Socio-economic Status and Social Capital in the Aetiology of Obesity

Liam Charlie Nicholas Blackwell

Submitted to the University of Hertfordshire in partial fulfilment of the requirement of the degree of PhD.

May 2024

Contents

Contents of Tables

Contents of Figures

Contents of Equations

Glossary

Term	Definition
Aetiology	Investigating the cause, set of causes, or manner of causation of a disease or condition.
Austerity	Government cutting or freezing the wages of public service employees, cutting back programs, people experiencing homelessness, a freeze on hiring, and a freeze on pensions.
Basal metabolic rate	The rate at which the body uses energy while at rest to maintain normal function.
BBC	British Broadcasting Corporation
Bioelectrical impedance analysis (BIA)	A non-invasive method for estimating body composition, by passing a weak electrical current through the whole body to measure the resistance from body fat, muscle mass, and hydration.
BMI	A body measurement using height and weight to produce a classification.
Body Composition	A term often used by doctors and health professionals, referring to the percentage of fat, bone, and muscle in a body.
CCG	Clinical Commissioning Groups were NHS organisations set up by the Health and Social Care Act 2012 to arrange and deliver NHS services in England. On 1 July 2022 they were abolished and replaced by Integrated Care Systems due to the Health and Care Act 2022.
Commercial	Companies that aim to make a profit.
Constitutional	This is the established set of rules set by the Government.
Deprivation	The damaging lack of necessities in a society.
Diet	The food that a person often consumes.
Descriptive characteristics	Background information about populations including ethnicity, sex, income, and social class.
Economic	The use of resources, production of goods and services, growth of production and welfare over time, and a variety of other complex issues vital to society.

Epidemiology	The study and analysis of the distribution, patterns, trends and determinants of health and disease conditions in populations.
Epistemological	The theory of knowledge, regarding methods, validity, and scope, and the difference between belief and opinion.
Equation	A mathematical process equating one thing with another.
Gastropubs	A restaurant in a pub, moving away for the traditional pub that just sold bar snacks.
Great Britain	England, Scotland, and Wales
Habitus	The way people from a background perceives and reacts to the world.
Health survey for England (HSE)	A statistical survey which is conducted annually collecting information about health, related behaviour of people living in England.
Hydration	The process of absorbing fluid, the human body requires adequate hydration to function properly.
Inequality	The difference in size, degree, and circumstances of people.
LSOAs	Lower Layer Super Output Areas - A low level of area classification containing populations of approximately 1,500 people, there are 34,753 Lower Layer Super Output Areas (LSOAs) in England.
Mann Whitney	Sometimes called the Mann Whitney Wilcoxon Test or the Wilcoxon Rank Sum Test, it is used to test whether two samples are likely to be from the same population.
Mean	The average of a set of two or more numbers.
Median	The middle value of a sorted list of numbers.
Morphology	The scientific study of the structure of animals, humans, and plants.
N	Number of participants.
NHS	National Health Service
NHS England	The National Health Service for England specifically
NICE	National Institute of Health Excellence - an executive non-departmental public body of the Department of Health and Social Care in England.

NIHR	National Institute for Health Research
Non-parametric	Statistics that do not assume a normal distribution, without a normal bell curve. (Medians)
P	P-value is statistical measurement used to measure used to validate a hypothesis from data.
Paradigm	An example or pattern of something; a pattern or model
Parametric	Statistics which assume a normal distribution, known as a bell curve. (Means)
PHE	Public Health England - Government department
Policy	Rules and guidelines set out mostly by Governments
Population health	The health outcomes of different groups.
Poverty	When a person lacks the financial resources for a good standard of living.
Primary Care	Provides the first point of contact in the healthcare system, for example GP surgeries and clinics, these are described as acting like the 'front door' of the NHS
Qualitative	Non-numerical data (For example: Focus groups)
Quantitative	Numerical data
Regression	A statistical technique that relates a dependent variable to one or more independent (explanatory) variables.
Retrospective	Recorded information for reasons other than research.
RIO	Rotherham Institute for Obesity a former tier 3 weight management centre
Risk ratio	Also called relative risk, compares the risk of a health event (disease, injury, risk factor, or death) among one group with the risk among another group.
SARS-CoV-2 or Covid-19	The name of the disease from a new strain of coronavirus.
Secondary Care	When referred from a GP to a specialist or taken care of by someone with an expertise in whatever problem a patient is having.

Social cohesion	The connection between different groups of people.
Social Determinants	The economic and social conditions that influence differences in health status.
Society	A group of people sharing the same space and subject to the same political or cultural expectations
Socio-economic Status (SES)	The social standing or class of an individual or group, measured as a combination of education, income, and occupation.
Somatotype	Unique combinations of the three body types: ectomorph, mesomorph, and endomorph.
Sugar Tax	Government adding 18p per litre on soft drinks containing between 5g and 8g of sugar per 100ml. 24p per litre on soft drinks containing more than 8g of sugar per 100ml.
Systematic	Carrying out something according to a fixed system or method.
The high street	A common street name for the primary business street of a city, town, or village, especially in the United Kingdom
Thematic analysis	A method of analysing qualitative data (for example: interview or transcripts) to identify common themes.
t-test	An inferential statistic used to determine a significant difference between means.
UK	United Kingdom - includes England, Scotland, Wales, and Northern Ireland
USA	United States of America
Ward	A division of a city or borough that is represented by a councillor.
WHO	World Health Organisation - oversees the health of populations across the world.
WLM	Weight Loss Management/Maintenance
WWI	World War One - 1914-1918
WWII	World War Two - 1939-1945

Abstract

The message given to those who are overweight and obese is often to eat healthier and move more. However, it would cost the most deprived people in England 42% of their weekly income to follow the NHS eat well guide (Scott, Sutherland, & Taylor, 2018). Additionally, social factors also play a part in influencing obesity. So how do we expect people to adopt a better lifestyle when it is beyond their financial means, and when their social environment discourages them from developing healthier habits?

Multiple factors influence the risk of people being overweight and obese: levels of social inequality, social capital, social class, income and individuals' location of residence and their position on the *'deprivation index'*. However, a former Tier 3 Weight Management Centre was able to help overweight and obese people to achieve weight loss and improve wellbeing, even in areas of high deprivation and without the need for surgery.

Using a mixed-methods approach, this research investigates the Socio-economic Status and Social Capital in the Aetiology of Obesity across three studies: (Study 1) using base data from the English Populations Health Survey for England; (Study 2) data from the Weight Management Centre, Rotherham *"Lose it with RIO* [Rotherham Institute for Obesity]" programme; and (Study 3) focus group discussions with attendees at Weight Management Centres in Hertfordshire, 2017.

The modelling of the English Populations dataset (Study 1) showed that lack of social capital and lower levels of socio-economic status increased the risk of being obese. Analysis of the RIO dataset (Study 2) demonstrated successful weight loss at follow-up attendance after 6 months; with a similar improvement pattern shown for wellbeing across the range of BMI levels. Focus group discussions (Study 3) also found social capital elements spontaneously highlighted as reasons for becoming obese, while improving these helped overcome weight issues.

This research has revealed that whilst social capital appears highly influential in increasing the risk of obesity, the latter can be successfully managed and reduced by weight management programmes which, by their nature, do not attempt to influence social cohesion. Our strong recommendation is that weight management centres, which fell victim to financial austerity between 2010-2017, be re-established as this research shows at least one of them to be effective.

Despite the many risk factors associated with low socio-economic status suggesting the likelihood of obesity, this research demonstrates that obesity need not be inevitable given an appropriate programme of education, for exercise nutrition and psychological support.

Foreword

"If you do not believe you can do it, then you have no chance at all" (Wenger, 2004)

My motivation…

"Dear Sir or Madam, will you read my book? It took me years to write,
will you take a look?" (Lennon & McCartney, 1966)

I am excited for you to read my thesis. My motivation for starting this research comes from my reason to take psychology as my first degree, *"I want to help people feel better"*. The plan when starting my undergraduate was to become a clinical psychologist, however shortly after taking the research methods module it was clear that this could be my passion. I started my academic career as a University of Hertfordshire BSc Psychology (Hons) graduate, majoring in Health Psychology, Forensic and Criminal Psychology. I began work at the Centre of Health Services and Clinical Research within the Research Methods and Statistics Unit within the University of Hertfordshire. Extensively co-ordinating and conducting mixed methodology (qualitative and quantitative – focus group interviews) analysis across evidence-based research. Here I worked two clinical trials being conducted at Guys St Thomas's Hospital, Kings College London, undertook predictive analysis, forecasting, identifying trends and gaps in research. I was able to work with national services, locals trusts and in health intelligence, developing surveys, conducting interviews and focus group discussions. Preserving the safety of the people undergoing the trials and presenting this analysis to the ethics boards with partners across Public Health.

After working in health, I moved into policing, taking a role in project management resulted in me working alongside external company Deloitte to deliver the transformational change project in the National Enabling Programme. I led on the first national project to achieve faster processing times between Rape and Serious Sexual Offences (RASSO) and the Criminal Prosecution Service (CPS). The outcome of

this has been a reduction in processing time resulting in earlier court appearance/no further action.

During the early parts of the COVID-19 pandemic, I took a role in Health Intelligence at Public Health Hertfordshire, using my epidemiologist skills to track and report patterns of illness and deaths across Hertfordshire and West Essex, mapping this information to inform Members of Parliament, councillors and local services of the risks and issues with a weekly situation report. I then returned to policing, working in the Strategic Hub. I took the lead on the National Vulnerability Action Plan (NVAP), this work focuses on improving the police service for vulnerable victims. I also assisted in crafting the Violence Against Women and Girls (VAWG) strategy for the Constabulary, aligning this strategy with the themes and actions across the NVAP.

Promotion has led me to become a lead research fellow working to improve the police response to vulnerability, conducting primary research and analysis to build an evidence base for changes that need to be made by the National Police Chiefs Council (NPCC) and College of Policing. This work all comes from my original underlying reason for starting work in psychology *"I want to help people"* and this thesis is the foundation to build on with my future work.

"The challenge is how to be better than the day before…" (Arteta, 2019)

Acknowledgements

For Laura and Dad.

Remembering June, Peter, Sam, and Liz

This work would not have been possible without the love and support from my wife and dad. Not many will have to experience this process starting pre a pandemic, continuing during and completing after. The highs and lows of the process have only been possible with you both, thank you. Niamh, Theo, Binks, and Ivan, the different types of help and support you gave me will also be remembered.

I am extremely grateful to the participants who gave up their time to take part in this research. I would like to express my gratitude to the team at the Rotherham Institute for Obesity for your welcome and openness to explain the process of your service. Special mention for Collette, Lin and Matt and I wish you all well in the future.

My deepest gratitude to Nick for taking on my research, giving me the support and advice, I needed during tough times and getting me to this point, thank you. I'd also like to thank Keith for helping my development in epidemiology working at UH and getting me started on my PhD journey.

I would also like to mention and thank my co-workers during this process. I have learnt and developed so much in many different areas. With these skills and knowledge if I was ever mad enough to think, let alone start another PhD I would be able to achieve and deliver in a much more strategic way, project managing and overcoming the obstacles, taking the technical level higher because of the development of myself personally and professionally.

"The manor might be changing, but the people still remain…"

(Dunford, 2022)

UTA

1. Chapter One - Chewin' the fat

In 2016, the National Director of Health and Wellbeing for Public Health England, Professor Kevin Fenton stated, *"Obesity will overwhelm the NHS within the next 10-20 years if not tackled now"* (Fenton, 2016). It can be assumed that this trend has continued and even increased since two of the last six years have included a pandemic that restricted people's movement, changed the way people work, socialise, shop, and consume food and drink.

Obesity is a topic that is in the news or across social media on an almost daily basis. So much so Heuer (2010) coined the term '*Fattertainment*' with the media showing weight loss as a form of entertainment, because of shows such as Jamie's Ministry of Food, Fat Families, Biggest Loser, and Supersize vs Super skinny to name a few (Heuer, 2010). The media have a constant flow of adverts from new weight loss programmes, losing weight at gyms, weight loss teas to the different illnesses being linked to obesity (Stanford, Tauqeer, & Kyle, 2018); (Hilton, Patterson, & Teyhan, 2012). Often the people presented in these entertainment programmes are vulnerable, suffering from low confidence and coming from less affluent backgrounds and locations. (Fleming & Chaudhuri, 2020).

In the United Kingdom (England, Scotland, Wales, and Northern Ireland), obesity has become a big issue. Over a quarter of all adults (26%) in England alone are now classified as Obese with a Body Mass Index (BMI) greater than or equal to 30 (NHS Digital Health Survery for England, 2017). This figure is up from 15% of adults who were recorded as obese back in 1993 (HSCIC, 2016); (Moody, 2013). In the UK, the estimates suggest over £10 billion annually, about 10% of the UK National Health Service budget is spent on obesity-related disorders (Fenton, 2016). The wider economic costs in terms of loss of employment and workplace productivity are much greater. Lifestyles and social factors are crucial to our long-term health. However, research still suggests that the health inequality gap is increasing in England and across Europe (Smith, 1996); (Detollenaere, Desmarest, Boeckxstaens, & Willems,

2018). These findings can vary across regions, as each area is uniquely different because of the local history of decisions made for social policy, culture, and location. Each area, region, and country will have their issues that are a result of these decisions that have been made over time (Gostin, Boufford, & Martinez, 2004).

When exploring the issue of Obesity in English populations, a step-by-step approach, is required to explore past and present issues, after all, "*Those who cannot learn from history are doomed to repeat it.*" (Santayana, 1905). Only by reviewing and understanding how the country has arrived at where it has, investigating potential themes and risks that have created a society where people experience a risk of becoming obese, will allow for better understanding and help to develop effective interventions to reduce these risks. In time, making it possible to reverse the problem.

The motivation for this research comes from the personal belief in giving vulnerable people experiencing an issue, in this case obesity as the health outcome, a voice. Obesity is a global issue, however, what unique social factors have led to an increase in England? This is an area that needs further investigation, as this will help to inform future policies and interventions. Over time the British government has introduced several policies aiming to tackle and reduce the growing issue of obesity. These have ranged from the sugar tax on fizzy drinks and traffic light-coded food labels, to NHS weight loss centres (Department of Health, 2015); (Department of Health and Social Care, 2020); (Food Standards Agency, 2018). This has been ineffective in making a dent in the number of people who are overweight and obese in England.

The fight for equality and fairness will continue across society, however as shown in Figure 1-1, instead of giving everyone the same help (Equality), a focus on giving certain populations a *'leg up'* to get the specific and tailored help needed, equity, could be the answer.

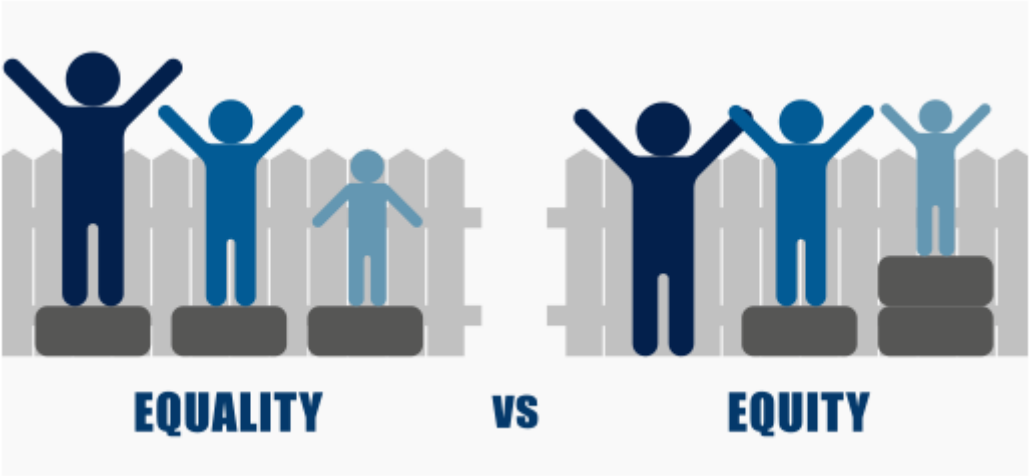


Figure 1-1: A visual representation of Equality vs Equity

Health equity can be described as *"Equity in health can be defined as the absence of socially unjust or unfair health disparities…"* (Whitehead, 1992). However, because social justice and fairness can be interpreted differently by different people in different settings, a definition is needed. A further definition for equity in health can be defined as *"the absence of systematic disparities in health (or in the major social determinants of health) between social groups who have different levels of underlying social advantage/disadvantage—that is, different positions in a social hierarchy. Inequities in health systematically put groups of people who are already socially disadvantaged… at further disadvantage with respect to their health; health is essential to wellbeing and to overcoming other effects of social disadvantage."* (Braveman & Gruskin, 2003).

