (.) with my doctor to understand my problem* (care and support).

Concluding the interview with whether the interviewee wants to add anything more for his/her own care and support: Ivan shows concern about his wife's health and wellbeing and mentions that she is helpless. As Ivan expresses his expectation (unmet need):

I guess I need to have some sort of help from the government for extra money or fund (.) maybe it could help me (.) because it costs a lot for a good healthy diet.

The result on unmet social care/support needs: From the above narrative, it is noted that Ivan is embarrassed by taking the support and care from his wife, who is already unwell and considers himself a burden **(lack of emotional support)**. In addition, Ivan feels vulnerable and shows concern that his wife lacks the necessary skills to provide him proper support (**lack of carer's knowledge**) besides his **financial hardship**. Moreover, his expressed needs are sub-optimally satisfied, and he is insecure about his existing unpaid care. Finally, he is having **lack self-confidence in obtaining existing social care services.**

#Case number 10:

Lisa (52 years, female, severely obese, positive coresidents)

Lisa is a 52-year-old lady who is recently divorced and lives with her daughter. Lisa is from a white British ethnic background and is severely obese (BMI= 39.8 kg/m2).

Life in terms of disability, health status and life satisfaction: Lisa is entirely self-sufficient and capable of doing all the tasks for daily living independently. Lisa marks her health as 'good'. However, Lisa lists several health problems, including carcinogenic neck lump and ongoing kidney problem with 4% kidney function restored (health status / life experience):

I just had a nasty divorce (.) was trying to cope up (.) with the situation (.) you know it was hard, my daughter is very supportive (.) but dealing with the bereavement of my parents is harder […] I started having mental health problem (.) anxiety, depression […] was getting better with counselling (.) but had to stop.

Lisa feels very safe in her own home since she is there for 23 years (safety in the home).

Therefore, she reveals that she is 'partially satisfied' in her life, mainly due to bereavement and financial problems (life satisfaction):

it's very difficult being on your own (.) hard to deal with the loneliness […] you know, at least someone to speak (.) when I am in need (.) in the middle of the night.

Existing care and support: Lisa started having counselling service for the last 3 months, and she felt that her condition was improving. However, she had to pay for the service independently, and it was very stressful for her. As Lisa mentions, *I stopped now because I couldn't afford it.* Lisa is 'fully satisfied' with her appearance and the food and drink she has in everyday life. But her needs are not fully met (care and support):

I have a good circle of friends (.) good family (.) still awful sometimes staying on my own (.) lack of emotional support […] especially at the weekends (.) Sundays (.) feel like to have someone.

Concluding the interview with whether the interviewee wants to add anything more for his/her own care and support: Lisa expresses her worry about her financial situation. Lisa experiences

that there is a sort of gap between becoming single also reduces your income, because she does not have a partner who is financially supporting each other. Finally, she wants more accessible support or care (unmet need).

The result on unmet social care/support needs: From the above narrative, it is noted that Lisa conveys her void of **loneliness** and **lack of emotional support** throughout her interview besides having **financial hardship**. She desires to have **more accessible support service**. Moreover, the privately paid counselling therapy was helping her but had to stop due to her financial hardship. In addition, she has a **lack of self-confidence obtaining existing social care services.**

#Case number 32:

Alison (53 years, female, severely obese, positive cohabitation)

Alison is a 53-year-old lady, and lives with her partner. She is from a white British ethnic background and is severely obese (BMI= 35.9 kg/m2).

Life in terms of disability, health status and life satisfaction: Alison faces several difficulties with the activities of daily living. Moreover, she is dependent on a walking stick; and sometimes she uses wheelchair and elbow crutches. In addition, she has a couple of health issues, mostly related to problems with her back and joints due to arthritis and osteoporosis. A few of her health conditions are long standing (health status).

Alison marks 7 out of 10 (on a Likert scale of 0 to 10, where 10 is the best) regarding safety in her own home (safety in the home):

Mainly due to the stairs in the house (.) sometimes I feel dizzy (.) weak (.) sometimes I feel like (.) I might fall down one day.

Alison is 'partially satisfied' with her life overall (life satisfaction):

it varies and depends on the day (.) I have good days and bad days (.) but mostly bad (.) because lack of mobility makes me not so satisfied (.) I get depressed and frustrated (.) for being in pain (.) for taking so many pills (.) due to COVID, can't even go for swimming or other exercises.

Existing care and support: Alison has a couple of housing adaptations like raised toilet and bath seat. However, she wants the bath to be taken out, as the shower will be more accessible. Alison had a few sessions of physio exercises that she did not have to pay. But she regrets that due to the pandemic, her physio sessions are cancelled. Alison's partner is her primary carer. Currently, Alison is receiving PEEP (Personal emergency evacuation plan) and reduced council tax. And her partner has just applied for a carer's allowance. The care and support she receives from her partner make her feel guilty (care and support / unmet need):

he is good (.) it's been a roller-coaster (.), but it's pretty good now […] sometimes struggle to make him realise the need is.

She marks herself 'partially satisfied' in terms of the care and support she receives from her partner. However, Alison informs that she is happy about her partner's time and states that *sometimes I like to spend time on my own*. But she regards that her needs as 'hardly ever met'. According to her, *I don't feel the way I was before (.) can't do socialising*.

The way Alison's partner cares and looks after her makes her feel 'very good' about herself. However, the way others treat her makes her feel 'fair' about herself. As she conveys her feelings,

He (partner) does try to understand […] he is getting older (.) he has medical needs too […] sometimes I feel like a burden […] a few months back, he fell ill (.) I was calm; it was difficult for me […] children came to rescue and looked after me […] family and friends don't understand me fully (.) my condition.

She is 'fully satisfied' with her appearance and cleanliness. However, due to her food intolerance, it is difficult for her to get the right food.

Concluding the interview with whether the interviewee wants to add anything more for his/her own care and support: Alison conveys her desire to do more exercise and considers that few more housing adaptations are needed to make her life easier to live (unmet need):

The realisation from people or everyone (.) that I have good and bad days […] I want people's empathetic understanding towards me (.) not to decide by seeing my appearance and condition […] I don't want to be disabled (.) treated as disabled (.) trying to have a normal life.

The result on unmet social care/support needs: From the above narrative, it is noted that Alison feels guilty for receiving care from her partner and perceives herself as a burden (**lack of emotional support)**. She faces challenges in socialising **(**lack of socialisation) with others. In addition, she gets a sense of **social discrimination** while tries to mix with others. Moreover, Alison feels vulnerable due to a **lack of housing adaptations** and **lack of safety in her own house** due to the precarious nature of her existing unpaid care. In addition, Alison puts a high value on her independence to protect her self-esteem and misses doing her hobbies (swimming, exercise, physiotherapy) due to the pandemic.

#Case number 7:

Ali (57 years, male, moderately obese, on his own)

Ali is a 57-year-old widow and lives on his own. He is from a British Pakistani ethnic background and is moderately obese (BMI= 32.4 kg/m2).

Life in terms of disability, health status and life satisfaction: Ali faces a problem using the toilet and using a bath as part of the difficulties in daily living. Although he does not use any type of aids to make his moving or daily living easier. Ali considers his general health is 'fair', mainly due to back pain and joint pain. However, he does not regard having any chronic illness (health status.

Ali assesses his safety score 5 out of 10 (on a Likert scale of 0 to 10, where 10 is the best), living in his own house (safety in the home).

Moreover, he interprets his overall life satisfaction as 'partially satisfied' (life satisfaction).

As Ali appraises his health and wellbeing:

When I go to the bath, I have to be very careful (.) I couldn't stand for long […] I mean to say, there is not enough support to hold onto something […] I have slipped a couple of times (.) no walking shower (.) I do everything on my own […] there is no support (.) one lady came to visit me and said, she is going to write to my county or borough […] she wrote, but nothing happened […] I don't have any other health problems, but the back pain is the worst of all […] when I don't feel good, I try not to go out […] I were living in this flat (Local Authority housing) for the last 12 years […] I feel, people, come in my absence […] building entrance has a problem with lock […] lack of security […] because of my back pain, I lost my job (.) then all the problems started.

Existing care and support: According to Ali, currently, he is not receiving any care or support, and his needs are 'hardly ever met'. Although he is 'fully satisfied' with his cleanliness and appearance. However, the foods and drink he gets in everyday life are not enough for him, making him 'unsatisfied' (care and support / unmet need):

I applied for the job seeker's allowances a few months back (.) but they refused (.) by saying that 'you didn't pay for the taxes, so you can't apply for this' […] if the employer doesn't give me enough shifts that I could pay the tax […] they only give me two days jobs […] it's not my fault [...] I pay for my national insurance number […] the situation is frustrating […] as I don't have any choice, managing as much as I can […] basically compromising.

Concluding the interview with whether the interviewee wants to add anything more for his/her own care and support: Ali expresses his desire to have a separate apartment with a walk-in shower (unmet need):

if possible, to have proper support with few housing adaptations [...] as I live on my own […] help with daily living, such as the washing machine is in the distance […] even picking up something from the floor, makes me worried.

The result on unmet social care/support needs: From the above narrative, it is noted that he is frustrated about his circumstances (**lack of emotional support**) besides having **financial hardships**. Moreover, Ali feels vulnerable due to **a lack of housing adaptations** and **safety in his own house.** His expressed needs are sub-optimally satisfied, as he does not qualify to access social care support (service-based).

#Case number 19:

Andrew (66 years, male, overweight, positive cohabitation and coresidents)

Andrew is a 66-year-old man and lives with his wife and daughter. He is from a white British ethnic background and is overweight (BMI= 28 kg/m2).

Life in terms of disability, health status and life satisfaction: Andrew encounters several challenges of daily living, such as using a map, recognising physical danger, preparing a hot meal, shopping for groceries, taking medication, managing money and sometimes with communication and making phone calls. Andrew gets confused and cannot remember everything. He does not like to use a walking stick, although he falls over a lot. And all these started after Andrew had a stroke in 2012, but Andrew considers his general health is good (Health status).

However, he does not feel very safe in his own home. And overall, Andrew perceives his life satisfaction as *very poor* (unsatisfied) (safety in the home). As Andrew examines his health and wellbeing:

I can't remember what I am doing (.) sometimes I try to do something, I get confused (.) suppose I am making a cup of coffee (.) I can't remember how many spoonsful of coffee I have added (.) I just keep on adding […], then when I drink it, it tastes awful, and I get confused (.) I am sorry that I am explaining this […] I know I fall over a lot (.), but I keep saying to myself, I never ever going to use a wheelchair or anything like that (.) I probably sound stupid […] the days I feel unwell, I like to go out (.) I know it can be dangerous, but I have to keep trying (.) if I don't feel right, I just sit down a bit […] The days I am good, try to stay at home […] I get really upset.

Existing care and support: Andrew's wife and daughter look after him. And Andrew feels fully satisfied having the care and support from them. Andrew is happy about the time his wife and daughter spend with him. However, Andrew interprets that his needs are usually met. He is not so satisfied with his appearance and cleanliness and states, *I accept myself the way I am now.* However, Andrew is 'fully satisfied' with the foods and drink he gets in everyday life, and the care and support makes him feel excellent about himself (care and support / unmet need):

They (wife and daughter) *are wonderful (.) but I can't remember if I get any other supports! […] everyone loves me now, obviously, that's the wonderful part of it (.) but most of the time (.) in my head (.) I get very upset to myself […] I wait for my wife or daughter to come back home from work (for food) […] I do try on my own, all I tend to take is (.) a Pizza (.), and I don't like it, but that takes 12 mins to microwave (.). If I don't have it, then I don't know what I am dealing with […] I look at egg (.) sometimes I feel like to have it (.), but I can't remember what to do with it (.) then I get confused […] So even I don't like Pizza, I still have it […] at least I got something to eat.*

Concluding the interview with whether the interviewee wants to add anything more for his/her own care and support: Andrew expresses that he cannot follow a conversation if in a group but feels like contributing during a one-to-one conversation. Andrews accepts that it is difficult for someone to look after him, but thankful for his wonderful family, who is always ready to serve him. Andrew loves mixing with people and loves to share his experiences. Although he cannot remember everything, he loves helping other people in need (unmet need).

The result on unmet social care/support needs: From the above narrative, it is noted that Andrew has several existing needs in terms of ADLs and IADLs, but lack of support with everyday activities necessitates. Although he is having some supports from his family (informal carers), he is somehow neglected (**have inadequate existing care**) due to their (carer's) busy

schedules (**lack of carer's time**). Moreover, Andrew tries to compromise with his present situation and expresses his frustration (**lack of emotional support).** In addition, he is vulnerable in his own home in terms of his foods and drinks, staying on his own for a long time (**lack of safety in his own house**). In addition, Andrew puts a high value on his independence to protect his self-esteem and misses being independent. And he feels his self-worth by getting the chance to help others.

#Case number 21:

Kevin (73 years, male, moderately obese, on his own)

Kevin is a 73-year-old widow and lives on his own. He is from a white British ethnic background and is moderately obese (BMI= 32.8 kg/m2).

Life in terms of disability, health status and life satisfaction: Despite having a heavy-weight, Kevin is entirely self-sufficient and capable of doing all the tasks for daily living independently and considers his general health 'good'. Although he had his double knee replacement 6 years ago and existing arthritis with painful fingers (health status).

He feels reasonably safe in his own house and scores it 9 out of 10 (where 10 is the safest), and fully satisfied with his life overall (safety in the home).

Since then, although I don't have any problem (following knee replacement*) […] I find that I can't run (.) and I like to say, I can't kneel down (.) and also (.) once I used to do my own decorating, I would kneel down and paint the skirting and all that (.) but now I can't do anymore (.) that's the only drawback […] I feel quite safe, but always that possibility that something happens (.) in my back of mind (.) as no one is there.*

Existing care and support: Kevin does not receive any form of social care support. He is 'fully satisfied' with his appearance and the foods and drinks he has in everyday life; besides, the way everyone treats him makes him feel 'very good' about himself (not excellent). However, all his needs are not met fully, as he mentions 'usually met' (care and support / unmet need):

Obviously, with this circumstance (COVID-19 pandemic) *now, I receive plenty of offers from my neighbours […] if I need any shopping or anything! (.) apart from that, I do all myself […] my wife passed away 6 years ago […] couple of years later, I applied for a part-time job (.) taking special need children to and from school […] so that's get me out of the house […] obviously, interacting with people keeps me busy […] obviously, during the evening, I am on my own […] that's why I do this driving job […] that keeps me busy and (.) my mind from going crazy […] my sons are away (.) they are busy in their own life (.) I always keep in touch with my family members […] obviously, before my wife passed away, I mean I walked in from work, and my meals were on the table […] I have to do all that myself now! (.) and I decided, I don't want to live on fast food […] so, I try to make a balanced diet, something different every day.*

Concluding the interview with whether the interviewee wants to add anything more for his/her own care and support: Kevin ends the conversation by saying that he is reasonably *content* and happy to live independently (unmet needs):

Don't need anything more […] like I said, there is always someone there, at the other end of the telephone […] I am happy with my life.