Supporting and helping change the lives of the most vulnerable is something England populations and communities both big and small can develop to assist people who are struggling. After all, "*The true measure of any society can be found in how it treats its most vulnerable members"* Mahatma Gandhi. (BPS, 2022)

This thesis investigates the Socio-economic Status and Social Capital in the Aetiology of Obesity in English population.

1.1. Obesity

The World Health Organisation (WHO) defines obesity as an abnormal or excessive accumulation of fat, that has an impact on an individual's health and considers it a significant public issue by formally recognising it as a global epidemic in 1997 (Caballero, 2007). Since the mid-1970s, obesity has almost trebled globally, with 1.9 billion adults classified as overweight in 2016, of these 650 million were obese (The World Health Organisation, 2019). The consequences of obesity are observed and experienced across society today with increases in poorer habits causing weight gain and leading to health diseases, hence health issues are examined both historically and geographically.

The human body requires a daily intake of solid and liquid nutrition, this is made up of calories (a unit of energy) which are contained within everything an individual consumes. On this basis, the body requires nourishment from calories to create the energy that allows human bodies to function fully, so that it can carry out each task during the day. Different amounts of energy are produced from food and drink, with a varying number of calories and nutrients in each portion of food and drink. The NHS and Public Health England recommend a daily intake of kcals (kcals are displayed on food menus and marked on packaging) for adults, 2500 kcal for males and 2000 kcal for females (NHS England, 2019); (Public Health England, 2019). The amount of Kcal advised for those 18 years and under, is reduced and changes as it goes down the age and sex groups. The calorie burning process (ketosis) produces energy from calories consumed. A more active individual (training for a marathon, for example) may need to increase the number of calories they are consuming due to the body needing more energy to carry out the extra tasks it is being given. On the other hand, where there are fewer calories being used by the body (due to lower levels of activity), less needs to be taken in. Weight gain occurs when an individual consumes more calories than their body can use over time. If this trend of consuming more calories than an individual requires to use as energy continues, an individual's

weight and waist size can increase. Eventually reaching a level where they are classified as obese by the WHO. Once an individual is classified as obese, they are at a higher risk of other health include issues such as heart disease, diabetes, cancer and other chronic diseases (Colditz, 1992); (Mokdad, 2003); (Ryan, 2015).

The modern advice given by health professionals for people wanting to lose weight is often, *'you need to eat less and move more…'* (LocalGP, 2016) but this is not always as simple as it may seem.

1.2. Obesity in England

In the United Kingdom (England, Scotland, Wales, and Northern Ireland) today, obesity has become a big issue. Over a quarter of all adults (26%) in England alone are now classified as Obese (BMI ≥30) (NHS Digital Health Survery for England, 2017). This figure is up from 15% of adults who were recorded as obese back in 1993 (Moody A. Chapter 10: adult anthropHealth and Social Care Information Centre, 2016); (Moody, 2013). As a result, obesity, and obesity-related health issues, are a huge concern for the future health of the population across the country.

Using Obesity data collected over the previous two decades, researchers have warned that if current trends continue, it is projected that there will be 11 million more obese adults in the UK by 2030 (Wang Y. C., 2011). This has led to the latest estimates, suggesting that the NHS spent a staggering £6.1 billion on obesity-related health issues (including diabetes) between 2014 and 2015 (Public Health England, 2017). To give this figure some perspective, this is more money per year than is currently being spent on the justice system, the police and the fire service combined.

As the trend of obesity increases across the UK, this cost will also increase adding to the stress already being faced by the NHS. The projection is that the increase will go to over £10 billion, approximately 10% of the United Kingdom National Health Service budget, will need to be spent on obesity and related disorders, with a further increase of £2 billion per year by the year 2030 (Fenton, 2016); (Wang Y. C., 2011).

The wider economic costs in terms of loss of employment and workplace productivity are far greater, with some estimates suggesting it is costing society as much as £27 billion (Public Health England, 2017).

During a National Institute for Health Research (NIHR) workshop, Professor Kevin Fenton (National Director of Health and Wellbeing for Public Health England); suggested that Obesity will overwhelm the NHS within the next 10-20 years if not tackled now (Fenton, 2016). Without serious work to halt the increase, by creating and implementing interventions with a multi-disciplinary approach to educate, inform, and support those struggling with obesity, the issue will only increase. It is important to understand how obesity has occurred over time, as well as the changes in eating habits.

1.2.1. Obesity and British Social Factors

A key part of the historical evolution of humankind has been hunting, gathering, and consuming food (Megarry, 1995). This would involve collecting and eating food during good times, allowing the body to prepare for any period when food may become limited, and keeping them in good shape to evolve. Often this would involve periods of feast and famine, as seasons changed, and food became hard to find and then much easier to collect. As a result, becoming obese was unlikely as the food was limited. However, carrying some excess weight when food was available allowed for this stored weight to be used as energy during the times when food was scarce (Pontzer, 2012). Over time, humankind developed skills that allowed the growing and the collection of food sources. This improved the potential availability of food, with food becoming a power under the control of leaders of the time.

Fast forward in time to a point that being plump (Overweight or Obese) was now a sign of being affluent. An example of this is demonstrated during King Henry VIII's reign as King of England between 1509 – 1547 (Trowell, 1975). During King Henry's time, the most important and noble people all aspired to be (overweight) plump. This

was to show in high society that they had the availability of food, along with the non-requirement to take part in any manual labour activities (Trowell, 1975).

This social trend continued over the next few hundred years, including Victorian and Edwardian Britain. An example of this can be seen in the writing, of Charles Dickens's novel Oliver Twist. Dickens describes the workhouse master as a *"fat, healthy man"* (Dickens, 1868). This gives cultural reference to underline those of status being plump due to their perceived healthy and affluent appearance of the day. It is important to examine the social changes during the last one hundred years to see how people living today have been affected and how this has impacted the obesity level seen currently.

1.2.2. The War Years: 1914-18, 1939-45

During World Wars (WWI and WWII) due to food shortages, food was rationed across Britain. During the War years, national weight-related information was not collected, so no statistics are available today. However, weight gain leading potentially to obesity does appear to be a government issue, with the Ministry of Health commenting on this as early as the 1920s. The Chief Medical officer of the time, Sir George Newman stated in a report that *"excessive and unsuitable food combined with lack of fresh air and exercise"* was partly responsible due to being *"over-fed – giving their poor bodies little rest, clogging them with yet more food"* (Oddy, 2016); (Hankey, 2018). Despite this, much of the working and lower classes still made do with the limited amount of food they had. This continued for an extended period, as the food was rationed due to shortages during the mid-1950s for people in the UK (BBC, 2017).

During this time food was sparse, with food needing to be bought and used within a short period due to the lack of home preservative solutions. As a result, in 1952 few meals were consumed outside of the household, with only a fifth eating one meal out during a week (Press Release: Department for Environment, Food & Rural Affairs, 2016). People's access to buy *"take away"* food was limited, with the only choice for

most being the British classic fish and chips. Until the first Wimpy Bar opened its first bar in 1954. Now hamburgers and milkshakes were available, with Wimpy targeting a new age group for the first time, teenagers (Castelow, 2018). By the late 1950s, food storage was beginning to change with higher-class households able to store food for longer.

1.2.3. The 1960's

In the 1960's food availability and storage began; this saw the beginning of the transformation into today's modern life in Britain. The way people across the UK lived and consumed food changed drastically. One of the first major changes in households across Britain was when chilling food in a fridge at home became a common occurrence. By the end of the 1960s over half (58%) of all households across Britain now had an electric fridge in their homes (Pendrous., 2017). Not only this but for the first-time teenagers had a disposable income. Wages were higher than in previous decades, which transformed the culture of how people were consuming clothing, music, and food (Ranadev, 2012). Britain was now changing faster than before, and by the end of the decade British supermarket Iceland opened its doors. Now stores were able to offer more variety by selling frozen foods and groceries to the public (Iceland, 2019). Obesity rates pre-1970s are not available as BMI classification was not used until Keys adopted the Quetelet index formula (previously known as the average man measurement), which was later to become the Body Mass Index calculation (Eknoyan G. , 2008). By the end of the 1960's the trend of eating out and fridge freezers were much more accessible across households in Britain.

1.2.4. The 1970's

From eating food that had been traditionally made at home in the previous decades, the 1970's saw new trends in eating out. Further ways of dining were becoming more readily available, with a new chain of British restaurants opening their doors,

including Beefeaters and Brewers Fayre (Beefeater, 2019); (Brewers Fayre, 2019). These chains offered traditional British food that diners were used to preparing and cooking at home. But instead, they could eat their favourites without going shopping and cooking for themselves. This menu was also available with the same choice across Britain from north to south, but now British people could also get the taste of America. Another new way of being able to consume food came with the introduction of the American fast-food chain McDonald's, opening its first British restaurant in 1974 (McDonalds, 2019) and later introducing the concept of a drive-through. Better still, convenience food was improving and offering new ways to eat food. People were now able to have more choices of frozen and tinned food, which meant that instead of shopping every day, a weekly shop was now possible.

Frozen food expanded across the decade with 95% of family homes now having access to a fridge freezer (Press Release: Department for Environment, Food & Rural Affairs, 2016). Socially, issues were arising in the late 1970s when money began to become tight, and the increase in these problems was causing an issue for the government. Widespread strikes began taking place in public sector trade unions who were demanding pay rises due to the ongoing pay caps, this led to the Winter of Discontent 1978/79 (Hay C. , 2009). This was a difficult period with many households feeling the effects of the strikes, money became tight for many across Britain with jobs being lost and inflation at extremely high levels (Biressi A. &., 2013). As job losses increased and money was tight during the late 1970s and early 1980s research into the prevalence of obesity across the UK began.

1.2.5. The 1980's

By the 1980s, researchers now had the earliest estimates of the prevalence of adult obesity across the UK. The estimates suggested that 6% of men and 8% of women were now classified as obese (Great Britain Parliament House of Commons Health Committee, 2004).

The British public's opportunity to access food had progressed further in the 1980s with an increased demand for convenience foods, eating out and fast food. Another popular development across the late 1970s, and throughout the 1980s was the trend of owning a microwave oven (Hobbs, 2016). The increase in the availability of these quick-cooking ovens led to many households choosing easy cook meals, and thus the invention of ready meals. Microwave meals were quick and cheap, which was ideal as unemployment increased.

The rate of unemployment reached a record high during 1984 with a rate of 11.9%, putting pressure and a financial squeeze on the cost of living (Office of National Statistics , 2018); (Office of National Statistics , 2023). A further problem during the mid-1980s, which hit households across Yorkshire and the Midlands was the miners' strike. This resulted in many jobs being lost across the region, with half of the miners still unemployed a year after the mines were shut (Darlington, 2014); (Miners' Strike - National Coal Mining Museum for England, 2018). In contrast, in London young upwardly-mobile professionals *('Yuppies'*) were thriving in the city money markets, making more money than before, going to the gym, eating the best food and taking drugs (80s Actual, 2015); (The Guardian, 2017).

The high streets of Britain saw takeaways again increase in popularity, with another major fast-food chain opening, Pizza Hut. In 1987, Pizza Hut averaged one new restaurant opening per week (Pizza Hut, 2019). A new introduction to England in the mid-1980s was the introduction of the new McDonald's drive-thru restaurants (BBC News, 2016). This allowed people for the first time to buy food on the go, without the need to get out of the car. These became extremely popular, and more and more drive-thru restaurants began opening across the decade. As the increase in popularity of easy fast food on the go and at home continued, this decade saw obesity research intensifies, this is shown in Table 1-1 with 1980-90 seeing an initial spike in results relating to obesity and this trend continuing until the last decade.

Table 1-1: Obesity related Google Scholar results across the decades

Decade	Google Scholar Results
1900-10	2,030
1910-20	2,950
1920-30	4,850
1930-40	7,620
1940-50	8,110
1950-60	14,600
1960-70	17,800
1970-80	27,900
1980-90	**107,000**
1990-00	659,000
2000-10	2,230,000
2010-20	1,940,000

1.2.6. The 1990's

The early 1990s saw analysis of data collected by the department of health, a health survey for England (1993) showed that obesity had doubled between 1980-1991 across the country (Bennett, 1995). This link between eating habits changing and obesity levels increasing continued across the last decade. The 1990s saw a continuation in convenience food and peoples shopping habits continuing to change.

In the late 1980s and across the 1990s American-style shopping centres, with big car parks on the edge of town started to appear. This signalled a trend of smaller supermarkets being replaced by bigger out-of-town supermarket stores (Defra, 2006). These shops could now accommodate more shoppers due to larger free parking sites. While also stocking more variety and choice, allowing people to buy a variety of fresh, frozen, and pre-prepared food. For the first time, shoppers could also shop for clothing and household items whilst doing their grocery shop, all under one

roof. As shopping changed, highstreets began to change, with an increase in restaurants and takeaways.

The 1990s saw a new type of dining and the rise of coffee shops, 'Gastropubs' were created and became popular (Norrington-Davies, 2005). Pubs and bars now recognised the attraction of selling food as part of the evolving public house experience. Along with this Coffee shops also exploded on to the high street. Coffee shop expansion grew in the UK at a rate of 847% between 1993 and 1997 (Thurston, 2013). Coffee shops were now offering a wider variety to compete with cafes and bakers, people could get hot and cold drinks, cakes, and biscuits. The impact of these changes on the high street and people's habits and lifestyles was investigated by researchers.

Researchers also found that people's lifestyles had now changed compared to the previous decades with levels of activity dropping for many (Stubbs, 1993). So much so that due to the low levels of physical activity now prevalent across Britain in the mid-1990s, this was playing a key role in the increase of obesity (Prentice & Jebb, 1995). Prentice and Jebb (1995) states that from 1996 public health strategies should be targeted at the reduction in the fat content within people's diets. They go further, suggesting the aim should be to reverse the levels of inactivity, by encouraging physical activity, to reverse the current trends in obesity and related health consequences. As high street shopping and eating out became more common, this saw more job availability. The rate of unemployment began to drop towards the end of the decade, and this resulted in more money and disposable income for households across Britain (Denman, 1996).

1.2.7. The 2000's

The choice of takeaway and fast-food outlets increased again across the 2000s, along with a major increase in cooking programmes. The traditional fish and chips shops, Indian and Chinese restaurants, with small fast-food shops like Kebab shops remained a strong presence. American fast-food chains were now increasing, with

McDonald's, KFC, and Burger King just as common (KFC, 2019); (McDonalds, 2019); (Burger King, 2019). Ready-made microwave meals had continued to be common in households across the country, with people also trying to cook from scratch.

Cooking shows were launched in the late 1990s, with massive popularity. The British public was tuning in to learn easy recipes. The BBC led the way, with shows such as Ready Steady Cook, Can't Cook Won't Cook and the Naked Chef. These shows differed from the normal cooking shows of the previous few decades. *'Ready Steady Cook'* and *'Can't Cook Won't Cook'* put two teams against each other in a competition (McCrum, 2006). The teams were made up of two members of the public put with a professional chef. Each team could spend a maximum of £5 on the ingredients and these ingredients were a surprise to the chef until revealed at the start of the show. The teams then had the time during the show to create a meal from scratch. This allowed less skilled members of the public to learn new, easy, and affordable cooking recipes. The Naked Chef (Jamie Oliver) was a show aimed at the younger generations and made cooking more *"blokey"* from the traditional formats (BBC News, 2003). Jamie was in a band and made cooking cool, his cooking was always done for a purpose (hen night, babysitting, band practice and nights in) made in his home kitchen and delivered to the people to eat at the end of the show, again making cooking attractive to the public.

Towards the end of the decade there was the introduction of a new food labelling initiative by the government. These labels were commonly known as *'traffic lights'* and were launched to help people make healthy choices (Food Standards Agency, 2007). This was a simple idea to mark all food with a red, orange, and green light label. This would then indicate the calories, fat and sugar content within the food or drink together with the number of servings contained. Red indicated bad, orange ok and green a healthier good choice. Towards the end of the decade, tackling obesity and helping people eat healthily was now starting to be shown in cooking shows.

Rotherham in South Yorkshire has been branded the obesity capital of England. In 2008 Jamie Oliver had a new show Jamie's Ministry of Food, based in Rotherham to tackle the problem head-on (Jamie's Ministry of Food, 2008). The show aimed to bring back the Ministry of Food idea used during World War II. Teaching people a selection of recipes and giving them the job to pass on these recipes to family and friends, making cooking fun and social. Obesity became a mainstream issue, with the government developing further public health measures to reduce obesity across England.

To answer the public and media calls to tackle obesity, the year after Rotherham was branded the obesity capital, Public Health England introduced a new approach to tackle the causes of obesity *'Change 4 Life'*. The programme aimed to educate the public in several ways, using social media and ad campaigns, inviting people to visit the website to find out more and order a helpful pack (Change4Life NHS, 2019). The programme was based around changing to healthy behaviours using six key points. Eating five portions of fruit and vegetables a day, decreasing salt intake, cutting down on fat intake, giving examples of 100 calories snacks (max two days) and advising 400 calories breakfast, 600 calories lunch and 600 calories dinner with examples. This being lower than the daily recommended calories for males and females, with the aim to lose weight. By taking on these healthy swaps it aims to change people's behaviour over the longer term. A new method of shopping became available as online grocery shopping began to increase.

Online food retailers (Ocado, 2019) began to change the way people could shop with home delivery only. Ocado did not have a single store for shoppers to visit, instead, shoppers could order online via their website and have groceries delivered direct to their door. All major supermarkets in England followed, with home delivery services becoming more readily available, except they all had the store experience as well (Tesco, 2020), (Sainsburys, 2020), (Asda, 2020); (Morrisons, 2020); (Iceland, 2020). The

following decade would see more changes in the new habits of eating and shopping for food.

1.2.8. The 2010's

At the beginning of the decade things changed politically with the formation of a Conservative and Liberal Democrat coalition government. A policy focused on Obesity and Healthy Eating was created during this time. The policy expressed the importance of people increasing their physical activity while eating and drinking healthy options. It aimed to encourage people to take responsibility for what they consume by giving them informed choices (The Department of Health, 2011). This was done by splitting the now-named Public Health Responsibility Deal, into four main networks: alcohol, food, health at work and physical activity (The Department of Health, 2011); (Department of Health, 2015). These networks aimed to develop and improve information on alcohol labels, develop guidelines for what is contained within food while offering recommendations for physical activity. This came at a time when a person's daily movement was being reduced, across the 10's the weekly shop for households had further evolved.

In the 10's the UK Government introduced austerity measures, with public services being cut back to save money. Analysis of austerity impact has shown that the biggest impact is on the poorest and most vulnerable in society (Hastings, Bailey, Bramley, & Gannon, 2017); (Widdop, King, Parnell, Cutts, & Millward, 2019). Furthermore, austerity impacted different areas in a variation of ways (a post-code lottery) leading to more severe issues for some local areas while others had less impact (Gray & Barford, 2018). As data from the Trussell Trust and Independent Food Aid England and Wales becomes available, analysis by May et al (2020) states that use of food banks were on the rise with food insecurity remaining a key issue due to austerity (May, Williams, Cloke, & Cherry, 2020).

Now people could order online, for home delivery, or click and collect, missing out on the social interaction and steps. All the major supermarkets introduced the online

shopping service allowing people to order for delivery and collection without going into the main shop. The big four supermarkets (Tesco, Sainsbury, ASDA and Morrisons) faced new competition from smaller international food shops (lidl, 2020); (Aldi, 2020) and bargain shops (Bandmretail, 2020); (Pound Land, 2020) etc. who were now offering food products at lower prices than supermarkets and in more convenient high street locations. As food became easier, food on the go was in demand more than ever.

The high street saw an increase in bakery and sandwich shops (Greggs, 2020), (Pret, 2020), fast food outlets introduced saver menus, offering their products at a basic level for lower costs (McDonald's, KFC, and Burger King). Fridge ownership had further increased with 99% of all UK households containing at least one (Bre, 2013). Ready meals increased in variety with all supermarkets offering classic British menus (sausage and mash, roast dinners) to Indian, Chinese, and Italian cuisine. The pressure to make convenience food healthier became more common with the introduction of traffic light food guidelines (Food Standards Agency, 2018).

Take away food was evolving, as outlets had now increased by 43% since 1997 (Burgoine, 2016). These companies now offered people the choice of ordering online and having takeaways and fast food delivered directly to their door. As a result, the amount of household spending increased across the decade (Department for Environment Food & Rural Affairs, 2015). By 2017 94% of households across the UK now had a microwave. Over the decade, obesity started to become a hot topic for the government.

The national government policy to help tackle obesity was the introduction of a soft drinks levy, known as the *'Sugar Tax'* (TM Treasury, 2018). The sugar tax levy was introduced on soft drinks that contained total sugar over 5g per 100ml. It was estimated that this would raise between £240 million and £520 million a year, which would go towards doubling the Primary Sports Premium, the creation of Healthy Pupils, and increasing the funding of sports in primary schools (TM Treasury, 2018);

(Diabetes UK, 2018). Another issue linked to obesity was the amount of unhealthy food being advertised.

Obesity had increased so much, 68% of men and 60% of women were now overweight or obese (NHS Digital Health Survery for England, 2020). Additionally, the previous 10 to 15 years saw fast-food advertising had grown to become such an issue that in 2018, the Mayor of London banned all fast-food adverts across the London transport network (Mayor of London, 2018). The mayor explained that this was part of a large consultation to help tackle obesity and promote healthier lifestyles. The ban was introduced for advertising on buses, over-ground and under-ground train networks, trams and river services but would not stop fast food companies from advertising all together, with the new rules put in place, these companies instead would only be allowed to promote their healthier products. The downside of this was that the fast-food companies was still advertising their brands without the food, as people were already aware of what they sold.

1.2.9. The 2020's

The end of 2019 saw an outbreak of a new strain of coronavirus, SARS-CoV-2, which became commonly known as Covid-19. The first officially confirmed case of Covid-19 in England was on January 31st, 2020, in York (The Times, 2020). In February 2020, the UK government published the Health Protection (Coronavirus) Regulations 2020, a statutory instrument covering the legal framework behind the government's initial containment and isolation strategies, and its organisation of the national reaction to the virus for England (The Health Protection (Coronavirus) Regulations 2020, 2020). This was updated over time, in both relaxing and increasing measures.

In early March 2020 shops across England began to see shelves empty of essential food items and toilet rolls, as panic buying began. In response, a joint letter from UK retailers was issued to remind customers to be considerate in their shopping quantities (Coronavirus: Supermarkets ask shoppers to be *''considerate''* and stop stockpiling, (BBC News, 2020). The retailers explained, there was no shortage in

production and no reason to panic. Any shortage was simply due to overbuying unnecessarily, which was leaving others without much-needed items. On the 23rd of March 2020, the Prime Minister addressed the nation, and a national lockdown was introduced (Prime Minister's Speech, 2020). People would only be allowed to leave their homes for a few reasons, these included shopping for necessities as infrequently as possible; one form of exercise a day (alone or with members of your household), any medical need, to provide care or to help a vulnerable person, or for key workers travelling to and from work, but only when that work could not be done from home.

All non-essential workplaces and shops shut immediately, including food restaurants, pubs, takeaways, and fast-food outlets including drive-throughs. Due to shortages of some items on the shelves in the build-up to the first national lockdown and having to queue outside to get into food shops; food anxiety had increased with food insecurity in adults in Britain estimated to have quadrupled under the COVID-19 lockdown (Loopstra, 2020). Early indications by Loopstra (2020) states that a lack of food in shops alone could explain approximately 40% of food insecurity experiences since the COVID-19 lockdown. However, not all households were equally affected, with adults in deprived areas, with disabilities and single adults with children particularly vulnerable. The strictest first lockdown measures continued for 3 months, with some measures relaxed and increased over time. As a result, everyone's daily life was impacted by new habits developed by staying away from shops and restaurants and limiting socialising and activities.

As measures were first relaxed restaurants and takeaways did not allow customers to come in and sit down for meals. Instead, they found new ways to maintain service during lockdowns, with click-and-collect takeaways and delivery services. During this phase companies such as *'Just Eat'* saw UK orders soar by 733% (Evening Standard, 2021). While Deliveroo saw 71.4 million orders in the first six months of 2021 alone (Mail Online, 2021). This trend continued with an estimated 38% of homes continuing

to use these fast-food delivery services even when restrictions were eased and lifted (Mail Online, 2021). This added to the pre-pandemic issue being experienced in society when the government launched a review into obesity.

In July 2020 the department of health and social care published the new government obesity advice during covid-19 called Tackling obesity: empowering adults and children to live healthier lives (Department of Health and Social Care, 2020). The policy gives three key points to tackle the obesity problem, Empowering, fair deal, and marketing.

1. Empowering everyone with the right information to make healthier choices. The aim is to tackle obesity by not consuming too many calories, this will be helped by food and drink displaying the information needed to make informed decisions. As of 2020, traffic light labelling was still a voluntary scheme introduced in 2013 in the UK, this information also needs to be displayed in takeaways and restaurants. Added to this companies will be required to provide labelling for any alcoholic drinks they sell.
2. Giving everyone a fair deal. Across the UK, often food products on promotion (for example, buy one get one free) do not contribute to a healthy diet. End-of-aisle offers can encourage people to buy more increasing their weekly spending. As a result, the government will legislate to end these types of offers in-store and online in England.
3. Shaping the marketing to our children. The marketing campaigns that influence the buying of food and drink products often do not promote healthy food choices. As a result, the government intend to ban unhealthy food products from being advertised on TV and Online before 9 pm by 2022. As the policy has few baseline measurements it will be difficult to determine the impact.

As national measures eased and were reintroduced the impact of social isolation, was harming the health, well-being, and weight gain of the population. This was seen

with the changes in diet, due to the way people were working, giving themselves treats, combined with sedentary behaviour, isolation from social networks, increased alcohol intake, lack of self-control, low mood, poor sleep, anxiety and impacts of the life events being experienced globally (Begni, 2020); (Branley-Bell, 2020); (Robb, 2020); (Arora, 2020); (Mattioli, 2020). As measures were reduced, the NHS made the move to relaunch the better health every mind matters website, and app with an advert campaign (Better Health, every mind matters, 2022). The service offers a *'Your mind plan'* asking five questions, an individual's response will produce a free plan for helping to deal with stress and anxiety with the aim to give people control during a difficult time. Further advice is offered to keep a healthy mind and body, cope with Covid, improve well-being, improve mental health issues, and get support from others. The four key areas the site focuses advice on are losing weight with a free 12-week weight loss plan (NHS UK, 2022), recipe ideas, getting active with couch to 5k (NHS UK, 2020), and active 10 exercises, with added help for those quitting smoking and drinking less. The medium to long-term impacts on health and well-being is yet to be seen. Over the coming years, the impact of the two years of lockdown measures will certainly need to be tackled on top of the issues that were there before. Short term links have shown an increase of eating and a reduction of physical activity during lockdowns leading to poor mental health (Robinson, et al., 2021).

In 2022, Britain moved into a cost-of-living crisis, with inflation reaching record highs leading to more expensive household food and energy prices soaring while wages remained the same (Rising cost of living in the UK, 2022). It is widely reported that millions of people are being forced to skip meals to save money and some not being able to afford to eat (Butler, 2022). As a result, more people are forced into using food banks (Lovett, 2022). The poorest families who are entitled to free school meals are being further impacted. Almost 30% of school caterers now using more processed food, reducing the quality of school meals due to the cost of supplies (Chowdhury, 2022). Further still, the cost of living crisis sees every household having

less money, with the knock-on effect of food banks running low on supplies and even closing due to the rent prices being too high (Sky News, 2022); (Sajan, 2022).

1.3. Chapter One - Summary

Obesity has evolved across time in England, from Dickens describing the workhouse master as a "*fat, healthy man*" in his Oliver Twist novel, to over a quarter of all adults in England being classified as Obese.

As stated by Professor Kevin Fenton, *"Obesity will overwhelm the NHS within the next 10-20 years if not tackled now"* (Fenton, 2016). However, so far political interventions such as the *'sugar tax'*, food and drink *'traffic light labels'*, introducing a ban to help reduce unhealthy food advertising and attempts to encouraging physical activity have not succeeded in significantly reducing obesity.

Across British history cost of living due to striking, job losses, austerity and a pandemic have seen people's ways of shopping and consuming food change. During, between and after the war years saw food shortages. Later, technological changes in food storage evolved the way British people could shop and store food. Different types of food entered the shopping market and meant that consuming food became a social experience (eating out). Over the decades obesity increased, with the modern-day person not needing to leave the house or speak to anyone to get their weekly shop or daily meals.

2. Chapter Two – Obesity body composition and treatment

Measurement and treatment for Obesity Body Measurement

Determining if a person is overweight or obese can be achieved in many ways using different types of body measurements. The following chapter explores the key and commonly used measurements that are recommended across the health care service and clinical settings, they are:

- The Body Mass Index (BMI)
- Percentage body fat
- Waist size
- Somatotype, body composition, and morphology
- Bioelectrical impedance Testing

This is key to understanding the key body measurements used in Study 1 and Study 2 along with the rationale behind the use of these weight measurements.

This chapter will also explore the different types or treatments and interventions available for patients suffering with obesity, along with the structures in place for different levels of care through the NHS in England.

2.1. Body Mass Index (BMI)

The Body Mass Index (BMI) is the main measure used across the world, in the NHS and recommended by the World Health Organisation, as an indicator measuring health by weight (World Health Organisation, 2022). The BMI formula is very convenient, with the measurement of BMI score achieved by using a simple calculation, using height and weight measurements (World Health Organisation , 2022).

The concept was developed by Belgium mathematician Adolphe Quetelet in the mid-1800s. Quetelet aimed to develop a formula that was able to describe the physical characteristics of the 'average man'. Quetelet used a mathematical formula known at

the time as the Quetelet index. In the 1970s Ancel Keys adopted the Quetelet index formula, renaming the calculation the Body Mass Index as it is known and used today (Anand, 1994); (Eknoyan G. , 2008).

Equation 1 uses an individual's height and weight to calculate a score that is categorised as > 25 overweight and >29.9 obese. Visually, this can be plotted on a BMI chart (Figure 2-1) indicating weight scores using a Red, Amber, and Green rating. The formula used to show a person's weight classification (as shown in Equation 1) is as follows BMI (kg/m^2) = mass (kg) / height $(m)^2$ (WHO, 2005).

Imperial English BMI Formula

$$\text{weight (lbs)} \times 703 \div \text{height (in}^2\text{)}$$

Metric BMI Formula

$$\text{weight (kg)} / \text{height (m}^2\text{)}$$

Equation 1: BMI equation for metric to imperial measurements.

As shown in Table 2-1, the formula and WHO define anyone scoring 18.50 or under as *'underweight'*, with the ideal *'normal weight'* being between 18.50 and 24.99. Individuals with a BMI score of 25.00 and over are deemed to be *'overweight'*. The WHO has a further three levels defining obesity, *'class I'* obesity scoring 30.00 – 34.99, *'class II'* scoring 35.00 – 39.99, and *'class III'* individuals scoring >40.00 (World Health Organisation, 2022). Shown in grey in Table 2-1, Class II and Class III are not commonly used clinically across health research, instead anyone over 30 is considered obese.

Table 2-1: The World Health Organisation classification for adults using BMI scores.

Weight Classification	BMI Score
Underweight	<18.50
Normal Weight	18.50 – 24.99
Overweight	25.00 – 29.99
Obese Class I	30.00 – 34.99
Obese Class II	35.00 – 39.99
Obese Class III	>40.00

*Shaded grey–- Obese Class II and III not commonly used instead Obese is used to cover all 30>

As an easy-to-use and understand body measurement, the BMI formula is used for calculating an individual's healthy weight, across the UK healthcare system. BMI is widely used by NHS England as an indication of risk conditions, such as heart disease, diabetes, strokes, and certain cancers (NHS UK , 2022); (Pi-Sunyer F. X., 2009). BMI is also widely used by weight loss companies across the UK such as Weight Watchers, Slimming World, Lighter Life, and even gyms (Weight Watchers, 2016) "WW Reimagined: Weight Loss & Wellness Help, (WW, 2018); (Slimming World, 2018); (Lighter Life, 2018).

These companies explain that calculating your BMI score; not only allows you to work out your current BMI score, but also guides you to see what your ideal weight range should be for your height so this can be worked towards. The BMI chart shows the weight ranges for determining the classification of each person's score (Figure 2-1: BMI Chart).