The result on unmet social care/support needs: Kevin misses out on doing his old hobby (decorating) and his run, as his health condition does not permit that anymore (**lack of emotional support**). Moreover, living alone makes him paranoid about his situation that someday something might get wrong (**lack of emotional support**). In addition, Kevin is reluctant to request help and **hesitant to accept having unmet needs.** But Kevin feels coded

by getting the chance to do part-time work and puts a high value on his independence. However, Kevin admits that he does this job mainly to protect his mental health by being able to engage his mind and being able to socialise with others (*obviously, during the evening, I am on my own* […] *that's why I do this driving job* […] *that keeps me busy and* (.) *my mind from going crazy*) (to avoid being **lonely** and **socially isolated**).

#Case number 14:

Daniel (51 years, male, severely obese, positive cohabitation)

Daniel is a 51-year-old male and lives with his wife. He is from a white Spanish ethnic background and is severely obese (BMI= 39.6 kg/m2).

Life in terms of disability, health status and life satisfaction: Despite having a heavy-weight, Daniel is entirely self-sufficient and capable of doing all the tasks for daily living independently and considers his general health very good (health status).

Moreover, Daniel feels very safe in his own house. Although he has gout with very painful left foot and knees (safety in the home).

Somehow my energy is drained (.) I have sleep apnoea (.) I think the actual problem is there […] I am doing lots of exercises, but not lost enough weight […] sometimes I stop walking or exercise, because of gout […] I feel frustrated […] not losing weight regardless of doing exercise.

Existing care and support: Daniel feels 'fully satisfied' with the support he receives from his wife. Besides, Daniel is pleased with his wife's time with him and 'fully satisfied' with his appearance and the food and drinks he has in everyday life. Moreover, Daniel judges that all

his needs are 'fully met' and feels 'very good' about himself how his wife and others treat him. As he examines his care needs (care and support / unmet need):

My wife is always there to help (.) but I try not to ask too much, try to be independent […] sometimes our opinion differs […] I like to do things in a particular way (.) want to listen to a lot of music (.), but she doesn't like […] it's too noisy for her and (.) I have to always use a headphone […], not everything is perfect, there is always a room for improvement […] looking the way some people live (.) I live comfortably, but if there is money (.) I could live more comfortably.

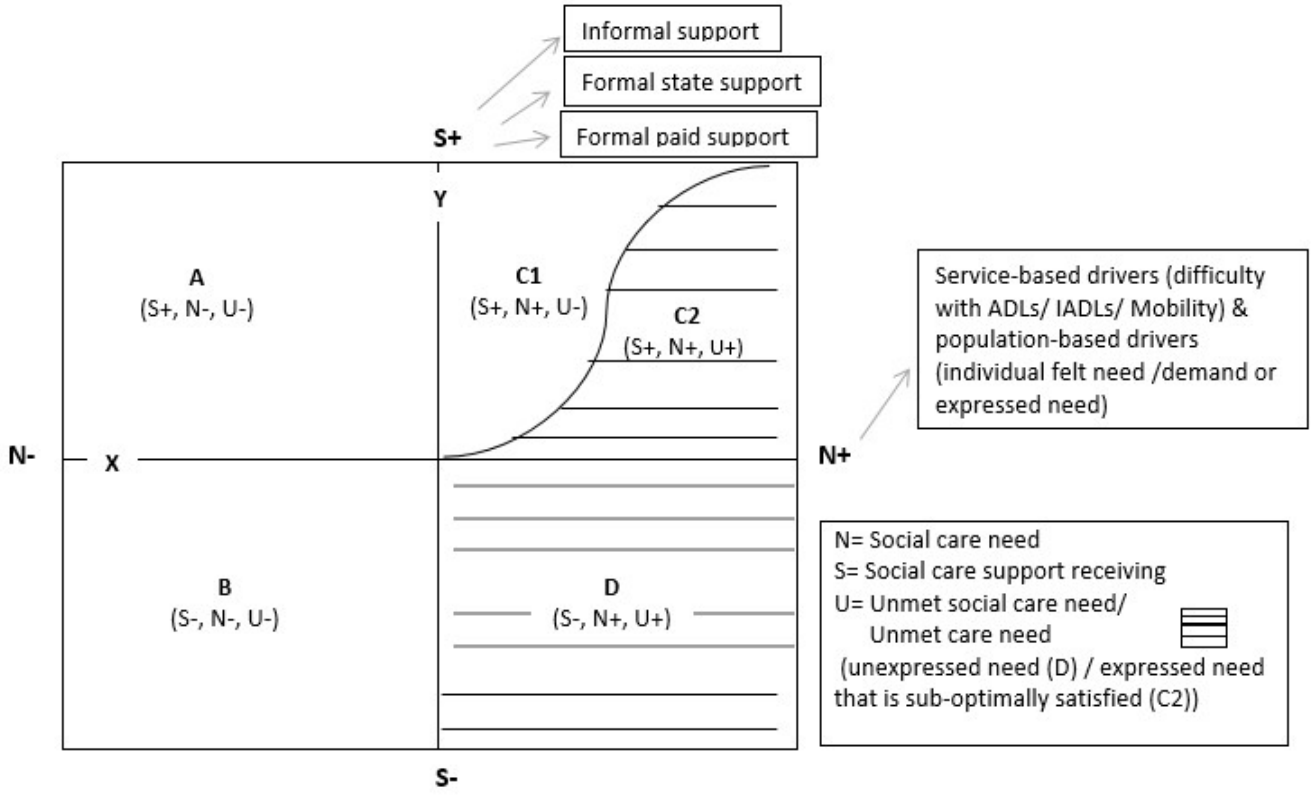
Concluding the interview with whether the interviewee wants to add anything more for his/her own care and support: Daniel ends the interview by thanking me for giving him the opportunity and time to express his views and says *I hope the study helps to get things right*.

The result on unmet social care/support needs: Daniel wishes to be fitter and lose weight but gets disappointed and frustrated (**lack of emotional support**) for not achieving weight loss as he desires. Besides that, although his wife is supportive, sometimes the difference of opinions makes him annoyed (**lack of emotional support**). Moreover, Daniel is reluctant to request help and **hesitant to accept having unmet needs.** Financially Daniel is stable, but he feels upset while comparing himself with others (**lack of emotional support**).

7.3.3 Discussion on main results and interpretation

The detailed discussions of the framework to evaluate the unmet care need are presented in chapter 4 (figure: 4.1). The framework is shown below to make it easier to discuss and interpret the results from the above narratives.

Figure 4.1: Conceptualised model on unmet care needs for social care and support



Constructed by the student researcher

According to the framework, all the participants in the narratives above either have 'unexpressed needs' (D) or 'expressed needs that are sub-optimally satisfied' (C2). The ‘unexpressed needs’ are where participants are either having care needs in terms of ADLs, IADLs, mobility but do not perceive their difficulties (case number- 19, 14) or participants who are reluctant to request help and support (case number- 19, 27, 21, 14, 32). The ‘expressed needs that are sub-optimally satisfied', are where participants are either not qualified to meet the eligibility criteria to access the local authority social care support (case number- 10, 7, 14) or have inadequate existing social care (case number- 2, 27, 30, 32, 19) and support. Some participants also have both unexpressed needs and expressed sub-optimally satisfying needs (case number- 27, 14, 32, 19).

The participants with impaired mobility or problems in daily living face the following challenges of unmet needs: ill health, loneliness, lack of socialisation, lack of emotional support (feeling frustrated, depressed, being a burden, being guilty, being embarrassed and anxiety), feeling vulnerable due to lack of carers' time (unpaid carers), lack of carers' knowledge, lack of housing adaptations, lack of support with everyday activities, lack of self-confidence obtaining existing social care services, lack of safety in one's own house and lack of financial aid (individual raised).

From the above narratives, it is discerned that most of the participants mentioned their painful back and joints resulting from different types of arthritis (case number- 2, 27, 53, 57), as the main reason for their disability, or the pain due to cancer, kidney dysfunction and previous surgery.

Participants with increasing level of obesity reported most of the unmet needs related to the lack of emotional support due to stress and frustration, disappointment, lack of social contact, feeling of social discrimination, feeling of being a burden, lack of housing adaptations, lack of safety, boredom or being unable to continue one's hobbies, lack of easily accessible support system. Whereas the normal weight and overweight participants (case number- 3 and 19) have unmet needs that mainly related to the gaps in service provision, such as lack of carer's time and knowledge.

The above narratives also reveal that participant's past health conditions (case number- 21, 14); their difficulties in daily living and mobility (case number- 3, 7, 19, 32, 30, 27, 2) or a combination of the above two and significant life events, like bereavement, divorce (case number- 10) generate unmet needs.

The above narratives show that older adults living with their spouse/ partner and/or children are getting some help and care than those living on their own.

The above narratives also show how the sense of frustration, social discrimination, lack of life purpose, depression, being a burden, being guilty, being embarrassed, anxiety, boredom, and being unable to do things they used to do diminishes participants self-worth and self-confidence. In addition, the narratives reveal that despite having a sound support system in terms of money, housing adaptations, mobility aids and unpaid care support (case number- 27) or not having any difficulty in daily living (case number- 21, 14) the older adult participants can still experience low self-esteem.

From the above narratives, it is noted that loneliness and social isolation are critical issues for many older adults (case number- 2, 10, 32, 21) than actual physical needs regardless of their disability and health status.

Some older adults are also afraid of being socially discriminated (case number- 27, 32) or socially judged (case number- 27, 32) or have social anxiety (case number- 30) or panicked while mixing with others are the factors that emerged from the narratives which in turn seems to lead to further social isolation or lack of socialisation and then poor wellbeing.

For many older adults taking care and support from their partner/ spouse (for some cases, taking care and support from the wife is not culturally accepted, for example, case number 3), itself is one of the major predisposing factors of having poor wellbeing (case number- 27, 30, 32). And it is seen from the above narratives that some older adults with fair/poor life satisfaction are more prone to have poor wellbeing and feel less good about themselves and that perhaps resulting to several unmet needs regardless of the care and support they receive (case number- 2, 30, 10, 32, 7).

On the other hand, Daniel (case number-14) gets frustrated with his life for not losing the desired weight. Although he is hesitant to accept having unmet needs, 'lack of emotional support' is one of the unmet needs emerging from his conversation. In addition, his tiredness

and lack of energy due to sleep apnoea resulted from his high BMI (Rössner, 2001; LGA, 2020).

Some older adults are more satisfied in their life overall, despite their unstable care and support system. Those are the people who have hobbies and recreational activities (case number- 32, although due to the pandemic Alison cannot continue and that makes her upset), they have an opportunity to help others (case number- 19, 21), or they take up part-time /full-time work (case number- 21, 2, although Sunita is currently unsatisfied with her life, as due to the pandemic Sunita is out of work and socially isolated), having family and friends to talk (even though via phone call: case number- 21) and having a positive cohabitation relationship (case number-14).

It is also noted that financial hardship is another unmet need that older adults are having. For example, Ali (case number-3) was in full-time employment, but he lost his job due to his painful back, and joints resulted from his obesity. However, older adults who put a high value on their independence to protect their self-esteem and hold a positive outlook are seemed to have higher wellbeing regardless of their increasing weight and also seem to have fewer unmet care needs than others (case number- 21, 27). The above narratives, also reveal that in many cases, minimal support like few adaptations or aids or just providing a counselling service (case number- 10) and/or providing a social network may help older adults to meet their needs.

7.4 Summary of the Chapter

The chapter presents the brief narratives of the qualitative interview data and submits the findings from the narrative analysis. The findings showed that older adults face various challenges in their life that generate care and support needs. If not met, then these are likely to generate or widen health inequalities over time. It is also noted that public social care services seem to be unable to support many of the participants (the above narratives show that most of

the participants are receiving voluntary care and support), or they somehow drop out from the care of social services. This is likely to be associated to the continuing effects of the 2008 global recession which lead to austerity and significant and continuing cuts to local authority services.

Furthermore, it is noted that poor health and wellbeing increase several unmet needs among older adults. As such, the above narratives reveal that participants with obesity are more vulnerable to having health inequalities due to lack of emotional support, resulting from a feeling of being a burden, disappointment, lack of social contact, feeling of social discrimination, lack of housing adaptations, feeling of lack of safety, boredom or being unable to continue one's hobbies, stress and frustration, lack of easily accessible support system, than their normal weight and overweight counterparts. Subsequently, this lack of emotional supports perhaps leading them towards adopting poor health behaviour. Moreover, it was found that the addition of minimal public social care support could help older adults meet these unmet needs in many cases and improve wellbeing.

The following chapter of the thesis will address the critical outcome of the research, the strengths, and weaknesses of the study, along with a brief description of the implication of the study for policymakers and health care providers, and future research recommendations.

CHAPTER 8

Discussion of the results

8.1 Introduction

This chapter highlights the critical exploration of the study findings in relation to health, wellbeing, and social care. It critically explores the key study findings in the light of relevant existing literature. The areas of agreement and disagreement are highlighted. In addition, the chapter highlights a brief analysis of the implications of the research findings for future policy and practice to promote the health and wellbeing of the older population in England. It focuses on how resources can be better used and that national and the local governments should consider reversing public health funding cuts (The King's Fund, 2020) and provide sustainable funding for adult health and social care to uplift the quality of life of this vulnerable population groups. The strengths and limitations of the present study are critically discussed. Finally, an overview summary of the chapter is presented.

8.2 Discussions on the key findings of the study

In the present study, the secondary and primary data are analysed to fulfil the four study objectives. The results of secondary data analysis are presented in Chapter 4, 5 and 6 and the results of primary data analysis is presented in Chapter 7. The key findings of the secondary and primary data analysis are critically discussed here against each study objective.

- First objective: To investigate the association between obesity, disability status, morbidities in older adults.

The exploratory data analysis of the study (Table 4.2) revealed that almost half and one-quarter of the participants having disabilities with at least one ADL or IADL activity, are obese and

81+years old respectively with majority of them are females. A study by Wahrendorf et al. (2013, p. 7) used data from three studies on older adults aged 50 to 85 years evaluated that "in contrast to mobility limitations, the onset of remarkable amounts of IADL limitations generally occurred at a later stage of the life course, and significant increases are evident at advanced age only (70 years and older)". Moreover, another prospective study of community-dwelling older adults from two European countries by Campanini et al. (2019) identified that physical function impairment and disability were most noticeable in older women with higher BMI and lower education levels. However, a cross-sectional study by Lee et al. (2018) found that compare to the women of their 50's in other countries, the prevalence of disability was the lowest among Korean women, even when they were in the 70-75year age groups.

Surprisingly, the present study found that the current smokers and frequently or daily alcohol drinkers are less impaired with at least one ADL or IADL activity compared to current non-smokers and none or rare alcohol drinkers. However, a cross-sectional English study by Melzer et al. (2005) found that although the frequent/daily alcohol drinkers reported less mobility disability, current smokers stated more mobility disability than the ex-smokers and non-smokers in the 50–64 year and 65–79-year age groups. The reason behind it can be explained by the fact that there are far more non-smokers than smokers in the present data sample. Moreover, current non-smokers during the data collection possibly were heavy ex-smokers before quitting smoking.