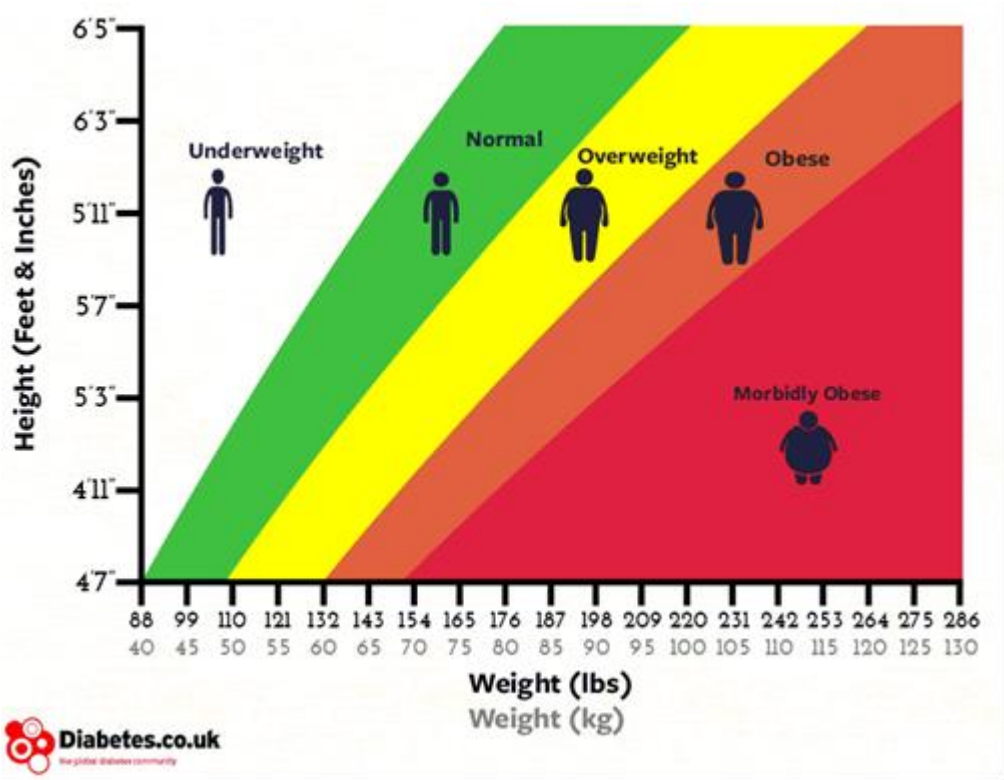


Figure 2-1 A BMI chart representing the different BMI categories (Diabetes, 2022).

As Nuttall (Nuttall, 2015) states this classification of weight should only be used as a useful guide for adult weight measurement.

Looking at an example of the BMI formula in practice can be shown by using British heavyweight boxer Anthony Joshua's body measurements. His height is 1.98 m (6 feet 5' inches) weighing 113kg (249 lbs). BMI = mass (89kg) / height (1.78m) ^{2} = 28.12. The final BMI score is then taken and plotted onto the BMI chart. Anthony Joshua's BMI score of 28.12 indicates he is on the higher end of the overweight section, verging on the obese band of weight classification. As he has a body fat percentage of just 14%, it is clear, British heavyweight Anthony Joshua is not overweight, instead, this BMI score could be down to the levels of muscle weighing heavier than fat this will also apply to other sportsmen and women. This example highlights the grey area and a limitation for the BMI weight measurement calculation.

Several issues arise from body measurement formulas. Firstly, it is extremely difficult to measure the same areas of the body repeatedly, leading to missing calculations.

Research into weight measurement has also been conducted by researchers using different methods and formulas. Researchers have developed other commonly used methods of weight measurement.

2.1.1. Percentage Body Fat

A method that calculates an individual's fat percentage was developed by Durnin and Womersley and is commonly known as the skinfold thickness measurement (Durnin & Womersley, 1974). This method takes the measurements from four areas of the body; biceps, triceps, subscapular, and supra-iliac (Figure 2-2:) using callipers that pinch the skin. The skinfold test is an anthropometric method for estimating body fat. Durnin and Rahanman; Later Jackson and Pollock developed a measure using points across the body. The term anthropometric is defined as measurements made of various parameters of the human body, such as circumferences of various body parts or thicknesses of skinfolds (Durnin & Rahaman, 1967); (Jackson & Pollock, 1978).

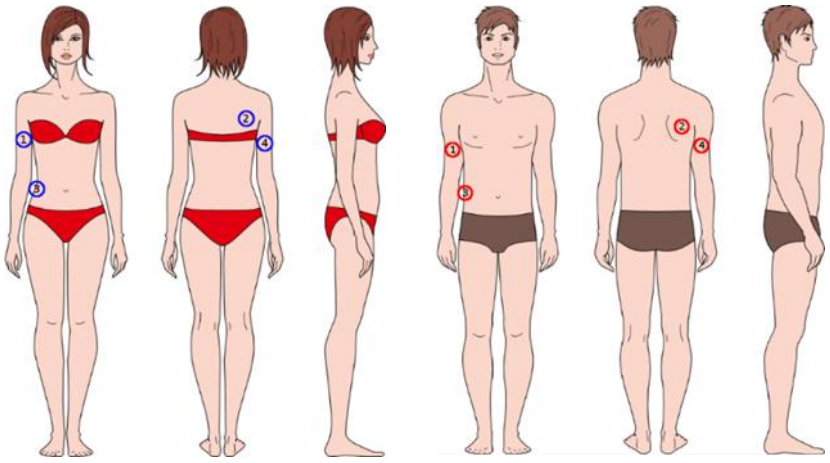


Figure 2-2: A visual representation of the skink fold thickness measurement locations.

These methods are based on statistical modelling, showed the fat content of the male participants varied from 5-50% of body weight, and from 10-61% in females. Once the results of the measurements were plotted, a formula for body measurement is found with the calculated score from the estimation of body density or body fat, using the four skinfolds. The positive from this is that they could develop separate formulas for different age groups and consider sex differences (Durnin & Womersley, 1974).

These skinfold measurements (in mm) from four areas of the body are used to calculate body density and body fat percentage. This is achieved with the help of several equations, the most used is the (Jackson & Pollock, Practical assessment of body composition, 1985) equation. The formula considers an individual's sex and age, which helps overcome one issue with BMI (Equation 2). Once the body fat percentage has been calculated, body density can be worked out.

Males

% Body Fat = (0.29288 x sum of skinfolds) – (0.0005 x square of the sum of skinfolds) + (0.15845 x age) – 5.76377.

Females

% Body Fat = (0.29669 x sum of skinfolds) – (0.00043 x square of the sum of skinfolds) + (0.02963 x age) + 1.4072.

Equation 2: Skinfold Equation for calculating % body fat (Jackson and Pollock, 1985).

The body fat percentage formula (Table 2-2) uses an adult's BMI score, multiplied by 1.20, minus 0.23, and multiplied by the individual's age, minus by 10.8 multiplied by either 1 for males or 0 for females, minus 5.4 equals the body fat percentage score. The body fat percentage formula by (Deurenberg, Weststrate, & Seidell, 1991) has shown both internal and external cross-validation for estimates of male and female adults and children's body fat.

Table 2-2: Body fat percentage

	% Body Fat Male	% Body Fat Female
Lean	<12	<17
Acceptable	12-21	17-28
Moderately Overweight	21-26	28-33
Overweight	>26	>33

As with the BMI calculation, this body percentage score is given a categorisation, however this time the categories are different for males and females (Figure 2-3). Males with a body fat percentage of under 12% are lean, with females scoring under 17% classified as lean. The acceptable range for males is between 12-21%, while for females this is 17-28%. Males scoring between 21-26% and females scoring between 28-33% are considered moderately overweight. The final category is overweight, with males scoring above 26% and females scoring above 33% being considered overweight.

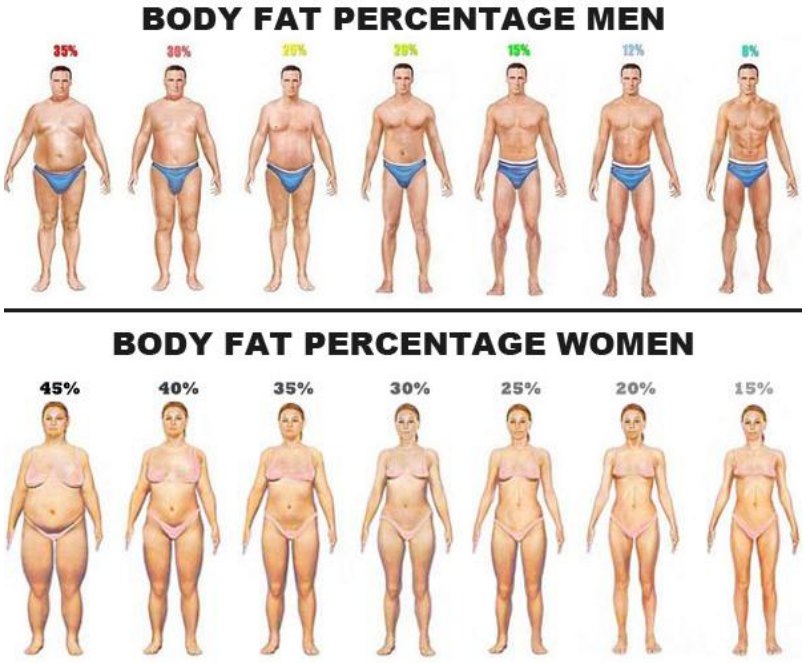


Figure 2-3: A visual representation of body fat percentages for men and women.

To understand this visually Figure 2-3 shows an example of male and female body fat percentages in body shape.

The body fat percentage is mainly used across elite sports (from rock climbing to football), in bodybuilding for body composition within gyms, due to the skin callipers required not being common in households (Collins, et al., 1999); (Espana-Romero, et al., 2009); (Munguia-Izquierdo, et al., 2018) and (Helms, Aragon, & Fitschen, 2014).

Several issues arise from body measurement formulas. It is extremely difficult to measure the same areas of the body repeatedly, leading to miss-calculations (Lloret-Linares, et al., 2013). Body shape for example causes one issue for the BMI formula (Nuttall, 2015). The issue of individuals scoring high in the BMI formula due to muscle mass can skew the BMI scores when the calculation is used causing the individual's body mass percentage to be slightly overestimated (Abramowitz, et al., 2018). This overestimation and sex differences can lead to prediction error, as shown in other methods of calculating body mass for example the skinfold thickness measurements (McRaw, 2010).

2.1.2. Waist Size

Measuring waist circumference is recommended (World Health Organization, 2011) for assessing obesity and health risks which consider subcutaneous fat around the abdomen (World Health Organization, 2011). Waist circumference is a function of visceral fat building up around abdominal organs and is linked to high blood fat levels, high blood pressure, and diabetes (Hamdy, Porramatikul, & Al-Ozairi, 2006); (Ibrahim, 2010); (Singh, et al., 2019). A larger waist measurement indicates the existence of excess fat within organs with negative consequences, for example, excess liver fat leads to excess blood lipids and sugars with consequent increased risk of coronary heart disease and diabetes (DiNicolantonio, Lucan, & O'Keefe, 2016).

As BMI did not account for waist measurements within its formula to calculate obesity, health practitioners speculated if waist measurement alone might be an effective indicator of potential health risks. (Bjorntorp, 1987) proposed a classification of obese patients and complications caused by surplus fat. Further research has linked waist measurements to the risk of serious illnesses such as heart disease, diabetes, liver disease, and certain types of cancer (Han, Van Leer, Seidell, & Lean, 1995); (Wei, Gaskill, Haffner, & Stern, 1997); (Church, et al., 2006); (Moore, et al., 2004) and (Wei, et al., 2018). (Kissebah, et al., 1982) developed a classification of obesity based on the waist-to-hip ratio. The waist-hip ratio formula takes the waist circumference and divides this by the hip circumference.

For consistency in body measurement and research, the WHO developed the STEPwise Approach to Surveillance (STEPS) providing a standardized collection method for analysing and disseminating data. The protocol instructs that waist circumference is ascertained by 'measuring the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest' (World Health Organizational, 2005); (World Health Organization, 2008); (World Health Organization, 2021), approximately 2-3cms above the navel; hip measurements should be taken around the widest portion of the buttocks.

The waist-to-hip ratio is used as an indicator of health, using the score from calculating the difference between the waist and hips as a good indicator of the potential risk of developing serious health conditions. The WHO defines waist-hip ratios (shown in Table 2-3) above 0.90 for men and above 0.85 for women as obese and therefore unhealthy (World Health Organization, 2011).

Table 2-3: The WHO waist-hip ratio measure of health

Men	Women
>0.90	>0.85

Waist measurements define obesity slightly differently from other methods. Instead, waist sizes are put into levels of risk, taking in to account the person's, sex, and ethnicity (Table 2-4).

The widely accepted approach helps to indicate the risk of serious conditions related to waist circumference used by the US department of human and health services and the NHS, with the British Heart Foundation, diabetes UK all having adopted the approach put forward by (Han, Van Leer, Seidell, & Lean, 1995).

Table 2-4: Waist circumference risk levels for men and women

Men	Women	Level of Risk
Below 94cm (37in)	Below 80cm (31.5in)	**'Low Risk'**
More than 94–102cm (37-40in)	More than 80–88cm (31.5-34.6in)	**'High Risk'**
More than 102cm (40in)	More than 88cm (34.6in)	**'Very High Risk'**

These are the guidelines for people of white European ethnicities, the WHO acknowledges that ethnicity has an impact on waist circumference, due to different body shapes (World Health Organization, 2011). To overcome this the WHO recommended work conducted by (Alberti, Zimmet, & Shaw, 2007) that suggests men and women of African Caribbean, South Asian, Chinese, and Japanese origin, waist circumference risks occur at a smaller waist measurement shown below (Table 2-5). Several leading organisations across England including (NHS UK, 2022), (British Heart Foundation, 2022), and (Diabetes UK, 2022) have all adopted the approach.

Table 2-5: Guidance for waist risk level for people from African Caribbean, South Asian, Chinese, and Japanese origin

Men	Women	Level of Risk
Below 90cm (35.4in)	Below 80cm (31.5in)	**Low Risk'**
Above 90cm (35.4in)	Above 80cm (31.5in)	**'Very High Risk'**

The remaining issues surrounding weight measurements involve the cultural and ethnic origin differences related to body shape along with genetics. Furthermore, people from black and Asian family origin or a minority ethnic group can also be at an increased risk of obesity-related health issues (such as diabetes) even if their BMI is 25 or below.

These issues have not currently been overcome by the current measurements. However, (National Instute of Health Care Excellence , 2013) and (Public Health England, 2014) give further advice and guidance for the black, Asian, and minority ethnic groups. Suggesting BMI should be used in conjunction with waist circumference, aiming to keep waist circumference under 90cms (35 inches) for men and under 80cms (31.5 inches) for women (National Instute of Health Care Excellence , 2013).

2.1.3. Somatotype, Body composition, and Morphology

As shown in the body measurements, ethnic differences required alterations in the recommendations for waist sizes. It is important to consider differences in body composition, two people with the same weight measurement score will carry their weight differently due to their body composition, for example tall and lean or short and stout. Body composition can be defined as the components of a body that often divide the body into two main components: a fat-free mass which is all the body tissue that is not fat, and fat mass which is the percentage of the total body mass that is fat (Oxford Reference , 2022). Morphology is the scientific study of the structure of animals, humans, and plants (Cambridge Dictionary , 2022).

In the 1940's Herbert Sheldon and colleagues, classified an individual's physique into three categories, ectomorph, endomorph, and mesomorph (Sheldon, Stevens, & Tucker, 1940). Sheldon suggests that an individual with an ectomorph body shape is often tall, thin, lightly muscled, flat-chested, and delicate. While Mesomorph individuals are often having a hard, rugged, triangular shape, with an athletic build often displaying well-developed muscles, thick skin, and good posture. Finally, Endomorph individuals are often short and soft with under-developed muscles and have difficulty in losing weight (Roeckelein, 1998); (Rajkumar, 2015). These three classifications of an individual's physique as seen in Figure 2-4 (ectomorph, endomorph, and mesomorph) suggest that how people distribute their body mass can affect BMI and waist scores. Instead, a more individualised formula to measure

an individual body mass would be more helpful, using a mixture of the key formulas as a guide but could be difficult in practice.

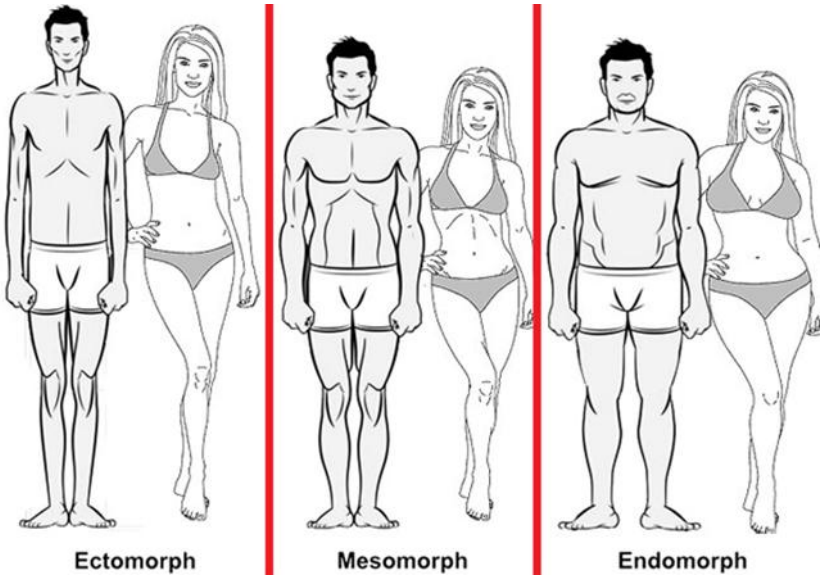


Figure 2-4: A visual representation of the Ectomorph, Mesomorph, and Endomorph body shapes for both males and females (Nicki Ong, 2022).