The present study also found that retired or unemployed participants have reported more disability with at least one ADL or IADL activity than their employed counterparts. The findings are in line with Melzer et al. (2005) that found that the higher the occupational social category and the more degree of education, the lower the proportion of participants who reported mobility disability.

Table 4.3 revealed that obese participants and the participants leaving formal education between 15-18 years of their age, reported having more occurrence of single morbidity, comorbidity or multimorbidity than their normal weight and the highest educated counterparts. Several studies support the fact that individuals with high BMI and lower education levels had a significantly higher incidence of multimorbidity (Walker, 27007; Vuković et al., 2008; Liu et al., 2016; Zhang et al., 2020b). Alike the statistical outcome for disability, the current non-smokers are more vulnerable of having single morbidities or comorbidity and multimorbidity than the current smokers. However, none/rare alcohol drinkers are having less occurrence of single morbidities and comorbidity than the frequently/daily alcohol drinkers. A longitudinal study by Dhalwani et al. (2016) found that although smoking and alcohol consumption was not found to be associated with the risk of multimorbidity among English older adults, the risk of multimorbidity was significantly higher when smoking and excess alcohol consumption were combined with obesity, lack of physical activity and inadequate fruit/vegetable intake. On the other hand, a Finnish study by Wikström et al. (2015) evaluated that the risk of multimorbidity can be significantly increased by 2.5-fold with smoking in initially disease-free older adults. "The relationship with smoking and alcohol consumption indicated possible health selection, where individuals were actively regulating their health behaviours" (Singer et al., 2019, p. 6).

The graphical analysis of the exploratory findings shows that (figure 4.2) the highest number of obese participants belongs to the 61-70 years of age group. The findings are in line with a Korean study by Seo et al. (2018) that found the incidence rate of general obesity and abdominal obesity peaked at roughly 60 years and 70 years, respectively. Although few past studies (Mokdad et al., 2001; Hedley et al., 2004; Flegal et al., 2002) revealed that for older adults, BMI peaked somewhere between 50 years and 59 years. At the same time, with increasing age beyond the 70 years, the prevalence of increasing BMI is reduced. A longitudinal study by Hajek et al. (2015) found that BMI is significantly reduced with

increasing age among German older adults, and the highest prevalence rate of overweight and obesity were visible among the individuals aged ≤ 80 years. The aspect can be partly explained by the fact that an increased BMI measurement among older adults can be due to the physiological shortening of stature due to their old age, not necessarily building up the adipose tissue (Hita-Contreras, 2018). Moreover, for the oldest old, “this comparatively low prevalence may be partly explained by a reduction in energy intake and unintentional weight loss, which is frequent in older adults” (Hajek et al., 2015, p. 11).

The outcome of Pearson’s correlation analysis (Table 4.5) reflects that the high BMI is strongly associated with an individual's disability with ADLs and the individuals are at major risk of having complex morbidities (single morbidity, comorbidity and multimorbidity). A study by Klijs et al. (2011) found that compared to smoking and alcohol consumption, obesity by BMI measurement was more strongly connected with an increased trajectory of years in functional disability during the lifetime among the Dutch older population aged 55 years and over. Having a strong association between high BMI and walking decline can partly be explained by the fact that difficulties in moving around can result in low energy expenditure, giving rise to higher BMI (Hajek et al., 2015). In addition, several studies support the fact that high BMI compared to normal is associated with an increasing degree of complex morbidities among older adults, regardless of gender differences (Zamboni et al., 2005; Samper-Ternent and Al Snih, 2012; Amarya et al., 2014). However, a cross-sectional single-centre study by Pes et al. (2019) identified that compare to the mild overweight category, the number of illness was lower among the Italian older adults (aged over 60 years) who were moderately overweight (BMI = 27.5–29.9 kg/m2). The physiological and behavioural factors may explain the aspect that "Overweight individuals can receive better medical treatment or respond better to therapeutic procedures depending on the type of chronic condition” (Leal Neto et al., 2016, p. 517).

In addition, the results evaluate that male respondent are significantly at risk of high BMI, and obesity is more prevalent among the employed respondents. There is clear evidence of gender disparity concerning the prevalence of overweight and obesity noted among the works of literature. A global survey by Finucane et al. (2011) identified that prevalence of overweight and obesity for both males and females varied by region. Moreover, there are studies that documented the global trends of overweight and obesity prevalence by a country's economic status (Kumanyika et al., 2002; Jones-Smith et al., 2011). However, a cross-country study by Kanter and Caballero (2012) found that compared to females, males were more vulnerable to being overweight and obese in both Europe and Central Asia, and this is in line with my findings. Few more studies support the fact that men are vulnerable to having higher BMI and excess weight (Hajek et al., 2015; Kaplan et al., 2003).

Moreover, the correlation analysis results (Table 4.5) are explained by the fact that as an individual's age increases, the prevalence of high BMI is significantly less at the 1% level. A longitudinal study for older adults in Germany by Hajek et al. (2015) identified that the highest prevalence of obesity was visible among the participants aged 80 years and below. There are few more studies to support the findings (Shatenstein et al., 2001; Peter et al., 2014), and the reason behind it can be partly explained by the fact that as age increases, the lean body mass decreases (age-related sarcopenia) (Genton et al., 2011). At the same time, the prevalence of obesity is significantly high among married respondents and non-smokers are at significant risk of having an increasing degree of BMI. However, a study by Kaplan et al. (2003) identified in their longitudinal study that unmarried/single Canadian older men (aged 65 and over) were more vulnerable to being overweight; besides, poor self-rated health increased the vulnerability to have obesity. Simultaneously, the outcomes of the correlation analysis evaluate that unmarried/single/divorced/widowed participant are more vulnerable to have disability with at least one of the ADLs and IADLs and the risk of having a complex degree of morbidities. The

findings are in line with a study by Rendall et al. (2011), in their review, reported that in case of disability, marriage has a protective effect for survival for younger adults and another review by Manzoli et al. (2007) revealed the same effect for older adults. However, a study by Pes et al. (2019) found that compared to single, married Italian older adults had a higher risk of having comorbidity, although divorced individuals were at a slightly greater risk.

Furthermore, the correlation analysis results reflect those individuals with frequent/daily alcohol drinkers are significantly having excellent/better SHS, having less/no disabilities by ADL and IADL activities and having fewer/ no morbidities. The findings are in line with an English longitudinal study by Singer et al. (2019) that found that increased frequency of alcohol intake could be associated with a lower risk of multimorbidity and multiple functional limitations among older adults. However, a cross-sectional study by Moore et al. (2003) found that for older adults (aged 60 years and over), drinking frequency of more than seven per week was associated with disability with IADLs and, to a lesser extent, disability with ADLs, but drinking more than three per occasion was associated with functional impairment with IADLs. Another longitudinal study by León-Muñoz et al. (2017) evaluated that moderate alcohol consumption was associated with a lower risk of functional impairment among the Spanish older adults (aged 60 years and over). Many studies support the findings that the increasing frequency of alcohol intake increases the individual's better SHS (Chang et al., 2018; Abuladze et al., 2017). In addition, the results reveal that an increasing degree of education significantly increases the opportunity of being in employment. Moreover, individuals with an increasing degree of education significantly have better/excellent SHS, less functional impairment with ADLs and IADLs and no morbidity/fewer complex morbidities than their less-educated counterparts. Many studies support the fact that an increasing degree of education is associated with better health among older adults (Abuladze et al., 2017; Araújo et al., 2018). At the same time, the results reflect that individual who are in employment significantly having more

chances of reporting excellent/better SHS, less functional impairment with ADLs and IADLs and no morbidity/less degree of complex morbidity than the individuals who are retired/unemployed. A cross-sectional study by Abuladze et al. (2017) found that compared to the individuals who were employed, retired Estonian older adults had twice as high odds of reporting poor health. Moreover, a study by Pes et al. (2019) identified that Italian older adults who were at low-rank occupation had a significantly increased risk of having comorbidity.

The outcome of correlation analysis (Table 4.6) reflects that older women with high BMI are significantly vulnerable to the increasing risk of having poor SHS, functional impairment with at least one ADL and IADL activity, and increased risk of complex morbidities There are several pieces of literature explored that older female with high BMI than normal have a significantly high risk of trajectories by ADL and IADL disabilities than males (Angleman et al., 2006; Chen and Guo, 2008; Nam et al., 2012; Leal Neto et al., 2016). And the fact that female is more vulnerable than male concerning functional disability, possibly be explained by certain chronic conditions, since older females are more prone to face health inequalities than their male counterparts (Vlassoff, 2007; Allen and Sesti, 2018). However, a longitudinal elderly (aged 60 years and over) study by Murtagh and Hubert (2004) found that there were no gender differences in ADL and IADL disabilities while the multivariate models were controlled for BMI, other predictors along with some health conditions (morbidities). Moreover, a longitudinal study for oldest old (aged 80 years and over) by Yin et al. (2014) identified that high BMI was associated with increased risk of ADL disabilities among Chinese oldest males. On the other hand, Pes et al. (2019) found that female Italian older adults with moderate overweight were associated with a lower risk of comorbidity load than their normal BMI counterparts. Whereas older men with high BMI are significantly pone to have complex morbidities. A cross-sectional study by Leal Neto et al. (2016) notified that for both genders among Brazilian older adults (aged 60-79 years), there was a significant linear trend between

an individual's BMI and the number of diseases they had. In addition, women with advancing age are significantly vulnerable to being single/ unmarried/divorced/widowed. The findings are consistent with several studies showing a significant percentage of single older women than single men (Gaymu et al., 2006; Koropeckyj-Cox and Call, 2007).

- Second objective: To determine the association between current health status and wellbeing in older adults with obesity.

The outcome of the exploratory data analysis (Table 5.7) reveals that respectively, 18.5% and 24.1% higher number of fair and poor SHS are documented by the obese individuals than their normal-weight counterparts, which is respectively, 15.5% and 20.5% higher than their overweight counterparts. The findings are consistent with previous studies, see for example- López-Garcí et al., 2003; Giuli et al., 2014, where the percentage of SHS rating as fair/poor was significantly higher for obese older adults than that of their overweight and normal-weight counterparts. The findings can be explained by the fact that, for obese older adults, lack of physical activities leads to depression and social isolation or discrimination, resulting in poor self-esteem and body image distortions (Trull et al., 2012; Abdelaal et al., 2017). Consequently, it is noted that about one quarter (22.7%) respondents have multimorbidity. The findings are in line with other UK estimates of multimorbidity that ranged from 23% (Barnett et al., 2012) to 58% (Macleod et al., 2004).

The outcome of the binary logistic regression analysis (Table 5.8) evaluates that compare to the normal weight individuals, the chance of having better SHS is significantly reduced for both of their obese and overweight counterparts. In addition, compared to the 50–60-year age group, increasing age significantly increased the chance of having better SHS, while the model is adjusted for other covariates. The outcomes are in line with an English Longitudinal Study conducted by Hulman et al. (2019) that high risk of poor SHS is associated with the

advancement of BMI in old age. However, the study found that poor SHS for the middle-aged participants (≤60 years <75 years) is related to only due to the development of BMI, whereas, for the elderly (≤75 years), it is due to the decline of BMI. Another cross-sectional study Araújo et al. (2018) revealed that most of the oldest-old participants with severe to moderate dependence had a reasonable to excellent SHS. The study compared centenarians' perceived health with their objective health status in a sample of the Portuguese population and concluded that the oldest-old might hold a positive outlook while appraising their health status despite having poor physical and functional status. Moreover, this can also be explained by survival bias theory, as obese individuals were at greater risk of dying early. Therefore, only selectively healthy individuals could survive into old age (Kuk and Ardern, 2009; Wildman et al., 2008; Ng et al., 2017). On the other hand, a Taiwan study by Chang et al. (2018) argued that overweight older adults had significantly better self-rated health score and obese older adults had significantly better self-rated happiness score than the normal-weight population. However, the study design was cross-sectional and was conducted in a moderately urban community, where heavier individuals perceived their weight beneficial for intensive farm work. Nevertheless, several studies explored that SHS of older adults is not solely dependent on ageing or age-related health status and functional difficulty, and there is an existing discrepancy between subjective and objective indicators of health among older adults (Cho et al., 2012; Araújo et al., 2015; Araújo et al., 2018).

Moreover, the regression analysis explores those chances of having better SHS is increased for older women compared to their male counterparts. The outcome is supported by a past cross-sectional study (Abuladze et al., 2017) of older adults in Estonia who evaluated older Estonian men with poorer SHS than women. However, the outcome is inconsistent, and a study by Hulman et al. (2019) mentioned that females are more prone to having poor SHS than males. The findings can be explained by the fact that older females face the menopausal or post-

menopausal transition (Dennerstein et al., 2003). Similarly, the analysis shows that the likelihood of having better SHS is increased for employed and non-smokers compared to the unemployed and current smokers. The outcome is in line with several studies (Svedberg et al., 2006; Abuladze et al., 2017). Abuladze et al. (2017) explored that retired people were twice as high odds of reporting poor SHS as those who were employed. A prospective Swedish study by Svedberg et al. (2006) for the older adults of 45 years and above found that the risk of having poor subjective health was associated with individual's positive smoking status, obesity, and unemployment, while controlling for age, gender, illness, education, and socio-economic status. At the same time, it is also noted that the frequent or daily drinker increased the chances of having better SHS compared to their none or rare alcohol drinker counterparts. The outcome is agreed by Chang et al. (2018) that found alcohol consumption had a significant protective effect on an individual's subjective health, and on the other hand, smokers rated their health more inadequate than non-smokers when the model was adjusted for other covariates. A cross-sectional study by Abuladze et al. (2017) found that although frequent drinkers reported their SHS as better than those abstaining from alcohol, daily drinkers were not significantly different from those abstaining. However, this is somewhat contradictory to the previous study findings that moderate alcohol drinkers compared to light drinkers positively affected health (Beulens et al., 2017). Furthermore, the analysis finds that being highly educated strongly increased the chance of an individual's good SHS. The findings are in line with a study by Liu and Zhang (2004) that found that the higher the educational level was, the better health status the older adults reported.

The outcome of the analysis (Table 5.9) reflects that obesity among older adults is significantly associated with single morbidity, comorbidity and multimorbidity, while the model is adjusted for other lifestyle and socio-demographic factors. The result is also in line with the present study outcome of correlation analysis in chapter 4. The result is consistent with several past

studies (Dhalwani et al., 2016; Li et al., 2016) that participant's obesity status was positively associated with an increased hazard of multimorbidity. Dhalwani et al. (2016) found that although obesity is not significantly associated with multimorbidity independently, the overall risk of multimorbidity is increased more with the combined presence of certain unhealthy lifestyle factors than the quantity, which is in line with the present study. Several past studies also revealed that high BMI compared to normal is associated with several potential adverse health effects among older adults, and obesity is the strongest predictor for several chronic diseases (Zamboni et al., 2005; Purty et al., 2006; Samper-Ternent and Al Snih 2012; Amarya et al., 2014). A prospective study by Kvamme et al. (2011) explored that among Norwegian older adults, BMI below 25 could be associated with increased mortality for both genders, and overweight individuals had the lowest mortality. Nevertheless, the risk of mortality remained higher for both genders with a BMI greater than 30kg/m2 (Kvamme et al., 2011; Amarya et al., 2014; Zamboni et al., 2005). At the same time, it is noted that the risk of having single morbidity and comorbidity for overweight older adults is insignificant. Several past studies revealed that for older adults aged 65 and over, the risk of all-cause mortality was not significantly associated for overweight and obese individuals concerning normal weight (Janssen 2007; Beleigoli et al., 2012; Ng et al., 2017). In addition, this can also be explained by survival bias theory (as discussed above). Moreover, "Another explanation is confounding due to disease-associated unintentional weight loss prior to death among obese individuals. This may result in shifting misclassification of obese individuals into the categories of low or normal BMI category" (Ng et al., 2017, p. 5). Furthermore, a cross-sectional US study by Pantalone et al. (2017) explored that high BMI is associated with a high prevalence of comorbidity, although, the study participants were ≥ 20 years old. There are only a very few studies exploring the association between comorbidity and BMI among older adults. Another cross-sectional single-centre study by Pes et al. (2019) found that moderately overweight with

a BMI range of 27.5–29.9 kg/m2 can be a protective factor for particularly older males concerning comorbidity. Some studies explored being overweight possibly be a protective factor concerning chronic diseases (Pes et al., 2019; Coqueiro et al., 2013), but the effect appears to be weakening for the elderly (Dixon et al., 2015). Besides, it is evident from the present study analysis that compared to the 50–60-year age group, the hazard of multimorbidity than no morbidity significantly increased with age. The findings are supported by by Booth et al. (2014) that found the prevalence of multimorbidity significantly increased with age in each overweight and obese category by BMI classification. The findings are also consistent with a past longitudinal English population study by Singer et al. (2019) that found that increasing age increased the probability of having multimorbidity. In addition, Li et al. (2016) evaluated that older age was positively associated with the increasing hazard of multimorbidity. Systematic reviews and meta-analyses by Ofori-Asenso et al. (2019) aimed at the older adults (aged ≥ 65 years) in high-income countries explored that 2 in 5 and 1 in 8 older adults had ≥ 3 and ≥ 5 chronic medical conditions, respectively. Nevertheless, in older adults, the relation between BMI and chronic diseases is complex, and the effect of BMI seems attenuated, which can be explained by the 'obesity paradox' (Dixon et al., 2015; Leal Neto et al., 2016) and perhaps a few combinations of medically diagnosed diseases are more hazardous than others (Hernández et al., 2019).

On the other hand, the regression analysis reflects that compared to females, the risk of having single morbidity, comorbidity and multimorbidity than having no morbidity is significantly reduced for males. The findings are in line with a prospective English population study by Dhalwani et al. (2016) that evaluated participants who were male reduced the risk of incident multimorbidity than females. Furthermore, this outcome is consistent with other UK, European and American studies (Marengoni et al., 2011; Violan et al., 2014; Agborsangaya et al., 2012; Li et al., 2016). Perhaps the reasons behind the higher multimorbidity among females could be

that they are more vulnerable to higher exposure to common risk factors for chronic medical conditions (Alimohammadian et al., 2017; Ofori-Asenso et al., 2019). Moreover, a study on older Irish adults by Hernández et al. (2019) explored the gender variations according to the prevalence of various clusters of comorbid conditions. For example, females had a high probability of suffering from osteoporosis, arthritis. At the same time, obesity and arthritis were the highest prevalence of comorbidity in the male participants. However, the study found that female cohorts might have a more complex set of highly occurring coexisting conditions than males. The regression analysis also explores that the risk of multimorbidity is significantly increased for current smokers than non-smokers, whereas the risk is insignificantly reduced for frequently or daily alcohol drinkers compared to none or rare alcohol drinkers. Moreover, this is agreed by a recent longitudinal study (Singer et al., 2019) that found the odds of having multimorbidity reduced by the increasing frequency of alcohol consumption. Another study by Dhalwani et al. (2016) did not find a significant association between the risk of multimorbidity and frequent alcohol consumption among the older English population. However, the study evaluated that obesity and smoking, if combined with excess alcohol consumption, lack of physical activity, and inadequate fruit/vegetable intake, could have the strongest association with multimorbidity incidence. Moreover, the outcome is in line with a Finnish population-based study by Wikström et al. (2015) that found smoking was associated with 2.5 folds increased risk of multimorbidity among the disease-free population. The study participants were from the 25–64-year age group. A longitudinal English population study by Singer et al. (2019) also found that compared to never smokers, ex-smokers had a greater odds ratio for complex multimorbidity, although the result is inconsistent for the older population, given the fact that heavy smokers die at a young age (Dhalwani et al., 2016). The study found that few combinations of lifestyle factors could be more hazardous than others in the increasing risk of multimorbidity. At the same time, the present study evaluates that compare to the individuals

with no education or minimum education (/≤14 years), having higher education insignificantly reduced the risk of single morbidity, comorbidity and multimorbidity. The outcome is supported by a multicentre study of older inpatients across China by Zhang et al. (2020b) found that individuals with a lower level of education were associated with a higher prevalence of multimorbidity. Moreover, a comparative study by Eikemo et al. (2008) compared the health inequalities according to the educational level of 23 European countries and observed that the predicted risk of the greatest overall prevalence rates of ill-health was associated with the countries lowest average years of education, namely the Southern and Eastern European countries.

The results of multiple linear regression analysis (Table 5.10) evaluate that the risk of having poor wellbeing increases with the increase of an older adult's BMI than their normal BMI (18.5-24.5 kg/m2), when the model is adjusted for BMI and other variables. The outcome is in line with a cross-sectional US study that used primary data and evaluated that overweight and obese patient had a substantially lower health-related quality of life, and the effect was reduced when combined with age, sex, smoking and comorbidity (Katz et al., 2000). Moreover, several pieces of literature agreed that compared to normal weight, high BMI is associated with a decline in health-related quality of life among older adults (López-García et al., 2003; Sach et al., 2006; Andreyeva et al., 2007). However, the results of analysis paradoxically find that increasing age for an older adult strongly reduced the risk of having poor wellbeing. The outcome is in line with an English study by Deaton et al. (2008), using data from a proceeding survey of over 160 countries that explored the U-shaped association between age and wellbeing, where 45-54 years age group had the worst wellbeing, although, they did not explore the combined effect of obesity, other lifestyle factors and subjective and objective health status on individuals' increasing age and wellbeing. In addition, another study by Blanchflower and Oswald (2008) explored the U-shaped association of age and wellbeing, where younger and older adults had

the higher wellbeing with the lowest at the middle age. The findings can be explained by the fact that retirement is perhaps beneficial for a person's mental wellbeing (van der Heide et al., 2013; Slater et al., 2018). Nevertheless, a progressive English study by Slater et al. (2018) found that older adults above 70 years had a 27% more risk of having depressive symptoms than older adults aged between 50-59 years, but participants aged between 60-69 years had 9% lower risk.

On the other hand, it is noted from the present study analysis that compared to non-smokers the hazard of poor wellbeing was significantly higher for current smokers. Which is in line with a systemic review of 54 studies by Goldenberg et al. (2014), that identified smoking is negatively associated with quality of life, and the extent of this association is connected to the number of cigarettes smoked. However, another cross-sectional study by Kao et al. (2019) found that smokers who attempted to quit smoking had a low health-related quality of life than the current smokers among the lower-income African Americans. Moreover, the present analysis explores that an older adult's poor subjective and objective health status are strongly associated with the risk of having poor wellbeing. Several past studies also agreed that multimorbidity is associated with poor health-related quality of life (Fortin et al., 2004; Li et al., 2016). Moreover, a longitudinal study by Shankar et al. (2014) evaluated that hedonic wellbeing (greater enjoyment in life) could be associated with an individual's poor health, and Steptoe et al. (2015) found that hedonic wellbeing could be declined progressively with the number of comorbidities.

- Third objective: To explore the differences in social care needs by the degree of obesity.

The result of descriptive statistics (Table 6.4) evaluates that out of a total of 5631 respondents, overweight and obese older adults together received more informal care support than formal care, the former is about 13% and the latter 3.3%. The findings are also supported by Nizalova

et al. (2020, p.6) in a longitudinal study that "The overall impact of obesity on any care-use appears primarily due to the effect on informal care, while the effect on privately-paid care or formal care is smaller. However, the prevalence of being overweight is highest for those not receiving any type of care". Which is in line with the present study that overweight individuals received the highest percentage of no care support (29.9%). Moreover, it is also noticeable from the outcome that older adults receive more informal and formal care support with increasing age. A cross-sectional English study of older adults aged 65 years and over by Vlachantoni et al. (2015) reported that the receipt of social care support from various sources increases with increasing age. Further, the study showed that almost half of the participants aged 85 years and over and who had at least one difficulty with ADL or IADL received support from informal sources. However, in the present study, among the 717 participants aged 81 years and over and whose BMI was ≥ 25kg/m2 received 46.2% informal care support. In addition, it is revealed that older adults who are married and have positive co-residence status receive significantly more social care support, primally informal. These findings are supported by a past study which found that an individual's marital status is a strong predictor of receiving social care from any sources and individual's living arrangements, especially if they have children, are the critical indicators of receiving support from informal sources (Vlachantoni et al., (2015). Not surprisingly present study explores that the significant proportion of informal and formal social care is received by the older adults with at least one ADL and IADL disability. A national institute for the health research study by King and Wittenberg (2015) explored that among the participants who reported difficulty with one or more ADLs, 84% received informal help with domestic tasks. However, in the present study, among 959 participants, older adults reported difficulty with at least one ADL, of whom about 63% received informal care support. The former study considered the study participants aged 65 years and over regardless of their obesity or malnutrition status. Furthermore, from the present

study findings, out of 54.7% reported long-standing illness of obese older adults, about 90% and 88.6% of those received informal and formal care, respectively. According to Copley et al. (2017), out of 44.3% reported long-standing illness of obese older adults, 81.4% of those made up a need for care.

The findings of binary logistic regression analyses (Table 6.5 and Table 6.6) reflect that high BMI than normal, progressively increases the amount of informal social care receive. However, the chances are high for the older adults with moderate and morbid obesity for receiving increasing amount of formal care support while the model is adjusted for other covariates. The findings are in line with the study by Nizalova et al. (2018), which explored that individuals' BMI over 40 kg/m2 is associated with a higher proportion of receiving informal care. Moreover, a report by the LGA (2020, p. 12), stated that "When obesity data was split into three categories (BMI 30-34.9/ BMI 35-39.9/ BMI 40+) it was found that severe obesity has a statistically significant effect on the use of long-term care, whether informal care, privately paid home care or formal home care" (while LGA considered severe obesity is BMI 40+, however, in the present study it is defined as morbid obesity). An Irish cross-sectional study by Mc Hugh et al. (2015) explored that when the model was adjusted with other covariates, an individual's BMI was not statistically significantly associated with the receipt of formal care support by state-provided home help service. Nevertheless, in the present study, only morbid obesity is significantly associated with the receipt of formal care at a 5% level. Further, Copley et al. (2017) stated that BMI is positively related to the self-reported need for social care, while the model was adjusted for socio-demographic factors and limiting long term illness.

On the other hand, a study by Broese van Groenou et al. (2006) evaluated that individual's socio-economic status is negatively connected concerning informal care use within Britain; however, the study used the 2001/2001 GHS (General Household Survey) data. In the present study, an individual's employment status represents the participants' socio-economic status, and

it is noted from the analysis that an individual's employment status is negatively associated with the receipt of informal and formal care support. Which reflects that the older adults who are employed reduce the amount of both informal and formal care support than their retired or unemployed counterparts Moreover, a cross-sectional English study of older adults (regardless of obesity status) aged 65 years and over by Vlachantoni et al. (2015) explored those women were strongly associated with receiving formal support by paid-for care than men and so as being single than married. Moreover, the study also stated that participants living with their children are having 0.22 more odds than those not living with their children. The present study is in line with the outcome that older males and individuals with positive co-residence status reduce the amount formal social care receipt. However, in this study, marital status is only strongly associated when the model was not adjusted for BMI, age, and other variables, where being unmarried/single/divorced/widowed increase the odds of the receipt of formal care. Nevertheless, when the model is adjusted with BMI and other covariates, being unmarried/ single/widowed/divorced is negatively associated with the receipt of formal care, and the association is not statistically significant. Unsurprising the from the findings it is noticeable that Compared to the individuals with a minimum level of education, having the highest education and medium level of education significantly reduced the odds of receiving informal care. It is probably because there is an impact of education on increasing physical functioning and SHS among adults of all ages (Mirowsky and Ross, 2003).

Moreover, the outcome explores those older adults with at least one IADL disability are strongly associated with the increasing number of receiving formal care support when the model is adjusted for BMI, age and other variables. However, the association is insignificant with ADL disability. The findings are in line with a cross-sectional English study by Vlachantoni et al. (2015) that reported ones' difficulty with the number of ADLs and IADLs are the strongest predictors of receiving state support. Particularly, the study showed that the

odds of receiving formal care by paid-for support was about 42 times for individual with at least one IADL disability than no difficulty with IADLs. In addition, the study reported that "the receipt of informal and state support is associated with a person's difficulty with ADLs such as bathing and getting dressed, while the receipt of paid-for support is more closely associated with one's difficulty with specific IADLs, such as shopping and doing housework or garden work" (Vlachantoni et al., 2015, p. 339). Moreover, they explored that limiting long-standing illness is a strong determinant of social care support receipt for both men and women. Further, the study evaluated that the odds of receiving formal support by paid-for care were almost double for the participants who reported limited long-standing illness than those who reported none, which is in line with the present study (OR:1.91 for long-standing illness). Furthermore, a study by Nizalova et al. (2020) found that using either type of social care can be reduced in the future with the effect of individuals having good or better SHS. This is in line with the present study, although the effect is insignificant. Further, the former study also found that depression does not affect the demand for social care use, which is also in line with the present study that participants' poor wellbeing does not affect self-reported receipt of any social care. A study by Grant et al. (2013) informed that increased depression symptoms could be a strong predictor of an individual's poor wellbeing.

- Fourth objective: To examine the role of obesity among older adults in determining social care needs by identifying their unmet care needs.