This method is different from the other statistical models used to determine body composition. Sheldon's *"somatotypes"* were defined using stereotyping of each body type, before describing their associated physical and psychological traits as follows in Table 2-6 (Carter, Carter, & Heath, 1990); (Roeckelein, 1998), (ML, 2011).

Table 2-6: Somatotypes and their psychical and psychological traits

Somatotypes	Physical traits	Psychological traits
Ectomorphic	Characterized as skinny, weak, and usually tall with low testosterone levels	Described as intelligent, gentle, and calm, but self-conscious, introverted, and anxious.
Mesomorphic	Characterized as naturally hard and strong, with even weight distribution, muscular with weight training, thick-skinned, and having good posture with a narrow waist.	Described as competitive, extroverted, and tough.
Endomorphic	Characterized as fat, usually short, and having difficulty losing weight	Described as outgoing, friendly, happy, and laid-back, but also lazy and selfish

Those categorized as having endomorph traits were more likely to be short, and fat with difficulty losing weight. This may be explained because of the laid-back, lazy, and selfish nature of the psychological traits of an endomorph, categorized by Sheldon.

The basis of defining body shape and the associated physical traits as a guide are still explored and taught today in the English curriculum, with research exploring somatotypes (Tes, 2022); (Nobari, et al., 2011).

However, Sheldon's claims have since been dismissed, with the BMI formula considered a more useful tool for body measurement (Maddan, Walker, & Miller, 2008). Sheldon's main research assistant of the time later claimed that Sheldon faked the data (Vertinsky, 2007).

2.1.4. Bioelectrical Impedance Testing

Bioelectrical impedance analysis (BIA) is a non-invasive method for estimating body composition that involves passing a weak electrical current through the whole body to measure the resistance from body fat, muscle mass, and hydration (Walter-Kroker, Kroker, Mattiucci-Guehlke, & Glaab, 2011).

The 1960s saw the development of an equation using whole-body impedance measurement to predict total body water (Hoffer, Meador, & Simpson, 1969). Hoffer et al, 1969 equation known as the impedance index used in the bioelectrical analysis, is the squared value of height divided by impedance measurements of the right half of the body. This produces a correlation coefficient of 0.92 with total body water, which converts to a body fat measurement (Yanovski, Hubbard, & Heymsfield, 1996). Further equations developed for the impedance index were developed to consider body weights and genders (Kushner & Schoeller, 1986). After this, came the development of different systems to measure body mass using electrical currents.

The bioelectrical analysis produces a body fat percentage (see body fat percentage) that is consistent (unlike the issues around the consistency of calliper measuring) while correlating closely with BMI scores (Heydari & Zare, 2011). Bioelectrical testing is widely used in clinical settings by researchers and clinicians as a non-invasive and safe method to estimate body composition and body water volume in humans (Kushner, Bioelectrical impedance analysis: a review of principles and applications, 1992). These types of measurements are now more affordable with scales starting from £25 (John Lewis, 2022). Other methods of body measurements include Bioelectric Impedance Analysis (Khalil, Mohktar, & Ibrahim, 2014), Hydrostatic Weighing (Biaggi, et al., 1999), Dual Energy X-Ray Absorptiometry (DEXA) Scan (Pietrobelli, Formica, Wang, & Heymsfield, 1996) and body volume index (BVI) scanners (Tahrani, et al., 2008).

2.2. Interventions for Obesity

Once a person has been identified as being overweight and obese how can they be helped. This can be split into four types of suggestions: diet, exercise, commercial and medical interventions. Firstly diet, cutting down on the number of calories being consumed. Exercise, to help burn more calories than are being consumed. This advice and support are free of charge via the NHS and government-related websites. In the commercial arena, companies make large sums of money assisting with these points charging customers to gain help by using their programmes. Medical interventions include medication being prescribed and in more extreme circumstances surgery. However, the NHS has a four-tier structure with tier-three weight management centres that can help people with non-invasive help and support, but these are rare.

2.2.1. Types of Treatment and Interventions

The types of treatments and interventions vary depending on the location, regions, districts, cities, towns, and villages, an individual life in, with some NHS trusts having more availability compared to others. The types of interventions can also vary within the private and commercial companies offering different programmes. The 'NHS' is the umbrella term for the four health systems of England, Scotland, Wales, and Northern Ireland, as a result services will vary (Shuttleworth & Nicholson, 2020). The current research will focus on NHS England.

2.2.2. NHS treatments and interventions

In England, NHS healthcare professionals are often the first to identify the potential of weight becoming an issue (Tahrani, et al., 2020); (Wharton, et al., 2020). During consultations, health professionals can discuss the issue of weight gain and obesity one to one with the patient. This gives them the ideal position to offer help and useful advice to patients with weight issues. The better the advice offered, along with the motivation to lose weight given to an obese patient, has been shown to increase the chances of losing weight (Jackson, Wardle, Johnson, Finer, & Beeken, 2013).

The NICE guidelines on obesity management in adults, explains the difference between losing weight and maintaining weight loss to health professionals (Nantional Institute for Health Care Excellence, 2019); (National Institute for Health Care Excellence, 2014). NICE detail that health professionals should inform and encourage the importance of developing both skills. A further important point that NICE explain, is that health professionals should point out that the shift from losing weight and the beginning of weight maintenance can take 6 to 9 months. This is useful as it informs the patients that achieving realistic and sustainable targets for weight loss takes time. So, they should not seek a quick fix, the process of losing weight takes time which is normal and expected. This NICE advice is not always available, due to health professionals feeling daunted at times, to bring up the subject of obesity, or feel that the advice they can offer is insufficient (Frank, 1993).

The general NHS advice on the treatment of obesity includes four main suggestions, diet, exercise, medication, and surgery (NHS England, 2014).

2.2.3. Diet

The NHS recommends that, if overweight or obese, people should reduce their daily calorie intake, along with cutting out unhealthy foods such as processed and fast food. Instead replace these foods with healthier choices such as fresh meat, fruit, and vegetables (NHS Better Health (Change4Life), 2022); (Change4Life, 2022). The NHS also suggest that people avoid so-called fad diets, such as fasting and cutting out a whole food group, as this can cause other complications such as sleep apnoea and long-term negative issues with food (NHS, 2019).

If people feel they need a more structured plan on how to eat well, the NHS offer a free 12-week weight loss plan (NHS.UK, 2016); (NHS Better Health, 22). The 12-week plan involves sticking to a calorie-controlled limit of no more than 1,900kcal a day for men (13,300 per week), and 1,400kcal for women (9,800 per week). However, the cost of following this plan was 42% of the weekly budget of the lowest earners (Scott, Sutherland, & Taylor, 2018). People can spread and save calories over a week,

depending on how they want, to allow flexibility. If a person goes over 400 on one day, they can reduce either 400 the next day or 100 over four days. This is designed to help people lose weight at a safe rate of 1–- 2lbs per week. Other advantages of the plan are a free calorie tracker, counting calorie guide, easy meal ideas, non-food rewards, weight loss tips and email support. A further part of the plan is to gradually increase activity levels, supported by podcasts and advice.

2.2.4. Exercise

The second recommendation by NHS England focuses on increasing activity levels, joining exercise with a healthy diet. NHS England supports The Department of Health (The Department of Health, 2011) recommendations that adults in the UK should do at least 150 minutes of moderate intensity exercise a week. The advice by the NHS is that people should aim to start doing between 15-20 minutes of exercise 5 times a week, before gradually building up, if people have been inactive previously. However, by becoming more active daily, burning off more calories, this will in turn help support weight loss progress. This can be achieved with the help of the NHS, by taking part in the NHS 12-week programme or different initiatives such as the 10,000-step challenge, gym-free exercises via the NHS website, or the couch to 5k podcast, which offers help to get you active in your own way (NHS.UK, 2020).

2.2.5. Medication

The third option for people who have a BMI >30, and who are already dieting and exercising, is anti-obesity medication (Orlistat, Saxenda–- daily injection and Mysimba (MedlinePlus, 2016). This is only recommended when a patient has made a significant effort to lose weight, agreeing to continue their exercise and diet plans, whilst on the medication. Orlistat has been shown to produce a significant clinical weight loss in overweight and obese patients compared to placebo (Kelley, et al., 2002). The medication works as a gastric and pancreatic lipase inhibitor, that reduces dietary fat absorption by up to 30% (Pi-Sunyer X. , 2009); (Klein, 2016). As a result,

this would lead to a 600-calorie deficit per day for a person with an intake of 2000 calories per day. The downside to this type of treatment is the number of side effects that can be embarrassing. These side effects range from flatulence and needing the toilet urgently to oily discharge from the patient's rectum (MedlinePlus, 2016).

2.2.6. Surgery

In more extreme cases NHS England offers bariatric surgery. This extreme measure of surgery is only available for patients with a BMI >40, or a patient with a BMI >35 who also has a serious health condition for which weight loss could help (NHS.UK, 2020). It is recommended that people will receive treatment and intervention at a tier-three weight management centre (NHS England - Public Health England London, 2014).

Bariatric surgery involves either reducing the size of the patient's stomach with a gastric band or the removal of a portion of the stomach by re-routing the small intestine to a small stomach pouch. However, as with many forms of surgery, there are risks during and after the operation, so this is recommended as a last resort (NHS.UK, 2020). This method is considered both cost effective and achieves weight loss (Picot, et al., 2009). However, research is mixed for the long-term effectiveness of these procedures after the initial weight reduction. Currently, patients are commonly only monitored for up to two years after surgery, after this people can often start regaining the weight previously lost due to the initial underlying reason for the weight gain not being tackled (Velapati, et al., 2018); (Clare, 2016). The perspectives of patients living with obesity after weight loss surgery is championed by Mr Clare who is the European Association for the Study of Obesity (EASO) patient council chairman who shines the spotlight to the longer-term complications after the two-year success period (Clark K. , 2016).

2.2.7. Commercial weight loss programmes

There are many large commercial weight loss companies in the UK. The three most used are (Lighter Life, 2016), (Slimming World, 2019) and (WW - Weight Watchers,

2019). Each of these companies uses a different method to achieve weight loss by reducing calories, as shown in Table 2-7. These methods range from very-low-calorie diets (Lighter Life, 2018), calorie counting via a points system (Weight Watchers, 2016) and free foods with *'Syns'* (Slimming World, 2019). *'Syns'* are used as part of the Slimming World plan, *'Syns'* defined by Slimming World are higher calorie and less nutrient-dense foods. A *'Syns'* score is assigned to those foods that are least satiating and are high calorie, high fat and/or high sugar foods such as alcohol, crisps, chocolates or butter, sauce, or gravy with a meal (Henderson, 2021). Slimming World, WW and Lighter Life companies sell readymade food, that fits within each of their systems, which are available in Iceland, Tesco, Sainsbury's and Morrisons.

Each of these companies run group sessions and weigh-ins, which allow people to feel part of a group during their weight loss programme. Slimming World and Weight Watchers offer advice about being healthy by becoming more active. The Lighter life approach focuses specifically on food nutrition, allowing individuals to purchase nutritionally balanced products. Further to this, (Lighter Life, 2016) offer group cognitive behavioural therapy (CBT) as they attempt to change people's behaviours with food.

Table 2-7: Commercial Interventions and their approach to weight loss

Company	Weight Loss Approach
Lighter Life	Intermittent fasting. A Very Low-Calorie Diet (VLCD). This involves eating nutritionally balanced 800 calories a day
Slimming World	Limiting and increasing food groups. Based on free food, healthy extras and *'Syns'*. This involves eating a mixture of these foods daily.
WW	Calorie counting. Based on a points system. This involves working out how many points are allowed daily.

Each of these companies boasts of the number of successful people that have used their weight loss method in national ad campaigns. However, there has yet to be a

full study with a follow-up following the many people progressing on these programmes. Along with this, there are many more so-called diets ranging from the cabbage soup diet to drinking water with pepper diets.

These types of diets are unhelpful as they cannot be continued in the long term. This can lead to people losing weight before regaining all of the initial weight lost and in some cases putting on even further weight than before (Clark K. , 2016); (Clark K. , 2016); (BDA The Association of UK Dietitians, 2022).

2.3. The NHS recommended weight loss pathway,

The NHS recommend a four-tier weight-loss pathway for each NHS trust across the United Kingdom (Figure 2-5). As a result, most areas across the UK have developed tier 1, tier 2, and access to tier 4 services.

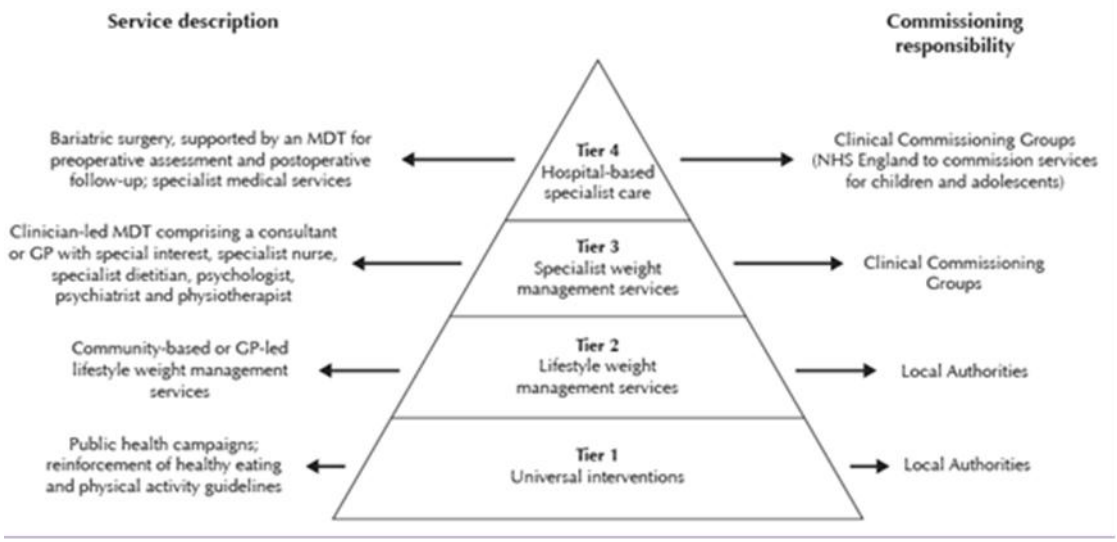


Figure 2-5: A visual representation of NHS England's Obesity care pathways and commissioning responsibilities of the time (Department of Health, Obesity and Food Branch, 2013); (Sharman & Nobles, 2015)

Commonly the public will see Tier 1 during January with public health campaigns including *'couch to 5k'* or *'Change4Life'* encouragement on social media to take up exercise or lose weight (Change4Life, 2022). Tier 2 are GP based services, with clinics or subsidised physical activities, these vary depending on local funding. Tier 3 are specialist weight management centres, these are extremely limited across England

due to finances, only a handful of NHS Trust tier 3 weight loss centres have been established UK-wide (Capehorn M. , 2016). As a result, the level of help available in each centre varies. Lastly, tier 4 is surgery-based interventions and will only be accessed by those that are extremely obese.

2.3.1. Rotherham NHS obesity framework

Rotherham is often considered the Obesity capital of the UK after a television programme by Jamie Oliver was based there in 2008 (Jamie's Ministry of Food, 2008). The television series showed Rotherham parents delivering junk food to their children at break times to get past Jamie Oliver's healthy food being cooked and served in school canteens (Jamie's Ministry of Food - Channel 4, 2008). Situated within South Yorkshire, Rotherham has a unique specific tier three weight service set out in the NHS Rotherham pyramid framework shown in Figure 2-6 (RIO NHS, 2015); (NHS Rotherham Obesity Strategy (the Health Weight Framework) , 2016); (Capehorn, Haslam, & Welbourn, 2016).

The NHS Rotherham framework is split into children and adults, offering different types of specific help and advice for each, shown in Figure 2-6 (NHS Rotherham framework, 2016). The first step for adults and children is Tier 1, this stage is within primary care and usually involves a mixture of people including school nurses, GPs, and health visitors who measure, monitor weight, and offer advice when weight is considered an issue. Tier 2 offers basic weight management and interventions within the community, some NHS trusts offer money off for weight loss programmes such as Slimming World, Lighter Life and WW. Along with this, GPs lead the community to other weight loss schemes, such as subsidised gym and slimming world memberships to health walks paid for by the local authorities (Get Healthy Rotherham, 2022); (Herts Health Walks, 2016).