The narrative analyses of the qualitative semi-structured interview indicate that participants face challenges in their everyday life regardless of their weight categories. Moreover, the stories reveal that older adult with disability concerning difficulties in either ADLs, IADLs and/or mobilities struggle to meet a range of compound needs than other older adult participants. The findings are supported by Age UK (2019) that found living with a single 'need' can be as stressful as living with compound needs and that if they remain unmet, then

individuals are often struggling with a combination of unmet needs Several past studies have found that various types of arthritis, cancer, and kidney disease can be directly or indirectly associated with individuals' high BMI level (Sach et al., 2007; Nizalova et al., 2018; Leal Neto et al., 2016). Which is also reflecting from the narrative stories of the study participant's that the main reason for their disability is either due to their painful back and joints or the pain due to cancer, kidney dysfunction and previous surgery.

Moreover, the narratives of the present study explore that loneliness and social isolation are critical issues for many older adults regardless of their disability and health status. Yet loneliness is a key predictor of poor self-esteem and lack of self-confidence (Dykstra, 2009). A longitudinal study on English older adults by Shankar et al. (2015) explored that loneliness and social isolation are associated with an individual's poor wellbeing. These findings are also in line with a NatCen study by Dunatchik et al. (2017, p. 6) from a primary interview dataset of older adults that "older people raised unmet need for social contact and mobility as being as important, if not more important as meeting basic needs of daily living". Furthermore, several studies support the finding that high BMI increases the risks/likelihood of loneliness, social discrimination, or being socially judged and social anxiety (Day et al., 2018; Jung and Luck-Sikorski, 2019; LGA, 2020).

Furthermore, it is noted from the interview narratives that some older adults are more satisfied in their life overall, despite their unstable care and support system. Age UK (2019, p. 20) state that "wellbeing for older people is multi-faceted and includes health, care and support, money, housing and social contact. It follows that people living with disadvantage in these areas, and even with a single need, are more likely to have lower wellbeing". A longitudinal study on the secondary ELSA dataset by Dunatchik et al. (2019) found that older adults' level of wellbeing is not a significant predictor of their future unmet care need. Another report by Dunatchik et al. (2017, pp. 66) on primary interview dataset of older adults showed that there are some areas

of unmet care need that have a stronger association with wellbeing than others, these are "lack of mobility and isolation and lack of access to hobbies and interests and the associated loss of independence". However, both studies considered the study participants included older adults that may be underweight and malnourished and so may not wholly apply to overweight and obese older adults. At the same time, the study by Dunatchik et al. (2017) found that an easily accessible helpline or community centres can be an intervention that reduces the risk of negative wellbeing. This is in line with this present study's findings that many older adults are frustrated and upset due to a lack of easily accessible support or helpline (case number- 2, 10).

Financial hardship is found to be another crucial issue for many older adults in the present study, since there is an association between obesity and unemployment (LGA, 2020), and older adults experiencing major transitional phases of life, like retirement (Han et al., 2011). As such, a cross-sectional study by Conklin et al. (2013) established obesity demands financial hardship regardless of social class, education, and housing tenure. However, older adults who put a high value on their independence to protect their self-esteem and hold a positive outlook are seemed to have higher wellbeing. Although, this finding needs to be treated with caution as according to Dunatchik et al. (2017, p. 6), "managing to cope, but with impacts on exhaustion and pain, or by limiting expectations is an indication of unmet need".

It is, however, important to state that qualitative interviews reveal people's perspectives to see their lives rather than quantify the number of people holding those outlooks (Dunatchik et al., 2017).

8.2.1 The integration of both phases of study outcomes

The secondary analysis of the present study (in Chapter 4) explores that an individual's age and high BMI are strongly positively associated with an individual's difficulty in daily living with ADLs or IADLs, regardless of their gender. The findings are in line with the primary data

analysis of the study, which finds that most of the older adults with high BMI than normal, have stated their unmet care needs are connected to their impairment of daily living as a result of musculoskeletal difficulties. In addition, the multivariate regression analysis of the secondary dataset in Chapter 5, has found that an individual's high BMI is a substantial contributing factor in predicting the individual's objective health status (clinically diagnosed diseases) while controlling the socio-demographic, socio-economic, and behavioural factors regardless of their type of morbidity. The findings are supported by the primary data analysis of the study, which finds that overweight and obese older adult's unmet care needs are predominantly dependent on their health conditions or ill health or previous surgery. Moreover, the secondary analysis of the present study (Chapter 5) has also found that high BMI is strongly and positively associated with the risk of fair/poor life satisfaction (subjective health status), while it is also apparent from the qualitative primary data analysis that obesity and fair/poor life satisfaction are one of the strong predictors of poor wellbeing after adjusting for other predicting factors. Simultaneously, the qualitative interviews in the present study, have revealed that low wellbeing has a significant impact on increasing the amount of unmet care needs among overweight and obese older adults. However, the secondary data analysis (Chapter 6) undertaken in this study has finds that an individual's poor wellbeing is not a significant predictor in determining the amount of informal and formal social care received. Nevertheless, data analysis from both secondary and primary data sources reveals that older adults with high BMI than normal are vulnerable to the risk of having poor wellbeing, which is one of the primary drivers of rising unmet needs for care and support.

8.3 Strengths and potential weakness of the study

The primary strength of the present study is that the study used a secondary nationally representative survey dataset, that is the English Longitudinal Study of Ageing (ELSA), which collects multifaceted data from a representative large probabilistic sample of the English

population cohorts aged 50 and older. However, the present study sample contained comparatively younger cohorts' participants (mean age 68 years), compared to the general population of older adults, due to the attrition of older participants from survey dataset. The cohorts are also healthier compared to the average UK population. Lastly, this data is collected from predominantly a white ethnic background (94.6%). Hence, the present study outcome may not apply to older age cohorts or to other ethnic groups. The ELSA sample is also obtained from older adults living in the community rather than in care homes. However, the institutionalisation rates for middle-aged older adults are generally low in England and, therefore, this should not be a significant bias (Melzer et al., 2005). The BNF (2016) identified that care home adults are more prone to be malnourished and therefore level of obesity may be lower in this group than the wider population of older adults. So, this selection bias may not have been significant. Therefore, the study outcome might be a conservative evaluation of the actual health, wellbeing, and social care implications of overweight and obese older adults.

On the other hand, application of cross-sectional weights in the SPSS data set has helped to minimise the longitudinal data's selection bias (attrition and non-response) by stratifying the sample. However, the cross-sectional study design is considered to be introduced selection bias (Rössner, 2001), as the factors are analysed at one point time due to the nature of the ELSA database; the study design cannot determine a causal association between an individual's weight gain or loss or the impact of alterations in individual's other characteristics (current societal, environmental, and economic factors), with the onset of disability, the prevalence of morbidity over time, changes in wellbeing status and alterations in the receipt of informal and formal social care. It therefore could not investigate outcomes such as the role of institutionalisation or the effect of BMI on mortality. However, the cross-sectional design does provide prevalence estimates, identification of potential risk factors, and preliminary associations (Li et al., 2016).

The present study has also adjusted for several covariates to minimise confounding factors; however, it could not rule out residual cofounding factors for which data had not been collected in ELSA. The present study, however, is designed to assess the prevalence of diverse health trajectories and the impact on the social care support due to high body mass index, which cannot feasibly control all the potential covariates for every health and wellbeing and lifestyle markers. Key confounding factors that may have impacted an individual's social, behavioural, lifestyle and health functions include physical activity, access to health care, social support, self-esteem, social isolation, loneliness, and depression. As such, these residual confounding factors could have influenced the present study's findings.

ELSA self-reported chronic disease diagnoses are based on doctor-diagnosed illnesses. In addition, individuals with either physical or cognitive disabilities had the opportunity for a proxy interview (for example, family member or professional carer) that is likely to have increased the validity and reliability of the information obtained on their chronic conditions (Dhalwani et al., 2016). Self-reported chronic disease estimates from ELSA have also been found to have good criterion validity when compared to other national estimations (Diabetes UK, 2010; Bozio et al., 2010). Apart from the anthropometric measurements of participant's heights and weights, all other information on lifestyle factors, ADL and IADL limitations, chronic disease diagnoses, wellbeing and the receipt of social care support was collected as self-reported data in ELSA. However, this may have introduced a potential risk of both recall bias and social desirability bias (Jackson et al., 2019). Participants may have forgotten or may have exaggerated or downplayed the health, wellbeing, and social care aspects that they reported on. Participant's response rate and the response types can also be affected by questionnaire administration (Bowling and Windsor, 2008). Nevertheless, the impact of recall and social desirability bias is likely to be small as several past studies have found good agreement on several health outcomes when using self-reported ELSA data for older adults

(Zaninotto et al., 2010; Shankar et al., 2015; Pongiglione et al., 2017; Jackson et al., 2019). Although self-reported chronic disease diagnoses were criticised in a past study (Hermosilla-Pérez et al., 2013).

Furthermore, several past studies have found good agreement on health outcomes using height coefficients from the ELSA dataset as height is measured in every alternative Wave in ELSA (Jackson et al., 2015; Fernihough and McGovern, 2015; Copley et al., 2017). Although for the present study, height was not measured in the same data collection wave as weight, other lifestyle, health, and social care factors, hence it could introduce measurement bias, as participants may have changed their height status since older adult's height can reduce due to age-associated spinal shortening (Han et al., 2011). Therefore, there is a possibility that the level of obesity is overestimated, as the height would have been lower than if measured at the same time of weight measurement, given that BMI is calculated as weight in kilograms divided by height in meters squared. However, most of the studies that deal with anthropometric measurements of height and weight, are based on the assumption that an individual's height is stable in adulthood, "because cohort comparisons are generally based on cross-sectional comparisons, and it is not possible to distinguish the effects of age and cohort without longitudinal data" (Fernihough and McGovern, 2015, p. 4). Hence the degree of the measurement bias does not seem to be significant. Alongside this, although BMI is a well-known measure, it may not necessarily the best measure of obesity as there is evidence that measuring central obesity might be a more critical factor in influencing health outcomes (Alexandre et al., 2018, Zaninotto et al., 2010). Moreover, different studies use different cut off points of BMI to determine obesity, so comparisons across studies can be difficult. Due to the limited data available from ELSA, it was not possible to use other measurements of obesity, such as waist circumference or waist-to-hip ratio and waist-to-height ratio, to increase the measurement validity of the present study findings.

The most common definition of comorbidity and multimorbidity used in other epidemiological studies is used in the present study (Fortin et al., 2012). However, different studies use a different range of chronic disease conditions when defining comorbidity and multimorbidity, such as epilepsy, learning disability (Li et al., 2016). In addition, some studies may classify depression and anxiety as separate entities, but other studies argue that these two conditions should not be treated as different conditions due to the very similar pattern of clinical outcomes (Fortin et al., 2004; Valderas et al., 2009). A systematic observational study by Violan et al. (2014) stated that the number of chronic conditions varied from study to study and ranged from 5 to 335. Therefore, it is essential to establish a consensus among researchers internationally, on a common definition of comorbidity and multimorbidity (Li et al., 2016).

Finally, the present study follows a mixed method design, which helps building up different knowledges to better explore the complexity of an issue and offer a multidimensional perspective. However, due to the onset of COVID-19 pandemic it was impossible to carry out an in-depth interview and random selection of the participants. In addition, the COVID-19 pandemic may have exacerbated and heightened existing mental health and wellbeing issues in overweight and obese adults, for example, greater lack of social contact and loneliness, increase in anxiety, fear, and distress, further decreases in physical activity, support for carers, and challenges with daily living like shopping and a lower income (Zhou et al., 2020; Brooks et al., 2020; Feroz et al., 2020). Hence this might have led participants to overestimate their unmet needs. Nonetheless, during data analysis, adjustments were made for data predominantly affected by the pandemic, for example if participants reported that they had lost their job for COVID then this data was excluded from the analysis. The present study findings are in good agreement with the other past studies on older adults (Age UK, 2019; Dunatchik et al., 2017a; 2019b).

8.4 Implications of the research on policy and practice

Obesity has several adverse effects on an individual's physical and mental health (Public Health England, 2019; Wharton et al., 2020). Hence systematic efforts were made prevent and control levels of obesity in the England population since 2010 (The King's Fund, 2020). However, tackling the challenge of obesity need a long-term strategic commitment particularly for older adults. Sustainable changes in weight can be achieved by adopting an individualised person-centred approach rather than weight loss carried out by alone (Wharton et al., 2020).

The outcome from the present study would enable policymakers and healthcare providers to have greater insight into the effects of socio-demographic and lifestyle factors and the effect of high BMI on older adult's health and wellbeing and their unmet needs for care and support. In addition, current obesity management guidelines for older adults should be holistic. They should also focus on both helping older adults to lose weight and tackle the wider factors that affect their health and wellbeing. This means providing support for an older adult's complex morbidities and social and economic factors such as, lack of emotional support, lack of social contact, and social stigma, and not just focus on weight loss alone. Since, for some older adults, 'emotional eating' can be driven by one's health and wellbeing status and wider social and economic circumstances, sustainable long term weight management can become a vicious cycle (the University of Texas at Austin, 2010; Andersen, 2015). However, most of the existing guidelines and literature are focused on weight-loss outcomes only (Wharton et al., 2020).

To date, obesity-related NHS expenditure and the burden on NHS services were the main driving force for the health care providers rather than its implication on adult social care services (LGA, 2020). However, the present study's findings on how environmental factors and lifestyle factors influence the amount of social care received and how it impacts people's lives may help policymakers and healthcare providers allocate limited resources for adult social

care service and promote healthy ageing rather than just focus on weight loss only. This would have the added benefit of also focusing on narrowing down health inequalities as many of these overweight and obese adults are in lower socio-economic groups. Furthermore, the present study has revealed that, in many cases, minimal emotional support through befriending and counselling services or through maintaining and supporting a social network can help older adults meet their need and improve both their physical, mental, and social wellbeing.

The present study may help the policymakers and the local authorities redesign adult social care services with special attention towards the older adults. In addition, all public, private (for example, food industry), and voluntary sectors must follow a collaborative Whole Systems Approach (WSA) to fight against these rising challenges of obesity (LGA, 2020) and assist local government to plan and tailor intervention for overweight and obesity management. However, there is a lack of systemic data collection and publication at the national and local ground about obesity and social care need among older adults (LGA, 2020). This present study has ventured meticulously to throw light in this area. More routine data collection, sharing, and data linkage may help overcome the gaps between data and the challenges in planning and tailoring successful interventions for overweight and obese older adults.

The present study found that receiving social care support varies and is provided by different sources depending on the environmental factors and lifestyle factors of older adults. The present study identifies several unmet needs that are not considered in current local social care services. These unmet needs may eventually affect an individual's health and quality of life, which may increase the future burden of social care and associated costs. Therefore, the eligibility criteria for social care needs should be revised, and the definition of 'need' for adult social care service should be widened to include more categories of need such as the unmet needs identified in the present study. A study by Asadi-Lari et al. (2003, p.4) stated that “The comprehensiveness of 'health' deserves a definition of health needs which over-rides political

considerations, or providers' limitations, and embraces current political strategy to conceptualise and meet health need in the widest sense". In addition, social care should empower and enable individuals to live as independently as possible focusing on their abilities rather than disabilities. Social care providers and policy makers should take a life course and human rights approach when designing social care services. They should also take account of the wider social and environmental context when delivering social care services by using a social cognitive and social model of disability framework.

8.5 Summary of the chapter

In the present chapter, the main study findings in relation to the study objectives are critically evaluated based on the relevant past research outcomes in this area. In addition, the amalgamation of both arm of the study findings are also highlighted. Study strength and limitations are discussed along with the approaches that are undertaken to overcome some of the limitations. Finally, the relevance of the current study and its implication on public health policy and practice are briefly discussed.

CHAPTER 9

Conclusions

9.1 Introduction

The final chapter highlights the key outcomes of the study based on the study objectives and research questions. It briefly presents those central theories that help the present study findings to be grounded. In addition, the chapter indicates the study methodology based on the research gaps to fulfil the study aim and objectives. The contribution of the present study to current knowledge is also pointed out. The future research recommendations are discussed based on the study limitations. Finally, an overview summary conclusion of the study objectives and its significance in obesity among older adults and their health and wellbeing and social care need in England is presented.

9.2 The study outcomes and contribution

The present study explores the effect of obesity on health and social care needs among older adults in England. The findings of the study provide an important update and a new outlook for the adult health and social care delivery team in England delivering care and support for older adults with obesity. For the first time, a study has explored the older adults' perspectives of living with obesity in the community.

A literature search is conducted using three databases: CINAHL Complete, MEDLINE and Academic Search Elite, with the help of Boolean Operators (EBSCO Industries, 2021). The research objectives, and research questions, are developed based on the knowledge gap identified by the concept of the 'obesity paradox' (Chapman, 2010) and the issues identified by

Vlachantoni et al. (2011). Chapman's 'obesity paradox' is the finding that thought weight loss for adults increases their risk of dying early (mortality), high BMI among older adults seems to have a 'protective effect' on their risk of dying. However, given this potential paradox, it is yet unclear what is the exact relationship between individuals' high BMI, their disability, health and wellbeing status, and their social care needs. Vlachantoni et al. (2011) have identified various types of needs among older adults that need to be supported by specific social care sources, the importance of identifying and taking account of unmet needs, and the need for adult social care service to be planned and designed to take account of these. No study to date has identified the different aspects of unmet need among overweight and obese older adults, who require support and care from public social care services. In addition, existing obesity management frameworks and guidelines (see in chapter 2.7) generally do not address the care pathway for overweight and obese older adults, their current health status and wellbeing, and how their quality of life can be further improved.

The key theories that underlie the findings of the present study are firstly, seeing obesity through a life course approach and social cognitive theory lens. Secondly, understanding disability through a human rights approach and social model of disability. Thirdly, framing wellbeing about helping individuals to recognise the abilities they have, not their disabilities, and feeling empowered and enabled. Lastly, appreciating that how individuals and organisations perceive need is multi-layered and includes felt need, expressed need, and unrecognised need.

All four study objectives that are set out for this PhD research are fulfilled. For the first phase, a conceptual model is developed (see Figure 2.1) by mapping out the theoretical arguments using the findings from the existing literature. A mixed-method approach is adopted, guided by key public health theories (see Chapter 2) and grounded in an appropriate philosophical

orientation. The secondary dataset has been analysed using appropriate statistical analytical tools including a series of multivariate logistic regression models.

The present study answers the unaddressed important question of Obesity Paradox regarding the association between high BMI with morbidity, wellbeing, and social care need. From the study it is clear that high BMI among older adults increase the risk of functional impairment of daily living and the hazards of complex morbidity (first objective).

This study has found that high BMI in older adults is positively and significantly correlated with an increased risk of functional limitations in Activities for Daily Living (ADL). Increasing age in older adults is positively and significantly correlated with an increased risk of functional limitations in both ADL and Instrumental Activities for Daily Living (IADL), while, increasing age and high BMI in older adults are strongly correlated with complex morbidity.

The study has also found that high BMI in older adults is significantly associated with poor wellbeing and complex morbidity in all three categories of single morbidity, comorbidity and multimorbidity, even when the model is adjusted for other lifestyle, socio-demographic and socio-economic factors. Moreover, it is revealed that an older adult's subjective health status is a strong predictor of their poor wellbeing, while older adults with comorbidity or multimorbidity insignificantly increase the risk of their poor wellbeing (second objective).

In addition, the study has found that, compared to the normal weight older adults, a high BMI in older adults, i.e., classified overweight and obese older adults are positively associated with receiving informal care. In contrast, severe obesity in older adults, i.e., having a BMI ≥ 35 to < 40, is positively associated with informal care but negatively associated with receiving formal care, while morbidly obese (BMI ≥ 40 kg/m2) is positively associated with receiving informal and formal social care; with the association of formal care being significantly positive.

Furthermore, this study has found that the majority of the care burden is lying on the informal care support system. The relevant factors are age (being between 71-80 years), level of education, level of functional impairment, and limiting longstanding illness that together play a significant role in determining the amount of informal and formal social care received (third objective).

For the second phase of the study, a second model is conceptualised (See Figure 4.1) to evaluate the gaps in social care provision by identifying unmet care and support needs. The qualitative data is collected using a semi-structured questionnaire, and a structured narrative analysis is conducted to analyse the primary data. The main finding of this part of the study is that poor health and wellbeing increases several unmet needs among older adults, particularly older adults with higher levels of obesity (fourth objective). These unmet needs include, lack of emotional and social support, lack of social contact, social discrimination, lack of housing adaptations, lack of safety in the home, and support of carers. These unmet needs widen the health inequalities that are already being experienced by obese older adults. As stated earlier, this also widens health inequalities among this group of people.

Present study findings are supported by a longitudinal study of Dunatchik et al. (2017), which used both secondary and primary data sources. They found that older adults (aged 65 and over) who had difficulties in Activities of Daily Living (ADL) with at least one functional limitation in ADL, or two or more functional limitations in Instrumental Activities of Daily Living (IADL), or impaired mobility and not receiving any care and support have several unexpressed and unmet needs (for example, loneliness, lack of social contact, boredom, being unable to access hobbies). In addition, the study had demonstrated that older adult's unmet care needs significantly impact their wellbeing. However, above study had considered only individuals with existing care needs as identified by a local authority social service. In addition, underweight adults were also included alongside adults with difficulty in performing either

ADLs or IADLs or impaired mobility and researchers did not analyse findings by overweight or obesity. Therefore, they considered the older adults of all weight groups and did not take into account older adults who had no difficulty with ADLs, IADLs or mobility, but who might have other unexpressed needs for social care.

9.2.1 Contribution to the knowledge

Insight into the unmet care needs of overweight and obese older adults compared to normal weight older adults in England is being presented uniquely as part of primary study question. It has increased the understanding of high BMI and other environmental factors on health, wellbeing and informal and formal social care need among older adults.

Previous studies examined the role of high BMI level on the health and wellbeing of older adults. However, fewer studies have evaluated the association between high BMI and social care needs among older adults in England and the nature of unmet care needs for older adults. The present research has used a series of multivariate analyses of a secondary dataset and narrative analysis of primary interview data. The study has advanced not only the knowledge base of consequences of high BMI and other environmental factors on the health, wellbeing, and social care need of overweight/obese older adults, but also for the first time, the nature of unmet care needs among this population.

In contrast to past studies, the present study incorporates the more recent holistic viewpoint regarding overweight and obesity in older adults. The study shows that obesity not only leads to physical impairments and complex morbidities but also affects their mental wellbeing and leads to an increase in the amount of informal and formal social care they need and receive.

Lastly, the findings prompt valid rationale to test the reverse hypothesis that existing inequalities due to the lack of emotional support may encourage an individual to follow

inappropriate health behaviour, causing the energy imbalance for overweight and obese individuals.

9.3 Recommendations for future research

Future research is needed to validate the present study findings in other countries and other populations. It would be interesting to inspect the variations of associations with obesity, disability, health status, wellbeing, and unmet care needs across other demographic subgroups. In addition, it would be useful to provide a more comprehensive understanding of the research questions and to investigate any potential reverse causality by using longitudinal data analysis on a wider range of physical health, mental health, and social care variables. Further research is also required to investigate the severity of chronic conditions in overweight and obese older adults' and identify the combination of chronic diseases that are more hazardous. In addition, it should address the epidemiology of comorbidity and multimorbidity and the most cost-effective treatment strategies among the overweight and obese elderly since they will remain a significant component of the population. Moreover, the present study findings need to be investigated further using objective measurements and other types of questionnaire administration. Further it is recommended to validate the instruments and identify if the current study findings can be generalised for the different study settings and different overweight and obesity measures. At the same time, future research should examine other covariates that may contribute to physical health, mental health, and demand for social cares support among older adults in England. Future research can also investigate the extent to which obesity-related health outcomes in older adults are associated to other measures of disability, health status and wellbeing, and predisposing factors to disability. Additionally, it is needed to look at the possibility of reverse causality of 'unmet care need' and the present findings on 'unmet care need' should be tested for in different population groups (for example, care home population, people with a learning disability). More research and advocacy are required to shift the focus

that obesity management for older adults should not focus on weight-loss alone, but to focus on improving their wellbeing status. There is also a need for randomised controlled trials exploring the risks and benefits of long-term weight management programmes for overweight and obese older adults since older adults are more prone to lose their muscle mass than their younger counterparts and therefore certain types of approaches may be or may not be effective (Han et al., 2011). Finally, further research needs to be done on the policy and financial implication of running such widely focused health and social care programmes for overweight and obese older adults.

9.4 Summary of the chapter

This final chapter has presented a brief insight of the present study and the key study findings in relation to overweight and obese older adult's health, wellbeing, and social care. The study contribution is also clearly pointed out. Finally, future research recommendations are discussed to build on the findings and approach of this present study.

The present research has tried to fill the existing research gaps by adopting a mixed-method approach. The research design has helped to explore the effects of high BMI levels compared to normal weight on the health and wellbeing and social care needs of older adults in England using a nationally representative dataset. The study used semi-structured interview data to explore the views of overweight and obese adults and their perceptions of their current unmet care needs. Through this methodology the study's aim is achieved. First, to determine the factors that may influence individuals' health, wellbeing, and the future burden on social care service for overweight and obese older adults. Second, to identify the gaps in the social care service provision by exploring the areas where care and support may help overweight and obese individuals live as independently as possible and promote their quality of life.

The study outcomes will enable policymakers and the health and social care providers to have a new perspective and insight into the needs of overweight and obese adults and how they can design an obesity management service for overweight and obese older adults in England that considers their both health and social care needs in a more holistic way. In addition, the findings will help policymakers, and healthcare providers allocate limited resources for adult social care service to promote healthy ageing with a quality-of-service delivery. Furthermore, social care should empower and enable individuals to live as independently as possible focusing on their abilities rather than disabilities.

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Appendices

Appendix 1: Ethical Approval Letters

A. College of Nursing, Midwifery and Healthcare (CNMH) Decision Letter

UNIVERSITY OF WEST LONDON
The Career University

College of Nursing, Midwifery and Healthcare
Research Ethics Panel
Paragon House
Boston Manor Road
Brentford TW8 9GA
Tel: +44 (0)20 8209 4110/4145
email: cnmh.ethics@uwl.ac.uk

Name: Gargi Ghosh
Date: 12th November 2019

Dear Gargi

Re: Application for Ethical Approval – IRAS 253586

Thank you for the NHS Ethical approval. This element is now fully approved.

If the research does not progress, or if you make any changes to your research proposal or methodology can you please inform the Panel in writing as this may entail the need for additional review. It is your responsibility, as the principal investigator, to submit a report on the progress/completion of the research twelve months from the date of this letter. Please find attached a blank report form to be completed by **Monday 16th November 2020.**

The Panel wish you well with your research and look forward to your report.

Yours sincerely

Professor Heather Loveday
Director of Research
Chair, College Research Ethics Panel

B. Health Research Authority (HRA) and Health and Care Research Wales (HCRW) Approval Letter

Professor Hafiz Khan
The Graduate School
University of West London
St Mary's Road, Ealing, London
W5 5RF

Email: hra.approval@nhs.net
HCRW.approvals@wales.nhs.uk

20 December 2019

Dear Professor Khan

HRA and Health and Care Research Wales (HCRW) Approval Letter

Research Wales (HCRW) Approval Letter

Study title:	**The impact of obesity on health and social care needs among older adults (50+) in England**
IRAS project ID:	**253586**
Protocol number:	**21374279**
REC reference:	**19/LO/1093**
Sponsor	**University Of West London**

I am pleased to confirm that **HRA and Health and Care Research Wales (HCRW) Approval** was given for the above referenced study, on the basis described in the application form, protocol, supporting documentation and any clarifications received. You should not expect to receive anything further relating to this application.

Please now work with participating NHS organisations to confirm capacity and capability, in line with the instructions provided in the "Information to support study set up" section towards the end of this letter.

How should I work with participating NHS/HSC organisations in Northern Ireland and Scotland?

HRA and HCRW Approval does not apply to NHS/HSC organisations within Northern Ireland and Scotland.

If you indicated in your IRAS form that you do have participating organisations in either of these devolved administrations, the final document set and the study wide governance report (including this letter) were sent to the coordinating centre of each participating nation. The relevant national coordinating function/s will contact you as appropriate.

Please see IRAS Help for information on working with NHS/HSC organisations in Northern Ireland and Scotland.

How should I work with participating non-NHS organisations?

HRA and HCRW Approval does not apply to non-NHS organisations. You should work with your non-NHS organisations to obtain local agreement in accordance with their procedures.

What are my notification responsibilities during the study?

The standard conditions document "*After Ethical Review – guidance for sponsors and investigators*", issued with your REC favourable opinion, gives detailed guidance on reporting expectations for studies, including:

- Registration of research
- Notifying amendments
- Notifying the end of the study

The HRA website also provides guidance on these topics and is updated in the light of changes in reporting expectations or procedures.

Who should I contact for further information?

Please do not hesitate to contact me for assistance with this application. My contact details are below.

Your IRAS project ID is **253586**. Please quote this on all correspondence.

Yours sincerely,

Rekha Keshvara

Approvals Manager

Email: hra.approval@nhs.net

Copy to: *Professor Heather Loveday* **List of Documents**

The final document set assessed and approved by HRA and HCRW Approval is listed below.