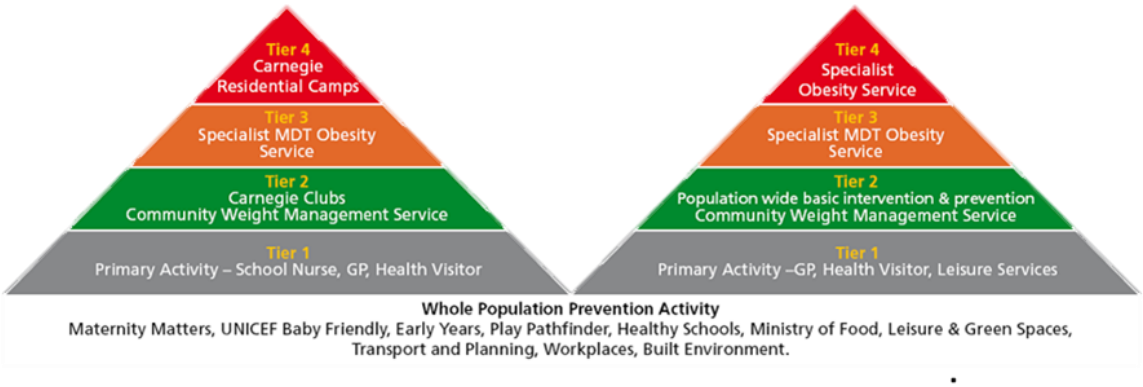


Figure 2-6: A visual representation of (NHS Rotherham Obesity Strategy (the Health Weight Framework) , 2016) across all tiers for children (left) and adults (right).

When weight becomes more of a concern and BMI scores increase to >30, patients can move to tier 3. However, tier 3 services are limited across the UK with only a handful of these available (Capehorn M. , 2016) This level of service is available at the Rotherham Institute of Obesity (RIO) since 2009. Headed by a clinical lead who has built and grown a team at RIO, along with the multi-discipline approach to tackling obesity.

The patients who are treated at RIO have a BMI of >30, and the average patient at RIO has a BMI of approximately 45. The team at RIO offer a range of help for weight loss, from nutrition advice, exercise plans, talking therapies and how-to cook courses. Up until 2015 RIO also offered help to children, however, due to local council cutbacks this service is no longer available. This has resulted in RIO not being able to treat patients until they reach the age of 18 years.

In the extreme cases of patients with a BMI >40, or a patient with a BMI >35 who also has a serious health condition for which weight loss could help; NHS England recommends bariatric surgery (NHS UK, 2016). Tier 4 services are hospital-based; these involve a multi-discipline team offering more intrusive forms of treatment such as bariatric surgery. This level of service is available across the UK but is only used as

a last resort, as surgery can be very dangerous for these patients while also costing up to £10,000 per operation (Private Health, 2022).

In some cases, patients can regain weight after surgery, this could be related to a pre-existing emotional eating disorder. Since 2017, RIO has been reduced in capacity due to funding being cut by the local Clinical Commissioning Group (CCG) (Capehorn M. , 2017). As a result, RIO has now become a private service with a reduced NHS arm (considered a tier 2 and a half), and further services are offered for private patients for a fee.

2.3.2. England's obesity tiers

Evaluations into different tier 2, 3 and 4 services are limited. However, Hazlehurst, et al (2020) critiqued the clinical pathways available for weight management in England. They found very little evidence available to be able to provide a full evaluation of tier 2 community-based lifestyle interventions (within Primary care) and tier 3 (specialist) weight management services. They suggest that access to treatment and fixed pathways, coupled with uncertain treatment outcomes and weight stigma act as major barriers for these services (Hazlehurst, et al., 2020).

Earlier work by Jennings et al (2014) evaluated a tier 3 weight management centre based in Norfolk. They recruited patients with obesity and related co-morbidities for their 12-month tier 3 weight management programme. The multidisciplinary team delivered the programme with the primary outcome of weight loss of at least 5% of baseline excess weight at 12 months (like RIO) (Jennings, et al., 2014). Patients were assessed via different body measurements as well as with questionnaires covering their diet, activity levels and quality of life. Service users also took part in focus group discussions to enable the centre to gain information of the participants' experiences over the course of the programme. Almost 50% of participants achieved the 5% excess weight loss target by the 12 months measurement. The centre observed improvements in service users' fruit and vegetable intake, activity levels and quality of life. Focus group discussions heard patients describing high levels of satisfaction

with the programme. Overall, the tier 3 weight management centre produced good health outcomes when compared to other existing services that were available at the time (Jennings, et al, 2014).

Brown et al (2017) focused specifically on tier 3 services across England, they systematically reviewed the evidence base for tier 3 weight management interventions for adults. They reviewed the characteristics, impact, and practice implications of programmes delivered by specialist multidisciplinary teams. They found that the team's skills and eligibility criteria varied from service to service. However, a statistically significant reduction in mean body mass index over time was observed in service users (Brown, et al., 2017). The findings showed that specialist tier 3 weight management services can demonstrate significant weight loss and can provide a key role in supporting service users to control what can often be complex forms of obesity. They highlight the need for further research into effective approaches to enable severely obese adults to be appropriately supported.

A further systematic review of Tier 3 specialist weight management service programmes available for adults in the UK living with obesity was conducted by Alkharaiji et al (2019). They found that both baseline BMI scores and waist circumferences were reduced by the 6-month measurement, with service users also improving in other areas; reduction in fasting blood sugars, insulin usage and blood pressure levels (Alkharaiji, Anyanwagu, Donnelly, & Idris, 2019). Also observed was an increase in physical activity at the 3 months check in, before this then declining after 6 months. Alkharaiji et al (2019) concluded that tier 3 weight management programmes have a short to mid-range positive effect on obese adult patients living in the UK for accumulated reduction in weight, glycaemic control, blood pressure and some subtle improvements in physical activity.

Other locations without specific tier 2 clinics or centres can refer or subsidise sessions with local services such as slimming world (Slimming World, 2021).

2.4. Chapter Two - Summary

The classification of Obesity using body measurements is key to measuring and monitoring interventions and their impact on health. Body compositions and morphology vary across populations with differences in sex and ethnicities requiring alterations in the recommendations for waist sizes. By using just one measurement (for example weight change on weighing scales) issues can arise due to the inability to see the whole picture. This may miss other positive body composition changes (decreases in waist circumference and body fat percentage) in participants who would otherwise be deemed as *'failing'* by missing their scale weight targets. It is therefore important to keep track of all measurements to enable people to stay motivated in their individual weight loss journeys. This analysis shows that many of these patients demonstrate positive changes in body composition that may convey health benefits.

Once a person has been identified as being obese the NHS offer help to reduce this via four types of intervention: Diet, Exercise, Medication (specifically for weight loss) and medical interventions (Surgery). A 5th type of intervention is available via commercial companies' and interventions that incorporate both diet and exercise, for example Slimming World and Weight Watchers.

Clinically, the NHS recommend a four-tier weight-loss pathway for each NHS trust across the country.

- **Tier 1:** Commonly noticed in January with public health campaigns including *'couch to 5k'* or *'Change4Life'* encouragement on social media to take up exercise or lose weight (Change4Life, 2022)
- **Tier 2:** GP based services, with clinics or subsidised physical activities, these vary depending on local funding.
- **Tier 3:** Specialist weight management centres with multidisciplinary teams working to help service users with weight loss, these are extremely limited

across England with only a handful of NHS Trust tier 3 weight loss centres established UK-wide (Capehorn M., 2016).

- **Tier 4:** is surgery-based interventions and will only be accessed by those that are extremely obese.

Rotherham was considered the Obesity capital of the UK, as a result the clinical lead and his team developed a tier three weight management service, called the Rotherham Institute of Obesity (RIO).

3. Chapter Three

Socio-economic Status and Social Capital

To determine what socio-economic status and social capital are, along with the potential risks these can have on individuals' health. The following chapter explores the key elements that combine to impact obesity:

- Social inequality
- Consequences of inequality
- Socio-economic status
- Health inequality
- Social determinates
- The Marmot reports.
- Index of Multiple Deprivation
- Inequality leading to obesity
- Social capital impact on health
- Social capital the concept
- Social capital and obesity

This will allow for an understanding of what is being experienced across populations in England regarding health and social inequality, the impact this can have on health, specifically obesity, and what has been done in these areas across the current evidence base.

3.1. Consequences of Inequality

(NHS England, 2019) define health inequalities as the *"unfair and avoidable differences in health across the population, and between different groups within society."* In recent years Public Health England and the NHS have developed an equality and health inequalities hub that defines Health inequalities as *"the preventable, unfair and unjust differences in health status between groups, populations or individuals that arise from the unequal distribution of social, environmental and economic conditions within societies, which determine the risk of people getting ill, their ability to prevent sickness, or opportunities to take action and access treatment when ill health occurs"* (England.NHS.UK, 2022). The NHS go further and detail how they believe health inequalities occur, they explain that *"the conditions in which people are born, grow, live, work and age… influence and impact the opportunities for good health, and (this impacts) how we think, feel and act, and this shapes our mental health, physical health, and wellbeing"* (England.NHS.UK, 2022).

The characteristics of people and communities who experience health inequality are those often with low socioeconomic status and deprivation, this is known as socioeconomic deprivation. Socioeconomic deprivation can be defined as *"a multidimensional concept as it refers to the relative disadvantage an individual or a social group experience… including a group defined in geographical terms… a community or a neighbourhood… in terms of access and control over economic, material or social resources and opportunities"* (Lamnisos, Lambrianidou, & Middleton, 2019). As a result, socioeconomic deprivation is a complex construct, capturing employment, income, education, occupation, living standards, justice, social position, and family support in each geographical location that has a consequence on the individual (Mills, 2021). This cycle will have an impact at an individual level with the level of education impacting occupation options, income levels (including unemployment). At a geographical level, this produces low-income areas due to affordability, with poorer people living in deprived areas experiencing poor housing,

higher levels of crime, and poorer education for children leading to future low income and unemployment. This can cause individuals to self-perceive their position in the social class and their socioeconomic status which in turn can impact on both their physical and mental health.

3.1.1. Socioeconomic Status

Can an individual's socio-economic status impact social capital and are these impacted by inequality?

Social inequality is a negative outcome across society which can be defined as *"(social) Inequality is the difference in social status, wealth, or opportunity between people or groups"* (Collins Dictionary, 2022). *Or as "Unequal rewards or opportunities for different individuals within a group or groups within a society"* (Oxford Reference, 2022).

Socioeconomic status can be defined as '*the social standing or class of an individual or group. It is often measured as a combination of education, income, and occupation'* (American Psychological Association, 2022). An individual's socioeconomic status is usually broken is to three levels, low, medium, and high. People with a lower socioeconomic status usually live in deprived areas, having less access to financial, educational, social, and health resources than those with a higher socioeconomic status. As a result, they are more likely to be in poor health and have chronic health conditions and disabilities (National Institute of Health, 2022).

The National Statistics Socio-economic classification (NS-SEC) is used widely across the UK by the ONS (The Office of National Statistics, 2023). This socio-economic classification is based on occupation, with those that are categorised never worked and long term unemployed being grouped together separately. Table 3-1 shows the eight, five and three class versions of the NS-SEC conceptual model as used by ONS (The Office of National Statistics, 2023).

Table 3-1: The national statistics socio-economic (NS-SEC) classification, eight, five and three class versions

Eight classes	Five classes	Three classes
1. Higher managerial, administrative, and professional occupations. **1.1.** Large employers and higher managerial and administrative occupations. **1.2.** Higher professional occupations. **2.** Lower managerial, administrative, and professional occupations. **3.** intermediate occupations. **4.** Small employers and own account workers. **5.** Lower supervisory and technical occupations. **6.** Semi-routine occupations. **7.** Routine occupations. **8.** Never worked and long term unemployed	**1.** Higher managerial, administrative, and professional occupations. **2.** Intermediate occupations. **3.** Small employers and own account workers. **4.** Lower supervisory and technical occupations. **5.** Semi-routine and routine occupations. ***Never worked and long-term unemployed*	**1.** Higher managerial, administrative, and professional occupations. **2.** Intermediate occupations. **3.** Routine and manual occupations. ***Never worked and long-term unemployed*

3.1.2. Inequalities in Health

A UK government report into health inequalities supports the fact that there are avoidable and unfair differences in health status between groups of people or communities. The report states that between 2014 and 2016, the gap in inequality for life expectancy between the most and least deprived areas of England was 9.3 years for males and 7.3 years for females (Public Health Outcomes Framework, 2018).

Higher mortality rates seen in deprived areas are linked to heart disease, lung cancer, and chronic lower respiratory diseases making a third of the total gap in life expectancy for both men and women. People in the most deprived areas are almost four times as likely to die prematurely from cardiovascular diseases compared with those in the least deprived areas, from 2010 to 2012 this has widened. (Public Health Outcomes Framework, 2018)

The main risk factors for this are smoking and obesity. Although the prevalence of smoking in England has declined, people in deprived areas are still more likely to smoke than people in the least deprived areas. The World Health Organisation states health inequalities come from *"social factors, including education, employment status, income level, gender, and ethnicity… influence how healthy a person is. In all countries – whether low-, middle- or high-income – there are wide disparities in the health status of different social groups. The lower an individual's socio-economic position, the higher their risk of poor health"* (Organisation, 2018).

Health inequities are systematic differences in the health status of different population groups. These inequities have significant social and economic costs both to individuals and societies.

3.1.3. Social determinants of health

The social (or wider) determinants of health are made up of the social, cultural, political, economic, commercial, and environmental factors that shape the conditions in which people are born, grow, live, work and age (The Health Foundation, 2022). In the mid-'00s the World Health Organisation created a commission on Social Determinants, setting them three tasks (World Health Organisation, 2008).

Firstly, assessing the global evidence on the social determinants of health. Secondly, assessing the impact of the social determinants on health inequity, and thirdly, from these outcomes make recommendations for actions to address these inequities

(Solar & Irwin, 2007). Based on the collected evidence the commission recommended a conceptual framework for the social determinants of health was created (Figure 3-1).

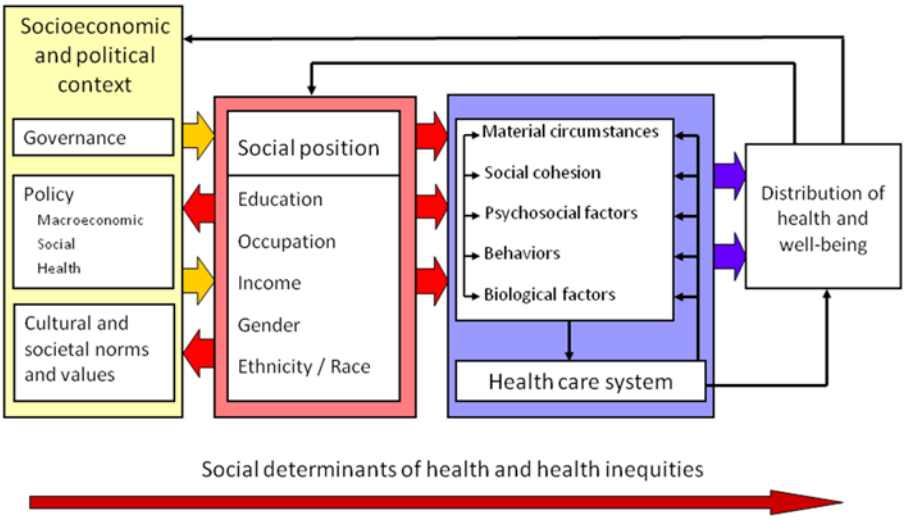


Figure 3-1: Commission on Social Determinates of Health concept framework Amended by (Venkatapuram, Bell, & Marmot, 2010), from (Solar & Irwin, 2007)"A conceptual framework for action on the social determinants of health," in the Discussion paper for the Commission on Social Determinants of Health (CSDA, 2008)

The model shows the socioeconomic and political context, including the governance, policy, cultural, and societal norms, and values. These interact with the social position of education, occupation, income, gender, race, and ethnicity. The way people interact with these affects their social position material circumstances, social cohesion, psychological factors, behaviours, and biological factors. These factors are linked to the health care system and can interact with material circumstances, social cohesion, psychological factors, behaviours, and biological factors in a cycle. These factors also impact the distribution of health and well-being that again goes back to the socioeconomic and political context and social position. On this basis, Venkatapuram et al, (2010) suggest the social determinants of health and health inequities in different areas should be tackled by decision-makers, who should set

out plans to improve health and health equality to reverse this (Venkatapuram, Bell, & Marmot, 2010)

A further model of health determinants that is used for helping to tackle social and health inequality by the NHS (Baxter, 2002) and the WHO (Whitehead & Dahlgren, 2006) is work by Whitehead and Dahlgren (Whitehead & Dahlgren, 1991) Figure 3-2.