Document	*Version*	*Date*
Confirmation of any other Regulatory Approvals (e.g., CAG) and all correspondence [CCGs approval]	v0.1	20 July 2018
Contract/Study Agreement template [Registration MPhil/PhD]	v0.2	22 May 2018
Covering letter on headed paper [Cover letter]	V0.1	10 May 2019
Covering letter on headed paper [Word]	V 0.2	03 October 2019
Evidence of Sponsor insurance or indemnity (non-NHS Sponsors only) [Insurance]	v0.1	31 July 2018
GP/consultant information sheets or letters [Word]	v0.1	22 May 2018
HRA Schedule of Events	2	19 December 2019

IRAS Application Form [IRAS_Form_03062019]		03 June 2019
IRAS Checklist XML [Checklist_03062019]		03 June 2019
IRAS Checklist XML [Checklist_23102019]		23 October 2019
Letter from sponsor [Sponsorship letter]	v0.1	11 October 2018
Organisation Information Document		
Other [IRAS ethical review revised table]	V 0.1	07 October 2019
Other [Recruitment Clarification]		25 June 2019
Participant consent form [Word]	V 0.2	01 October 2019
Participant information sheet (PIS) [Word]	V 0.2	01 October 2019
Participant information sheet (PIS)	0.3	04 December 2019
Referee's report or other scientific critique report [Word]	V0.1	29 July 2018
Research protocol or project proposal [Pdf]	V0.1	31 July 2018
Summary CV for Chief Investigator (CI) [Pdf]	V0.1	26 September 2018
Summary CV for student [Gargi's CV]	V0.1	02 October 2018
Summary CV for supervisor (student research) [Academic co-supervisor]	V0.1	27 September 2018
Summary CV for supervisor (student research) [Co-supervisor's CV]	V 0.1	07 October 2019
Summary, synopsis or diagram (flowchart) of protocol in non-technical language [Conceptual Framework]	V0.1	24 May 2018
Validated questionnaire [Word]	V0.1	22 May 2018
Validated questionnaire [Word]	V 0.2	01 October 2019

Information to support study set up

The below provides all parties with information to support the arranging and confirming of capacity and capability with participating NHS organisations in England and Wales. This is intended to be an accurate reflection of the study at the time of issue of this letter.

Types of participating NHS organisation	Expectations related to confirmation of capacity and capability	Agreement to be used	Funding arrangements	Oversight expectations	HR Good Practice Resource Pack expectations
There is only one participating NHS organisation therefore there is only one site type.	Research activities should not commence at participating NHS organisations in England or Wales prior to their formal confirmation of capacity and	An Organisation Information Document has submitted and the sponsor is not requesting and does not expect any other site agreement to be used.	No study funding will be provided to sites as per the Organisation Information Document.	A Local Collaborator should be appointed at study sites.	It is expected that the principles of the HR Good Practice Pack are followed for researchers working in primary care. Researchers are advised to follow the processes of the local

	capability to deliver the study.				primary care management function

Other information to aid study set-up and delivery

This details any other information that may be helpful to sponsors and participating NHS organisations in England and Wales in study set-up.
The applicant has indicated that they do not intend to apply for inclusion on the NIHR CRN Portfolio.

C. Research Ethics Committee (REC) Decision Letter

NHS
Health Research Authority

London - Southeast Research Ethics Committee
Barlow House
3rd Floor
4 Minshull Street
Manchester
M1 3DZ
Telephone: 0207 1048191

Please note: This is the favourable opinion of the REC only and does not allow you to start your study at NHS sites in England until you receive HRA Approval.

11 November 2019

Professor Hafiz Khan
The Graduate School
University of West London

St Mary's Road, Ealing, London

W5 5RF

Dear Professor Khan

Study title:	**The impact of obesity on health and social care needs among older adults (50+) in England**
REC reference:	**19/LO/1093**
Protocol number:	**21374279**
IRAS project ID:	**253586**

Thank you for your letter of 3rd October 2019 responding to the Proportionate Review.

Sub-Committee's request for changes to the documentation for the above study.

The revised documentation was reviewed and approved on behalf of the PR sub-committee.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised.

Conditions of the favourable opinion

The REC favourable opinion is subject to the following conditions being met prior to the start of the study.

Confirmation of Capacity and Capability (in England, Northern Ireland and Wales) or NHS management permission (in Scotland) should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements. Each NHS organisation must confirm through the signing of agreements and/or other documents that it has given permission for the research to proceed (except where explicitly specified otherwise).

Guidance on applying for HRA and HCRW Approval (England and Wales)/ NHS permission for research is available in the Integrated Research Application System.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of management permissions from host organisations.

Registration of Clinical Trials

It is a condition of the REC favourable opinion that **all clinical trials are registered** on a publicly accessible database. For this purpose, 'clinical trials' are defined as the first four project categories in IRAS project filter question 2. Registration is a legal requirement for clinical trials of investigational medicinal products (CTIMPs), except for phase I trials in healthy volunteers (these must still register as a condition of the REC favourable opinion).

Registration should take place as early as possible and within six weeks of recruiting the first research participant at the latest. Failure to register is a breach of these approval conditions, unless a deferral was agreed by or on behalf of the Research Ethics Committee (see here for more information on requesting a deferral:

https://www.hra.nhs.uk/planning-and-improving-research/research-planning/research-registratio n-research-project-identifiers/

As set out in the UK Policy Framework, research sponsors are responsible for making information about research publicly available before it starts e.g., by registering the research project on a publicly accessible register. Further guidance on registration is available at:

https://www.hra.nhs.uk/planning-and-improving-research/research-planning/transparency-respo nsibilities/

You should notify the REC of the registration details. We routinely audit applications for compliance with these conditions.

It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

After ethical review: Reporting requirements

The attached document "After ethical review – guidance for researchers" gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study, including early termination of the study
- Final report

The latest guidance on these topics can be found at https://www.hra.nhs.uk/approvals-amendments/managing-your-approval/.

Ethical review of research sites

The favourable opinion applies to all NHS/HSC sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" above).

Approved documents

The documents reviewed and approved by the Committee are:

Document	*Version*	*Date*
Confirmation of any other Regulatory Approvals (e.g., CAG) and all correspondence [CCGs approval]	v0.1	20 July 2018
Contract/Study Agreement template [Registration MPhil/PhD]	v0.2	22 May 2018
Covering letter on headed paper [Cover letter]	V0.1	10 May 2019
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IRAS Application Form [IRAS_Form_03062019]		03 June 2019
IRAS Checklist XML [Checklist_03062019]		03 June 2019
IRAS Checklist XML [Checklist_23102019]		23 October 2019
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Summary CV for student [Gargi's CV]	V0.1	02 October 2018
Summary CV for supervisor (student research) [Academic co-supervisor]	V0.1	27 September 2018
Summary CV for supervisor (student research) [Co-supervisor's CV]	V 0.1	07 October 2019
Summary, synopsis or diagram (flowchart) of protocol in non-technical language [Conceptual Framework]	V0.1	24 May 2018
Validated questionnaire [Word]	V0.1	22 May 2018
Validated questionnaire [Word]	V 0.2	01 October 2019

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

User Feedback

The Health Research Authority is continually striving to provide a high-quality service to all applicants and sponsors. You are invited to give your view of the service you have received and the application procedure. If you wish to make your views known, please use the feedback form available on the HRA website:

http://www.hra.nhs.uk/about-the-hra/governance/quality-assurance/

HRA Learning

We are pleased to welcome researchers and research staff to our HRA Learning Events and online learning opportunities– see details at:

https://www.hra.nhs.uk/planning-and-improving-research/learning/

19/LO/1093	**Please quote this number on all correspondence**

With the Committee's best wishes for the success of this project.

Yours sincerely

PP

Chair

Email: nrescommittee.london-southeast@nhs.net

Enclosures: "After ethical review – guidance for researchers"

Copy to: Professor Heather Loveday

Appendix 2: Participants' Information Sheet

Participant Information Sheet (04/12/19, Version 0.3)

Study title – The impact of obesity on health and social care needs among older adults (50+) in England.
IRAS ID: 253586
Centre Name: Addison House Surgery, Harlow
Doctoral research student: Mrs Gargi Ghosh

I am a doctoral research student, and I would like to invite you to take part in my research project which takes the form of a survey. Before you decide, I would like you to understand why the study is being done and what it would mean for you. I will go through this information sheet with you and answer any questions you may have. I'd suggest this should take about 5 minutes.

In this research study we will use information from you. We will only use information that we need for the research study. We will let very few people know your name, and only if they really need it for this study.

Everyone involved in this study will keep your data safe and secure. We will also follow all privacy rules.

At the end of the study, we will save some of the data in case we need to check it.

We will make sure no-one can work out who you are from the reports we write.

The information pack tells you more about this.

How will we use information about you?

We will need to use information from you for this research project.

This information will include your name.

People who do not need to know who you are will not be able to see your name. Your data will have a code number instead. I will only ask about your existing care and support and if that is making a difference to your health, wellbeing and quality of life.

We will keep all information about you safe and secure.

Once we have finished the study, we will keep some of the data so we can check the results. We will write our reports in a way that no-one can work out that you took part in the study.

What are your choices about how your information is used?

You can stop being part of the study at any time, without giving a reason, but we will keep information about you that we already have.

We need to manage your records in specific ways for the research to be reliable. This means that we won't be able to let you see or change the data we hold about you.

Where can you find out more about how your information is used?

You can find out more about how we use your information.

at www.hra.nhs.uk/information-about-patients/

our leaflet available from: www.hra.nhs.uk/patientdataandresearch

by asking one of the research team

by sending an email to: 21374279@student.uwl.ac.uk, or

by ringing us on -02082312953.

What is the purpose of the study?

Today there are one quarter obese adults in England. With increasing life expectancy, the population is ageing alongside this increase in obesity. Obesity coupled with the challenges of ageing, leads to an unfortunate burden of chronic diseases for family and carers. Specially, obesity in older adults is more complex than young population, due to the presence of degenerative muscle loss. The existing national guidelines for the care and support needs for the people with obesity, fails to address the care pathway for older adults with obesity for all aspects of their wellbeing and quality of life related to their current health status.

Moreover, the Health survey for England established that there is clear evidence of need for care and support for older adults with obesity, but this survey does not report on any particular types of care needs for obese older adults.

This highlights the need to find out the factors that would promote effective health and social care to improve wellbeing and quality of life for older adults with increased weight.

In addition, by doing this study, both medical, nursing staff and health policy makers would be beneficial as they can obtain the latest knowledge in regard to this topic. It will also increase our understanding of the relationship between patients' attitudes and expectation towards the health and social care received. Such information has the potential to benefit patient care in future. Finally, this study will also provide a means of overall cost effectiveness.

Why does this study use information from patients?

This purpose of the study is to find out the effect of obesity on health and social care needs among older adults in England, to explore the differences in social care received by degree of obesity. Finally, to examine the role of obesity in determining social care needs in older adults. The information I will collect from you will show how satisfied you are at your home with the existing care and support and if it is making a difference to your health, wellbeing and quality of life. For this purpose, you have to sign a consent form. But researchers must always make sure that as few people as possible can see this sort of information that can show who you are.

This study will only use your data that really needs to do the research. Most of the research team will not need to know your name. In these cases, I will remove your name from the research data and replace it with a code number. This is called coded data, or the technical term is pseudonymised data. It can be matched up with the rest of the data relating to you by the code number. No identifiable information would be collected from you for this study. You will be identified with a numerical case number, so your confidentiality will be protected all the time.

Why have I been invited?

You were invited to take part in this study because you fulfil the criteria used to select individuals for this study. The criteria are as follows:

Older adults of 50 years and over

Can speak and understand English.

Do I have to take part?

The decision to take part in this study is completely up to you. I will describe the study and go through this information sheet with you. If you agree to take part, you will be required to sign a consent form. If you need more time to think about it, you can take this information sheet and the consent form with you and contact me (my email id is: 21374279@student.uwl.ac.uk) within 2 weeks from now, if you want to take part for this study. You are free to withdraw at any time, without giving a reason. This would not affect the standard of treatment or current care you receive.

What will happen to me if I take part?

If you are interested to take part, then at first you will sign a consent form. Then, I will measure your height and weight to calculate your body mass index (BMI) to place you either obese (BMI $\geq$ 30) or non-obese group (BMI < 30). Finally, I will give you (whether you are obese or non-obese) a questionnaire about your current health status and current care and support you receive. Few questions are YES/ NO, but few questions need descriptive answers- no more than 1-2 lines. The whole questionnaires would roughly take 10-15 mins. I will write the answers for you. I will also inform your GP about your participation in this study. I will choose randomly any 10 participants for in depth interview to get more clearer idea about the health and social care practice.

How long does the study last?

The actual study would take place between December 2019 and December 2020. As mentioned above, your involvement should only last about 30-40 minutes.

Where will my data go?

All information which is collected about you will be kept strictly confidential in the password protected University server and only I will have access to it. Every questionnaire would denote individual as a case no. So, your name or hospital number won't be written anywhere in the study file. All the computers storing patient data must meet special security arrangements.

What are the potential disadvantages and risks of taking part?

There are no significant risks associated with taking part. As your confidentiality will always be protected and I am going to denote you as a case no. in this research project.

What are the possible benefits of taking part?

As this study does not involve treatment, there are no direct benefits of taking part. The study, however, will provide useful insights into patients' perspectives. It will also increase our understanding of the relationship between patients' attitudes and expectation towards the health and social care received. Such information has the potential to benefit patient care in future.

Will my taking part in the study be kept confidential?

Yes, I will follow ethical and legal practice throughout this study. All information which is collected about you will be kept strictly confidential and only I and my supervisor will have access to it. Every questionnaire would denote individual as a case no. So, your name or hospital no. won't be written anywhere in the study file.

What are my choices about my patient data?

You can stop being part of a research study at any time, without giving a reason, but the research team will keep the research data about you that they already have. I will manage your records in specific ways for the research to be reliable. This means that they won't be able to let you see or change the data they hold about you. Research could go wrong if data is removed or changed.

What happens to my research data after the study?

The results of this study will form a major component of my final thesis. Depending on the findings, the study results may be presented at a conference or published. Researchers must make sure they write the reports about the study in a way that no-one can work out that you took part in the study.

Once they have finished the study, the research team will keep the research data for 5 years in the password protected University server, in case they need to check it. You can ask about who will keep it, whether it includes your name, and how long they will keep it.

Usually, your hospital or GP where you are taking part in the study will keep a copy of the research data along with your name. The organisation running the research will usually only keep a coded copy of your research data, without your name included. This is kept so the results can be checked.

If you agree to take part in a research study, you may get the choice to give your research data from this study for future research. Sometimes this future research may use research data that has had your name and NHS number removed. Or it may use research data that could show who you are. You will be told what options there are. You will get details if your research data will be joined up with other information about you or your health, such as from your GP or social services.

Once your details like your name were removed, other researchers won't be able to contact you to ask you about future research.

Any information that could show who you are will be held safely with strict limits on who can access it.

You may also have the choice for the hospital or researchers to keep your contact details and some of your health information, so they can invite you to take part in future clinical trials or other studies. Your data will not be used to sell you anything. It will not be given to other organisations or companies except for research. No identifiable information of yours will be included in any of the reports. Having completed the research I will also share the executive summary of the study with the GP surgery, so that you get informed.

Who has reviewed the study?

All research in the NHS is looked at by independent group of people called a Research Ethics Committee, to protect your interests. This study was reviewed by the IRAS (Integrated Research Application System) for ethical approval and by my university research ethics committee.

Will the use of my data meet GDPR rules?

GDPR stands for the General Data Protection Regulation. In the UK we follow the GDPR rules and have a law called the Data Protection Act. All research using patient data must follow UK laws and rules.

Universities, NHS organisations and companies may use patient data to do research to make health and care better.

Universities and the NHS are funded from taxes, and they are expected to do research as part of their job. They still need to be able to prove that they need to use patient data for the research. In legal terms this means that they use patient data as part of 'a task in the public interest'.

If they could do the research without using patient data, they would not be allowed to get your data.

Researchers must show that their research takes account of the views of patients and ordinary members of the public. They must also show how they protect the privacy of the people who take part. An NHS research ethics committee checks this before the research starts.

What if I don't want my patient data used for research?

You will have a choice about taking part in a non-clinical interview session. If you choose not to take part, that is fine.

In most cases you will also have a choice about your patient data being used for other types of research. There are two cases where this might not happen:

When the research is using anonymous information. Because it's anonymous, the research team don't know whose data it is and can't ask you.

When it would not be possible for the research team to ask everyone. This would usually be because of the number of people who would have to be contacted. Sometimes it will be because the research could be biased if some people chose not to agree. In this case a special NHS group will check that the reasons are valid. You can opt-out of your data being used for this sort of research. You can ask your GP about opting out, or you can find out more at: https://www.hra.nhs.uk/information-about-patients/.

Who can I contact if I have a complaint?

If you want to complain about how researchers have handled your information, you should contact the research team. If you are not happy after that, you can contact the Data Protection Officer. The research team can give you details of the right Data Protection Officer.

If you are not happy with their response or believe they are processing your data in a way that is not right or lawful, you can complain to the Information Commissioner's Office (ICO) (www.ico.org.uk or 0303 123 1113).

Further information and contact details:

For specific information about this project feel free to contact me – E-mail: 21374279@student.uwl.ac.uk.

Last Modified 4th December 2019

Appendix 3: Consent Form (4/12/21, Version- 0.2)

IRAS ID: 253586

Centre Name: Addison House Surgery, Harlow

Study Number:

Participant Identification Number for this trial:

CONSENT FORM

Title of Project: The impact of obesity on health and social care needs among older adults (50+) in England

Name of Principal investigator: Professor Hafiz Khan

Name of Doctoral research student: Mrs Gargi Ghosh

Please initial box

1. I confirm that I have read the information sheet dated..... (Version 0.2) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected. ☐
3. I understand that the data collected during the study (without any of my identifiable information), may be looked at by individuals from [University of West London], from regulatory authorities or from the NHS Trust, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records. ☐
4. I understand that the information collected about me will be used to support other research in the future and may be shared anonymously with other researchers. ☐
5. I agree to my General Practitioner being informed of my participation in the study. ☐
6. I understand that the information held and maintained by the research team at the University of West London password protected server. ☐
7. I agree to take part in the above study. ☐

Name of Participant	Date	Signature
Name of Person taking consent	Date	Signature

Appendix 4: GP Information Sheet (22/05/18, Version 0.1)

Study title – The impact of obesity on health and social care needs among older adults (50+) in England.

Name of Principal investigator (PI) & Academic supervisor: **Professor Hafiz T.A Khan**

Co-supervisor: **Dr Salim Vohra**

Doctoral research student: **Mrs Gargi Ghosh**

I am a doctoral research student. I have started my PhD in Public health in January 2018 under University of West London. I am undertaking this above study as a part of my PhD project. It is a 3years project and will end roughly in December 2020.

What is the purpose of the study? Today there are one quarter obese adults in England. This highlights the need to promote effective health and social care to improve wellbeing and quality-of-life for adults with increased weight. and at the same time the older adults with or without obesity have the right to live a well-supported and honourable life at the very end of their life journey and as a health professional and as a researcher it is my responsibility to find out the factors that would promote their health and wellbeing.

In addition, by doing this study, both medical, nursing staff and health policy makers would be beneficial as they can obtain the latest knowledge in regard to this topic. Finally, this study will also provide a means of overall cost effectiveness.

Aim and objectives: The primary aim of the study is to explore the effect of obesity on health and social care needs among older adults in England.

Objectives:

The specific research objectives are as follows:

i. To investigate the association between obesity, disability status, comorbidity in older adults.

ii. To determine the association between current health status and wellbeing in older adults with obesity.

iii. To explore the differences in social care received by degree of obesity.

iv. To examine the role of obesity in determining unmet social care needs in older adults.

Research design and planning: The study would follow a mixed-methods design by using both quantitative data (from the English Longitudinal Study on Ageing (ELSA) and qualitative data to explore the research questions and satisfy the research objectives. Although quantitative data would be thoroughly analysed to answer some of my research questions, however quantitative data is not enough to answer all my research questions. Therefore, to understand the social picture, qualitative interview will follow. In addition, qualitative interview will help me to cross check some of the findings of quantitative research and also testing some of my research questions.

Therefore, for this study, qualitative interviews will be undertaken on a sample of 30-40 older adults (50+), in which each obese (BMI ≥30) and non-obese (BMI≤ 30) group would have15-20 older adults (I will check their height and weight and calculate their BMI on the spot, so I can divide the participants in two groups- obese and non- obese). They will all be given a semi-structured questionnaire for face to face and one to one real time conversation or 'guided conversation' through their responses to the questionnaire. The responses will be documented in situ by the researcher on individual questionnaires.

An in-depth one to one interview would follow at the same time with a sample of 10 (will be drawn randomly from the previously mentioned sample of face-to face interviewees), 5 from each group would be randomly selected for interview having previously been grouped on the basis of their BMI (I will check their height and weight and calculate their BMI on the spot).

These participants would be randomly selected from the Patients list of the minor illness clinic of an NHS GP surgery.

The recruited population groups have to satisfy the inclusion and exclusion criteria, set out for this study listed below:

Inclusion criteria:

Population group to be included in this study should satisfy following criteria-

- Older adults of 50 years and over
- Can speak and understand English.
- Older adults visiting to minor illness clinic.
- Older adults BMI ≥18.5 kg/m2

Exclusion criteria:

- Patients with a history of any of the following will be excluded-
- Cannot speak and understand English.
- Advanced stage dementia
- Individual with severe or profound ID (intellectual disabilities), individual with Prader Willi syndrome, Cohen syndrome or Bardet-Biedl syndrome

Ethical Considerations: Every participant has to give written consent before participating in the study. Every participant would be explained the purpose, design of the study and involvement to potential recruits by me as an interviewer. The participants will also be reassured that the care that they would normally receive will not be affected by their decision to participate or not and that they can withdraw the consent at any point. Their personal identity will be protected at all times; all data will be entered in the study only by case number. An IRAS (The Integrated Research Application System) application form will be filled in to obtain

permission and ethical body approval for NHS patients. The University ethical body approval application is already submitted.

Expected Contribution: The project aims to contribute to the field through:

- Providing an update to the obesity care pathway toolkit, developed by the National Obesity Forum which is too generalised and lacks the detail needed to identify the complex care needs of obese older adults.
- Providing research outputs to inform others in the field who are also designing services for older people and contributing to this body of knowledge.
- Contributing to social care policy.

Dissemination of Findings: The results of this study will form a major component of my final thesis. Depending on the findings, the study results may be presented at Doctoral conferences, Workshop, Seminar, Publications, Etc. No identifiable participant's information will be included in any of the reports. However, having completed the research I will share the executive summary of the study with the participants and their GPs.

How long does the study last? The actual study would take place between June 2018 and December 2020. As mentioned above, Participant's involvement should only last about 30-40 minutes.

What are the potential disadvantages and risks of taking part? There are no significant risks associated with taking part. As the participant's confidentiality will always be protected and I am going to denote each participant as a case no. in this research project. However, I will take the participant's name and email address/ postal address, so that I can share the study findings with the participants and their GPs after completion and these will be saved in a password protected file of university computer, which only I and chief investigator can access.

What are the possible benefits of taking part? As this study does not involve treatment, there are no direct benefits of taking part. The study, however, will provide useful insights into patients' perspectives. It will also increase our understanding of the relationship between patients' attitudes and expectation towards the health and social care received. Such information has the potential to benefit patient care in future.

What if there is a problem? Complaints: If you have a concern about any aspect of this study, you can speak to me directly or email me (21374279@student.uwl.ac.uk) and I will do my best to answer your questions, or you can directly contact my academic supervisor / PI: hafiz.khan@uwl.ac.uk.

Further information and contact details:

For specific information about this project feel free to contact me – E-mail: 21374279@student.uwl.ac.uk OR my academic supervisor / PI: hafiz.khan@uwl.ac.uk.

Last Modified 1st October 2019

Appendix 5: Data Management and Storage Statement

All applicants should familiarise themselves with the Data Protection Act 1998, and adhere to its principles in all aspects of their research:

http://www.uwl.ac.uk/sites/default/files/Departments/About-us/Web/PDF/policies/policy-on-data-protection.pdf

As a student or member of staff undertaking a research project, I understand that I am responsible for the following:

- The security and confidentiality of all data collected.
- Mitigating all risks to anonymity, privacy and confidentiality posed by all kinds of personal information storage, processing, including computer and paper files, e-mail records, audio and video files, and any information that directly identifies an individual.

I will ensure that:

- Data and codes and all identifying information will be kept in separate locked filing cabinets/files and working files will contain no identifying information and will only be accessed by one or two persons.
- All recordings will be transcribed using codes or pseudonyms for identification of individuals and destroyed upon completion of the research project.
- Access to computer files will be available by password only.
- Data will be stored for up to 5 years after the end of the project, after which they should be disposed of safely.

Name: Gargi Ghosh Application ID: 21374279

Project title: The impact of obesity on health and social care needs among older adults (50+) in England.

Appendix 6: Semi-structured Questionnaires for Qualitative Interviews

(01/10/19, Version 0.2)

Name of the GP surgery: Addison House Surgery, Harlow

Name of the interviewer: Gargi Ghosh

Date of Interview:

Participant serial number:

Age in years: Gender: Male/ Female/ Other Ethnicity: Marital Status / Existing partner: Yes / No	BMI: Height: Weight:

Questionnaire for participants (to be filled in either by yourself or by **Gargi Ghosh** as an interviewer):

1. Do you face any problem with any of the following activities in daily living? (Choose an option)

- difficulty in dressing
- difficulty in walking
- difficulty in bathing/showering
- difficulty in eating, such as cutting up foods
- difficulty getting in and out of bed
- difficulty using toilet including getting up or down
- difficulty using map
- difficulty recognising physical danger
- difficulty preparing a hot meal
- difficulty shopping for groceries
- difficulty making phone calls
- difficulty with communication
- difficulty taking medications
- difficulty working around house and garden
- difficulty managing money, such as paying bills
- None of the above

- Other

If you choose other or a combination of more than one options from the above selection, please mention in the box below -

If you face any problem with one or more of the above activities in daily living, how do you manage to do those activity/ activities? How do you feel about this?

2. Do you use any of the following technologies to help you moving/daily living? (Choose an option)

- A cane or walking stick
- A Zimmer frame or walker
- Wheelchair
- Buggy/scooter
- Special eating utensils
- A personal alarm in event of fall
- Elbow clutches
- None of these above
- Other

If you select a combination of more than one options from the above selection or other, please mention in the box below -

If you use any of the above technologies or other to help you moving/daily living, please mention how do you feel about using that?

3. What is your health in general? (Choose an option)

Excellent	Very good	Good	Fair	Poor

If you choose fair or poor, please mention if any reason that you think of?

4. Do you have any chronic illness? (Physical or mental impairment, or disability)? (Choose an option)

YES	NO

5. Which of the following score best describes how safe you feel at your own home? (Out of 10 score, where 0 is the worst and 10 is the best)

0	1	2	3	4	5	6	7	8	9	10

Please mention if any reason that you think of behind the score you are choosing for?

6. How satisfied are you with your life overall? (Choose an option)

Fully satisfied	Partially satisfied	Unsatisfied

If you choose partially satisfied/unsatisfied, please mention if any reason that you think of-

7. Are you currently receiving any social care support? (Choose an option)

YES	NO

If you select No, please mention if you think that you should receive one and why?

(If Q7 marks -**Yes**, then please answer- (8a-8j)

8a. Who is the person/organisation providing you the care and support?

(Choose an option)

- Husband/wife/partner
- Children/grand children
- Siblings
- Other Relatives
- Friend/neighbour
- Homecare worker/home help/ personal assistant
- Member of staff at care/nursing home
- Member of reablement team

- Warden/shelter housing manager/cleaner
- Council handyman
- other

If you choose other or a combination of more than one option from the above selection, please mention in the box below -

8b. If you are receiving care from any family members/friends/Neighbor, how do you feel about having support from your family member?

(Choose an option)

Fully satisfied	Partially satisfied	Unsatisfied

If you choose partially satisfied/unsatisfied, please mention if any reason that you think of-

8c. If any of the following pay for your social care? (Choose an option)

- Local authority/ social services or council pay
- Spouse/partner
- Other family member/friend
- On your own

If you pay for your own care, is it stressful for you to pay for your own care? (Choose an option)

YES	NO

If your spouse/ partner/ other family member/ friend pays for your care, please mention how do feel about that?

8d. Overall, how satisfied, or dissatisfied are you with the care and support services you receive? (Choose an option)

Fully satisfied	Partially satisfied	Unsatisfied

If you choose partially satisfied/unsatisfied, please mention if any reason that you think of-

8e. Whether help received meets your needs? (Choose an option)

- Hardly ever meets the needs
- Sometimes meets the needs
- Usually meets needs
- Meets needs all the time

8f. Are you happy with the amount of time your carer/family member or friend spend with you for the care purpose? (Choose an option)

YES	NO

8g. Are you satisfied the way the care and support services help you keeping clean and presentable in appearance? (Choose an option)

Fully satisfied	Partially satisfied	Unsatisfied

If you choose partially satisfied/unsatisfied, please mention if any reason you think of-

8h. Are you satisfied the way the care and support services help you with your food and drink? (Choose an option)

Fully satisfied	Partially satisfied	Unsatisfied

If you choose partially satisfied/unsatisfied, please mention if any reason you think of-

8i. Are you satisfied the way the care and support services help you in feeling safe? (Choose an option)

Fully satisfied	Partially satisfied	Unsatisfied

If you choose partially satisfied/unsatisfied, please mention if any reason you think of-

8j. Which of these statements best describes how the way you are helped and treated makes you think and feel about yourself? (Choose an option)

Excellent	Very good	Good	Fair	Poor

Any comment, <u>if you choose fair or poor</u>:

9. What do you want more for your own social care?

10. If there is anything else you would like to tell us, please write in the space below. We shall be very interested to read what you have to say.

Perceived Outcomes:
• To explore the demand of healthcare usage of obese older adults: Q1
• To inquire the relationship between high Body mass index and social care needs in older adults: Q3 to Q7 • To explore the need of technologies: Q2
• To explore the need by health status: Q1, Q3, Q4
• To explore the need of feeling safe: Q5.
• To explore the need of life satisfaction/quality of life/wellbeing: Q6
• To examine the unmet needs for social care of obese older adults: Q8 to Q10