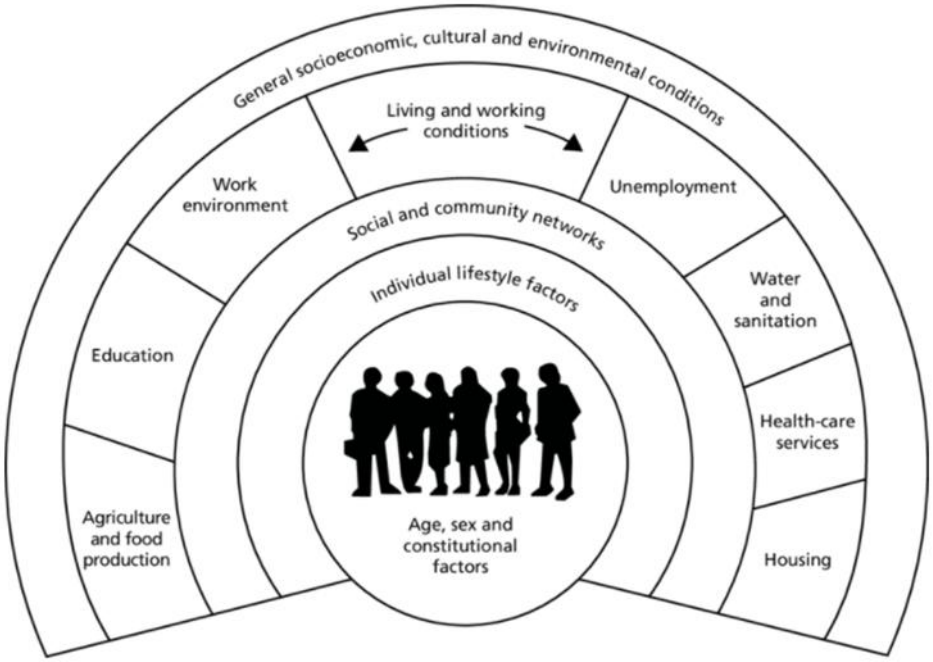


Figure 3-2: Dahlgren and Whitehead (1991) model of health determinants

At the core of the model are personal characteristics which include age, sex, and constitutional factors such as ethnic group and hereditary factors. Moving to individual lifestyle factors including physical activity (obesity), smoking status, and alcohol intake. Moving wider to the social and community networks of people's social circles and family. This is impacted by the living and working conditions being experienced. Living and working conditions include access and opportunities for jobs, housing, education, and welfare services. Overarching all of this are the general socioeconomic, cultural, and environmental conditions, which include factors such as

the amount of disposable income, taxation, and the availability of work. This model shows the social and economic conditions that determine the quality of health for the population and how each level and factor impact the individual.

3.1.4. The Marmot Reports

A highly respected researcher in social and health inequality is Sir Professor Michael Marmot, who has a passion and interest for research in inequalities (both social and health), their impact on health and their causes (Institute of Health Equity, 2022). He became a UK government advisor who highlighted health inequalities across the country. In November 2008, the Prime Minister of the time, Gordon Brown, announced that Marmot had been asked to chair a review of health inequalities in England; to inform policy making and address health inequalities from 2010 (University College London, 2008). The review was published and entitled Fair society, healthy lives: The Marmot Review (Marmot, 2010)

In the report, Marmot proposed new ways to help reduce health inequalities in England. He argues within the report that traditionally, government policies have focused resources only on parts of society. So, to improve health for all, and to reduce unfair and unjust inequalities in health, action is needed across the social gradient (Marmot, 2010). Marmot warns that no one is '*immune to obesity*'. However, some people are more likely to become overweight or obese than others due to income, social deprivation, and ethnicity as these have an important impact on the likelihood of becoming obese (Marmot, 2010).

The Institute of Health Inequality defines social gradients by "*The social gradient in health is a term used to describe the phenomenon whereby people who are less advantaged in terms of socioeconomic position have worse health (and shorter lives) than those who are more advantaged. A classic example of research on this subject is the Whitehall study of British civil servants. Analysis of this data shows a steep inverse association between social class and health and mortality from a wide range of diseases"* (Donkin, 2014)*;* (Institute of Health Equity, 2014).

The Marmot review 2010 found that people living in the poorest neighbourhoods across England, on average die seven years earlier, when compared to people living in the richest neighbourhoods (Local Goverment Association, 2010). Furthermore, the report suggests that the lower a person's social and economic status the increased likelihood of them suffering from poorer health. Marmot points to the social gradient of health inequalities. Marmot explains the complex nature of health inequalities, explaining that they arise from several complex interactions across many factors such as housing, income, education, social isolation, and disability, which impact and are affected by an individual's economic and social status (Marmot Review report – 'Fair Society, Healthy Lives, 2010). Despite the complex nature of inequality, Marmot suggests that health inequalities are largely preventable, with social justice needed to address the causes of health inequalities recommending action across all the social determinants of health from education, occupation, income, home, and the community (Local Goverment Association, 2010).

Ten years later the Health Foundation commissioned Sir Professor Michael Marmot and colleagues at the Institute of Health Equity to examine progress in addressing health inequalities in England. In 2020 Marmot published Health Equity in England: The Marmot Review 10 Years On (Marmot, 2020).

Again, the key findings from the report were that people can expect to spend more of their lives in poorer health with increases in life expectancy stalling. Furthermore, the Marmot review 10 years on report highlights those in the most deprived areas have a shorter life expectancy with the social gradient continuing to grow over the ten years between reports (Marmot, Allen, Boyce, Goldblatt, & Marrison, 2020). Marmot et al (2020) found regional differences in life expectancy, specifically showing that people living in more deprived areas of the Northeast of England experience worse health than the deprived areas of London. Furthermore, those living in the Northeast have a life expectancy of almost five years less. Sadly, England's mortality rates are increasing for men and women aged between 45-49

years of age. Marmot et al (2020) put forward the suggestion that this could be related to what is known as *'deaths of despair'* that have been seen in the USA with increases in suicide, drug, and alcohol-related deaths. In his original report 10 years previous, Marmot identified the health gap between wealthy and deprived areas, this gap has continued to grow, with further information showing the place a person lives is also has an important on the risk to their health (Marmot, Allen, Boyce, Goldblatt, & Marrison, 2020).

3.1.5. Multiple Deprivation Index for England

What defines whether an area is a deprived area is based on several characteristics included in the index of Multiple Deprivation (England.NHS.UK, 2019). This has been mapped using ArcGIS software to show the deprivation for 2015 and 2019 in England (Communities.Gov.UK, 2021) (ArcGIS, 2022).

The most recent Index of Multiple Deprivation from 2019 (unchanged from 2015) combines information from the seven domains to produce an overall relative measure of deprivation (Ministry of Housing Communities & Local Goverment, 2019).

The English Indices of Deprivation provide information on the prevalence of multiple types of deprivation in England. The set of measures of deprivation for small areas across England are based on seven different domains of deprivation:

- Income Deprivation
- Employment Deprivation
- Education, Skills, and Training Deprivation
- Health Deprivation and Disability
- Crime
- Barriers to Housing and Services
- Living Environment Deprivation

Each indicator is scored based on data from the most recent time point available consistently across neighbourhoods in England. These seven domains are combined

and weighted using expert judgments based on society's preferences, and relative importance to produce overall deprivation which has been independently tested to suggest a good rule of thumb (Watson, et al., 2019).

England is broken up in several ways by the government and the office of national statistics, these include:

- Nine government regions
- Country
- Local Authority Districts
- Middle Layer Super Output Areas (MSOA)
- Lower Layer Output Area (LSOA)
- Post Code

Figure 3-3: A map displaying the nine regions of England.

The nine English government regions are shown in the England map Figure 3-3 and labelled below:

1. Northeast
2. Northwest
3. Yorkshire and the Humber
4. West Midlands
5. East Midlands
6. East of England
7. Southwest
8. Southeast
9. London

3.1.6. Inequality leading to obesity in England.

Between 1997 and 2010 The UK Government introduced a national programme focusing on reducing health inequality in England (House of Commons Health Committee, 2009). Before a change of Government in 2010 ended the strategy, improvements were seen in life expectancy, with no direct impact on obesity levels across England observed (Barr, Higgerson, & Whitehead, 2017). However, since 2010 both Barr et al (2017) and Marmot reports (2010; 2020) point to social inequalities increasing further and the gap widening between the richer and poorer areas of society, resulting in an increased risk of obesity.

The link between inequality in England and obesity is shown by Heslehurst et al (2010) who found an association between morbid obesity and increased levels of unemployment (Heslehurst, Rankin, Wilkinson, & Summerbell, 2010). They also found demographic health inequalities associated with maternal obesity. This included an increase in the odds of obesity increasing with age. Regional health inequalities with a north south divide in childhood obesity are shown with work by Ellis and Fry (2010). They found overall health to be better in the south compared to the north, with childhood obesity specifically higher in London's poorer areas (Ellis & Fry, 2010).

Theis and White argue that Government Obesity policies have failed over the last 30 years and an alternative is required. Previous Government policies had mostly required individual behaviour changes and made no attempt to reduce social or health inequality, which is a factor in the increase of obesity levels (Theis & White, 2021). Instead, there needs to be more effective action against health inequalities and intervention-generated inequalities in health to reduce obesity levels (Griffin, et al., 2021). A further socio-economic issue found by Hooper et al (2018) shows those in poorer areas had less knowledge about the risk of health conditions and their associations to other conditions compared to those from more affluent areas (Hooper, et al., 2018). This suggests education and a reduction of inequality would help to improve levels in obesity in the long term.

3.2. The concept of Social Capital

Current research surrounding Social Capital aims to explore the different social aspects of an individual's environment and how this impacts them individually and in turn the wider population.

The earliest mention of the concept of social capital concerning social cohesion in the community was in 1916 by Hanifan (Hanifan, 1916). Hanifan developed the term *'capital'* as the assets and possessions (cash, jewellery, and property etc.) owned by individuals to be a part of social capital, as the things that matter most in fulfilling a person's life and social needs. The type of social capital Hanifan suggests is built with the idea that neighbours, contact with those around providing goodwill, friendship and group feelings all help the development of social capital (Hanifan, 1916).

Following this, very limited social capital work was developed, with there being no clear definition in place until the 1970s with work by Pierre Bourdieu outlining his theory of practice and habitus (Bourdieu, Outline of a theory of practice. Translated by Richard Nice., 1972); (Bourdieu, Outline of a Theory of Practice, 1977). French sociologist Bourdieu coined the concept of habitus. Habitus has been defined as "*the way society becomes deposited in persons in the form of lasting dispositions, or trained*

capacities and structured propensities to think, feel and act in determinant ways, which then guide them" (Wacquant, 2005). In lay terms, habitus comprises of the specific attitudes, values, behaviours, and social norms related to different social groups or classes. Bourdieu extended the idea of habitus being a single capital to the idea of it comprising of three categories: economic (money and possessions), social (the network of people surrounding individuals) and cultural (the contacts and opportunities individuals possess which are related to class. He termed this idea symbolic capital (Bourdieu & Wacquant, Symbolic capital and social classes, 2013).

Since the 1980s, the potential linkage between social capital and health outcomes has been explored in the areas of social epidemiology and population health. However, there has been little commonality in the definition of the term *'social capital*'.

The concept of *'social capital'* refers to aspects of social life that are developed as a cognitive construct through shared networks, norms, and trust; and is measured using subjective factors relating to trust, social support, and neighbourhood satisfaction (Harpham, Grant, & Thomas, 2002). Furthermore, Scheffler et al, suggest high levels of social capital can lead to a greater sense of belonging and increased well-being (Scheffler, Brown,, & Rice, 2007). However, the methods used to help explain social capital, are shrouded in debate due to the lack of one consistent definition (Kawachi, Kim, Coutts, & Subramanian, 2004).

Social capital has no single agreed upon definition; instead there are multiple key definitions as follows; Pierre Bourdieu (1986) defined social capital as *"the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition"* (Bourdieu & Richardson, 1986).

Later, Coleman stated that *"social capital is defined by its function. It is not a single entity, but a variety of different entities having two characteristics in common: They all consist of some aspect of social structure, and they facilitate certain actions of*

individuals who are within the structure. Like other forms of capital social capital is productive, making possible the achievements of certain ends that would not be attainable in the absence" (Coleman, 1990).

Loury put forward that social capital refers to the *"naturally occurring social relationships among persons which promote or assist the acquisition of skills and traits valued in the marketplace"* (Loury, 1992).

While Putnam suggested that social capital *"refers to features of social organization, such as networks, norms, and trust, that facilitate coordination and cooperation for mutual benefit. Social capital enhances the benefits of investment in physical and human capital actions"* (Putnam, 1993).

Nahapiet and Ghoshal add that *"the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit"* (Nahapiet & Ghoshal, 1998).

Definitions of social capital that are often cited are Uphoff who suggests that social capital is an *"accumulation of various types of social, psychological, cultural, cognitive, institutional, and related assets that increase the amount (or probability) of mutually beneficial cooperative behaviour"* (Uphoff, 2000).

And Ostrom summarises earlier social capital definitions as *"the shared knowledge, understandings, norms, rules, and expectations about patterns of interactions that groups of individuals bring to a recurrent activity"* (Ostrom, 2000).

The latest dictionary definition for social capital also demonstrates the differing nuances in the two different definitions in the Cambridge and Oxford Dictionaries.

The Cambridge dictionary defines social capital as the "*value of the relationships between people who work or live together and the knowledge and skills that they have and share"* (Cambridge Dictionary, 2022). While the Oxford dictionary definition is *"The processes and conditions among people and organizations that lead to their accomplishing a goal of mutual social benefit, usually characterized by interrelated*

constructs of trust, cooperation, civic engagement, and reciprocity, reinforced by networking" (Oxford Reference, 2022).

What is agreed is that social capital is formed from different elements that produce and affect the levels of social capital being experienced by individuals. Socioeconomic status often reveals inequities in access to resources, plus issues related to privilege, power, and control (National Institute of Health, 2022). Figure 3-4 presents a summary of all the elements included in the key definitions of social capital. The terms that are commonly used all combine to produce the level of social capital. The ten most common elements from the definitions include: *social norms, relationships, community, values, reciprocity, cooperation, trust, networks, possessions, and resources.* The definitions suggest that *relationships, culture, and networks, impact our community (local networks)*. This suggests that where we live (neighbourhoods), the physical, human possessions and contacts we have, will have a role in our levels of social capital. Further still, resources, trust, values, and norms (social cohesion) can impact our relationships, networks, and reciprocity within our social capital communities.

Figure 3-4: Visual showing the elements of social capital from key definitions

These elements of social capital can be grouped under *'social cohesion'* which is defined as "*the extent of connectedness and solidarity among groups in society… the sense of belonging of a community and the relationships among members within the community itself… people's needs for both personal development and a sense of belonging and links together individual freedom and social justice, economic efficiency, and the fair sharing of resources… [and] common rules*" (Manca, 2014).

3.2.1. Social Capital and Health

A systematic review on social capital and health by Ehsan et al put forward the suggestion that *"Contemporary social capital and health research goes beyond cohesion and network approaches and can be viewed through three complementary lenses: dimensions, settings, and levels of Social Capital. First, there are different dimensions of Social Capital that fall within both cohesion and network approaches to health: cognitive, structural, bonding, bridging, and linking Social Capital. Cognitive*

Social Capital refers to the perception of trust, reciprocity, norms, and values within a community" (Ehsan, Klaas, Bastianen, & Spini, 2019).

3.2.2. Social capital and Obesity

The area of social capital and obesity is very limited, while a significant number of studies regarding social capital and health outcomes were published between 2007-2018, only 7% of publications are related to obesity. Of these publications only one study uses data from UK populations. This shows that the area of social capital and obesity is currently under-researched (Rodgers, Valuev, Hswen, & Subramani, 2019). Rodgers et al (2019) identified partial associations between social capital and health, of these only 28% of studies reported positive findings.

There are two systematic reviews that have been conducted investigating the links between social capital and obesity, both reviews use the same criteria of social capital and obesity populations. Table 3-2 shows the key studies from the systematic reviews relating to social capital and obesity. The first researcher to conduct a systematic review of health-related outcomes and the links to social capital was Kim et al, (Kim, Subramanian, & Kawachi, 2008). They identified four studies (numbered 1-4 in Table 3-2) for social capital and obesity up until 2008. Studies used a mixture of health outcomes and applied different tools and scales to measure social capital, for example risk ratios.

The first review by Kim et al (2008) focusing on the first decade of social capital and obesity research was later updated by Rodgers et al (2019) who identified a further 10 studies (numbered 5-14 in Table 3-2) relating to social capital and obesity (Kim, Subramanian, & Kawachi, 2008); (Rodgers, Valuev, Hswen, & Subramanian, 2019).

The present researcher has identified a further two studies (numbered 15 and 16 in Table 3-2) meeting the same inclusion and exclusion criteria of social capital and obesity as used by Kim et al (2008) and Rodgers et al (2019). Table 3-2 shows the key studies from the systematic reviews relating to social capital and obesity. Mixed

results were produced with the majority showing a negative or no association, with only one study producing a positive association.

Table 3-2: Key Social Capital and Obesity studies

No.	Authors (year)	Population & Sample	Social Capital indicators	Obesity measure	Results
1	(Holtgrave & Crosby, 2006)	48 US states	Putnam social capital (14 indicators)	Obesity	Obesity: <P = 0.02
2	(Kim, Subramanian, Gortmaker, & Kawachi, 2006)	2 samples: Sample 1: adults in 413 countries across 48 US states (n=101,198) Sample 2: in 48 US states and districts of Columbia (n=181,200)	County level - 2 subscales (based on five indicators) formal group and attitudinal informal socialising. State level - 2 subscales (based on ten indicators) attitudinal/ informal, socialising/ formal group and formal civic and political participation	Obesity	*County-level analysis:* *High in social capital* on at least one of two subscales: OR = 0.98, 95% CI = 0.93-1.03 *State-level analysis:* *High in social capital* on at least one of the two subscales: OR = 0.93, 95% CI = 0.85-1.00

3	(Poortinga, 2006)	Adults across 720 postcodes in the UK (n=14,836)	Individual level: social support, social trust, participation, reciprocity	Obesity	1: *Severe lack of social support:* OR = 101, 95% CI = 0.88 – 1.17 2: *High social trust:* OR = 0.86, 95% CI = 0.78 – 0.95 3: *High social participation:* OR = 1.01, 95% CI = 0.90 – 1.14 4: *High reciprocity:* OR = 1.07, 95% CI 0.95 – 1.19
4	(Veenstra, G., Luginaah, I., Wakefield, S., Birch, S., Eyles, J., & Elliott, S., (2005)	Canada (n=1,504)	Membership/involvement in voluntary associations	BMI >27	*Higher voluntary association involvement:* OR = 0.91, p = 0.03
5	(Yoon & Brown, 2011)	50 US states and the District of Colombia (n=555,484)	Petris Social Capital Index (full-time employment in voluntary associations)	BMI >30	*Higher SC:* B = -1.30 (SE = 1.75); Lagged CSC by 2 years: B = -3.05 (SE = 1.61), p<.1

6	(Moore, Daniel, Paquet, Dubé, & Gauvin, 2009)	Canada. Adults aged 18-55 years (n=291)	Network social capital; trust; voluntary & community service participation	The waist size and BMI	*Higher Individual SC: WC:* OR = .81 (.69, .96), p<.01; BMI: OR = .81, (.71, .92), p<.01; *Upper reachability of network:* WC: OR = .36 (.14, .91); BMI: OR = .39 (.16, .99); *Greatest range of ties:* WC: OR = .98 (.97, .99); BMI: OR = .98 (.97, .98); *High social trust:* WC: OR = 1.24 (.84, 1.84); BMI: OR = 1.05 (.62, 1.77); *Low social participation:* WC: OR = 1.11 7(.33, 3.77); BMI: OR = 1.00 (.44, 2.27)
7	(Evans & Kutcher, 2011)	Upstate New York, US. (n=196) rural adolescents (aged 9-17 years)	Social capital index (community cohesion, social control, youth's relationship with adults)	BMI	*Higher SC:* B =-4.79 (SE=2.59) p < .07
8	(Borgonovi , 2010)	Young adults in the UK, participating in the national Child Development Survey (n=9,666)	Formal social networks; social trust political participation	BMI >30	*Membership:* B=.001, SE = .010, p>.05; *Religious attendance:* B=-.008, SE =.-24, p>.05; *Trust:* B= -.013, SE = .015, p>.05; *Voting:* B=-.025, SE = .014, p<.1

9	(Kobayashi, Suzuki, Oksanen, Kawachi, & Takao, 2014)	One company in Osaka, Japan. Full-time employees aged 18-64 (n=750)	Eight question workplace social capital index	BMI >30	*Low SC: Workplace SC* - Men: OR = 1.65 (.97, 2.79); Women: OR = .14, (.03, .67); *Bonding SC* – Men: OR = 1.95 (1.06, 3.61); Women – OR = .18 (.02, 1.45); *Low Bridging SC* – Men: OR = 2.13(.85, 5.31); Women – NA; *Linking SC* – Men: OR = 1.88 (1.13, 3.13); Women – OR = .15 (.03, .71)
10	(Xue & Cheng, 2017)	China (n=28,916)	Social trust & social relationships	BMI	*High SC & Non-Overweight: Social Trust:* OR = 1.093 (1.029, 1.162), p<.001; *Harmonious social relationships:* OR = .880 (.818, .946), p<.001
11	Guilcher, S., Kaufman-Shriqui, V., Hwang, J., O'Campo, P., Matheson, F., Glazier, R., & Booth, G., (2017)	Canada (n=2,300)	The 5-item scale of neighborhood social cohesion	BMI	*Women with higher SC:* OR = .96 (.94, .99) compared to men
12	(Wu, Moore, & Dube, 2018)	U.S. (n=7,714)	Individual perceptions of neighborhood social cohesion	Obesity	*Increase in SC:* RR = .98 (.82, 1.14)

13	(Richmond, Milliren, Walls, & Kawachi, 2014)	U.S. Adolescents in grades 7-12 (n=13,428)	Individual and school- level social capital (connectedness, treatment, parental involvement)	BMI	For girls, a 1-unit increase in *school-level connectedness:* B = -.43, p<.01, and an *increase in individual connectedness:* B = -.06, p<.05. *No associations among boys or for parental involvement or treatment.*
14	Mackenbach, Lakerveld, van Lenthe, Kawachi, McKee, Rutter & Brug (2016)	Participants from the SPOTLIGHT study conducted in five urban regions in Belgium, France, Hungary, the Netherlands, and the UK. (n=5,900)	13-item neighborhood social capital scale and social cohesion and social networks subscales	Over-weight	*Neighborhood social cohesion:* OR = .67 (.50, .89); after adjustment for *individual social cohesion:* OR = .76 (.56, 1.02); *Neighborhood social network:* OR = .71 (.51, .99); after adjustment for *individual social network:* OR = .75 (.54, 1.04)
15	(Xin & Ren, 2020)	China. China Family Panel Studies (n= 4,919)	Education levels measured by years of schooling. Trust and participation measures of cognitive SC and structural SC.	BMI & Depression	*Education positively correlated with BMI* r = 0.08, p < 0.001. *Older adults with a higher education level have higher cognitive SC* r = 0.11, p < 0.001. Structural SC r = 0.20, p < 0.001. *SC plays a mediatory role. Older adults with higher SC have a higher risk of obesity* (cognitive: r = 0.06, p < 0.01; structural: r = 0.03, p < 0.01). *Obesity effects of both cognitive and structural social capital are the same* (a1c1 = a2c2 = 0.005).
16	Cuevas, A., Kawachi, I.,	African American	Social Cohesion and Trust scale	Obesity BMI	*Greater social cohesion was associated with lower BMI* (b = -0.88; 95% CI: −1.45, −0.32).

	Ortiz, K., Pena, M., Reitzel, L., & McNeill, L., 2020)	community U.S. (n=1,467)

Three of the four studies Kim et al (2008) identified were carried out across North America in both the USA and Canada, with one study based in the UK (Kim, Subramanian, & Kawachi, 2008). Of the three American studies, Holtgrave & Crosby (2006) was the only study to use a state-level sample, using Putnam's social capital index to produce an inverse significance ($\beta<0$, $p=0.02$) for obesity (Holtgrave & Crosby, 2006). The largest sample was Kim et al (2006) who analysed county level and state level, using two population samples. Sample one is 101,198 adults across 48 states in the USA and sample two is 181,200 adults across 48 states and the District of Columbia. County-level analysis showed a modest significance between the association between higher state-level social capital and low individual risk of obesity (OR = 0.93, 95% CI = 0.85 – 1.00) with no association for country-level social capital (Kim, Subramanian, Gortmaker, & Kawachi, 2006). Veenstra et al (2005) explored social capital with a tool for social capital that included measures for membership involvement in voluntary associations on a sample of 1,504 adults in Canada. They found a significant risk for a higher BMI and higher voluntary association involvement (OR =9.91, $p=0.03$) (Veenstra, et al., 2005). The only UK-based social capital and obesity at this point was Poortinga (2006), who explored social capital and obesity at an individual level using a sample of 14,836 adults across 720 postcodes across the UK. Poortinga measured social capital at an individual level, using a tool for social capital that included measures for social support, social trust, civic participation, and reciprocity. The results were mixed with no associations with social support, civic participation, and reciprocity. However, the social trust did produce an association with obesity, but in reverse to what would be expected with (OR = 0.86, 95% CI 0.78 – 0.95) (Poortinga, 2006).

Rodgers, et al (2019) updated the review by identifying a further ten studies relating to social capital and obesity (Rodgers, Valuev, Hswen, & Subramani, 2019). Of the ten studies one produced positive associations, three produced negative findings and the remaining six produced a mixture of both negative and null findings. These studies were conducted across the world with six in North America, and one multi-

country in European study, with the remaining three single, studies in China, Japan, and the UK.

While Moore, et al (2009) study included a small sample of 291 adults in Canada, they found mixed results with individual social capital, waist circumferences and social networks producing an association with lower risk of large waist circumference and BMI> 30, (Social Capital: Waist Circumference OR = .81 (.69, .96), p<.01 and BMI: OR = .81, (.71, .92), p<.01) (Moore, Daniel, Paquet, Dubé, & Gauvin, 2009). However, this association was not shared with social trust or social participation. Yoon & Brown (2011) also found nothing of significance. The study was a large sample of 555,484 adults across 50 US states and the District of Colombia. They produced mixed findings finding (Higher SC: B = -1.30 (SE = 1.75); Lagged CSC by 2 years: B = -3.05 (SE = 1.61), p<.1) (Yoon & Brown, 2011).

Evans & Kutcher (2011) contained a small young sample of 196 New York based rural adolescents. They found an inverse association between social capital and BMI at the oldest point of the sample, 17 years old. However, this was only significant at the 10% level (Higher SC: B =-4.79 (SE=2.59) p < .07) (Evans & Kutcher, 2011). Borgonovi (2010) is a sample of 9,666 young adults in the UK, participating in the National Child Development Survey. The results produced findings for formal social membership, religious attendance, social trust, and voting participation were all associated with a lower likelihood of obesity, however, none of these relationships was statistically significant (Membership: B=.001, SE = .010, p>.05; Religious attendance: B=-.008, SE = .-24, p>.05; Trust: B= -.013, SE = .015, p>.05; Voting: B=-.025, SE = .014, p<.1) (Borgonovi, 2010).

A study by Kobayashi, et al (2014) was undertaken on 750 the only study to be based on full-time employees in one single company in Osaka, Japan. They found an association between an individual's network and women's risk of being overweight or obese, (Women – OR = .15 (.03, .71) without finding a statistically significant association after adjustment for covariates (Kobayashi, Suzuki, Oksanen, Kawachi, &

Takao, 2014). Xue & Cheng's (2017) sample consisted of 28,916 in China, their findings showed an association between social trust and a lower likelihood of obesity, however, they also found harmonious social relationships were associated with a higher risk of obesity (High SC & Non-Overweight, Social Trust: OR = 1.093 (1.029, 1.162), p<.001; Harmonious social relationships: OR = .880 (.818, .946), p<.001) (Xue & Cheng, 2017).

Guilcher, et al (2017) a sample of 2,300 people in Canada found that Women with higher social capital compared to men (SC: OR = .96 (.94, .99) (Guilcher, et al., 2017). Wu, et al (2018) based in the U.S. with a sample of 7,714 found that network diversity and generalized trust were associated with a lower risk of obesity, however, individuals with a higher number of social ties had a greater risk of being obese (Increase in SC: RR = .98 (.82, 1.14) (Wu, Moore, & Dube, 2018). Mackenbach, et al (2016) took 5,900 participants from the SPOTLIGHT study conducted in regions across Belgium, France, Hungary, the Netherlands, and the UK. they found (Neighbourhood social cohesion: OR = .67 (.50, .89); after adjustment for individual social cohesion: OR = .76 (.56, 1.02); Neighbourhood social network: OR = .71 (.51, .99); after adjustment for the individual social network: OR = .75 (.54, 1.04) (Mackenbach, et al., 2016). Richmond, et al (2014) was the only study to not use an adult sample, instead, the sample was made from13,428 teenagers in grades 7-12 in the US, this study was measured differently on a much younger sample so it is hard to compare, no significant findings were produced (Richmond, Milliren, Walls, & Kawachi, 2014).

Since the two systematic reviews the present researcher has identified two studies have since been identified to date that meet the criteria of the previous reviews, these are first, Xin & Ren (2020) was based in China, using a sample of 4,919 participants from the China Family Panel Studies. They found that Education positively correlated with BMI ($r = 0.08$, $p < 0.001$). Further analysis found that older adults with higher social capital have a higher risk of obesity (cognitive: $r = 0.06$, $p <$

0.01; structural: r = 0.03, p < 0.01) (Xin & Ren, 2020). They suggest that obesity influences both cognitive and structural social capital that are the same (a1c1 = a2c2 = 0.005). The second study is Cuevas, et al (2020) was the first study exploring solely 1,467 people from the African American community in the U.S. they found that greater social cohesion was associated with lower BMI (b = -0.88; 95% CI: −1.45, −0.32) (Cuevas, et al., 2020).

These studies have produced mixed results using several different tools to measure social capital and obesity as an outcome. One common method of research was using risk ratios and significant tests against outcomes of interest. Most of the sixteen studies have been conducted in North America on adult populations, with further research also mainly in western societies, suggesting that social capital and obesity are currently under research and required attention.

3.3. Limitations to existing literature

The introduction demonstrates the complexity across the areas discussed. It is important to show the literature explaining the reasons how and why English populations have higher levels of obesity and overweight today. However, some of the concepts are new, specifically social capital. This research is currently limited, with a lack of agreement of a definition for the concept, let alone the analysis and conditions being investigated. For example, the range of indicators is limited in current published research with only 4 or 5 (e.g. Trust, Shared responsibility, Social support, Social network) being used. Some studies focused on a subsection or social capital based on limited indicators ranging from 2 – 14. This limits the possible indicators that could be missed. Therefore, rather than be constrained to measure only a handful of indicators of social capital, dependant on any one specific conception of social capital, this thesis will measure a broad range of indicators to capture the full spectrum of what social capital can look like. The assumption is that social capital can change overtime, so studies conducted over a 10 years ago may not hold the same relevance today, but limited longitudinal studies are undertaken

to answer this question. Furthermore, most samples are under 1,500 people, with six studies over 5,000 people. These are measured directly in Study 1 and spontaneously expressed in Study 3.

A limitation for investigating social capital is that a consideration of social capital as potentially influencing health outcomes is a relatively new concept for the health field in general and specifically for obesity globally. Currently most research published originates outside Europe and is extremely limited within populations in England. Most of the research in the field is carried out in north America within the USA and Canada. The states within the USA, while we all share a language, social norms can vary wildly from state to state displaying cultures from being more individualist to collective societies. A further example is trusting neighbours, in England these will mostly be within proximity, however in north America with more land mass neighbours are commonly further away, this could also be reflected in social support, levels of trust and so on. The next most common area of research is Japan and China who again are very different to the western cultures, with many different social norms and communication styles.

However, how both socio-economic status and social capital are experienced, and therefore how they are measured and how they relate to other outcomes may be very different in England, versus other countries around the globe. To address this limitation, UK-relevant indicators will be measured. It is anticipated that findings will vary across different regions due to local norms and infrastructures informing peoples answers to the social capital survey.

3.3.1. Developing an exploratory model

In England, the link between becoming obese due to lower levels of socioeconomic status has been shown in the consequence of inequality producing a drop in the standard of health. This is shown by those living in highly deprived neighbourhoods often experiencing poorer health when compared to people living in the richest neighbourhoods. Lower Socioeconomic status is also the result of education, income,

and location, resulting in those people with a lower socioeconomic status usually being from a lower social class and living in deprived areas.

We know from the literature that low SES is related to an increased risk of obesity. It also appears that social capital is associated with a reduced risk of obesity. What remains unclear, however, is the relative contribution of social capital and SES, as well as which specific indicators of social capital and SES are important. To date, these have not been tested exhaustively at the same time. For example, in terms of SES, indicators can include income, level of education, or type of profession. In terms of social capital, these can include cognitive factors (such as trust), interpersonal factors (such as reciprocity), or environmental factors (such as levels of crime or access to green spaces).

Another consideration concerns the temporal importance of these social factors. Specifically, when predicting risk for obesity, a distinction must be made between factors that increase the risk of becoming obese and those factors that increase the risk of remaining obese (i.e. reduce the likelihood of weight loss).

A tentative model is indicated in figure 3-5 below. It is proposed that lower levels of SES increase the risk of becoming obese but reduce the likelihood of weight loss. Conversely, high levels of social capital reduce the risk of becoming obese but increase the likelihood of recovery. Several indicators of both SES and social capital are given since it is not yet possible to determine precisely which are important. In addition, this tentative model will be used to guide the design and interpretation of the three studies described in this thesis. The model will be revisited in the final chapter to describe which factors remain important in predicting becoming obese versus losing weight (in those who are obese).

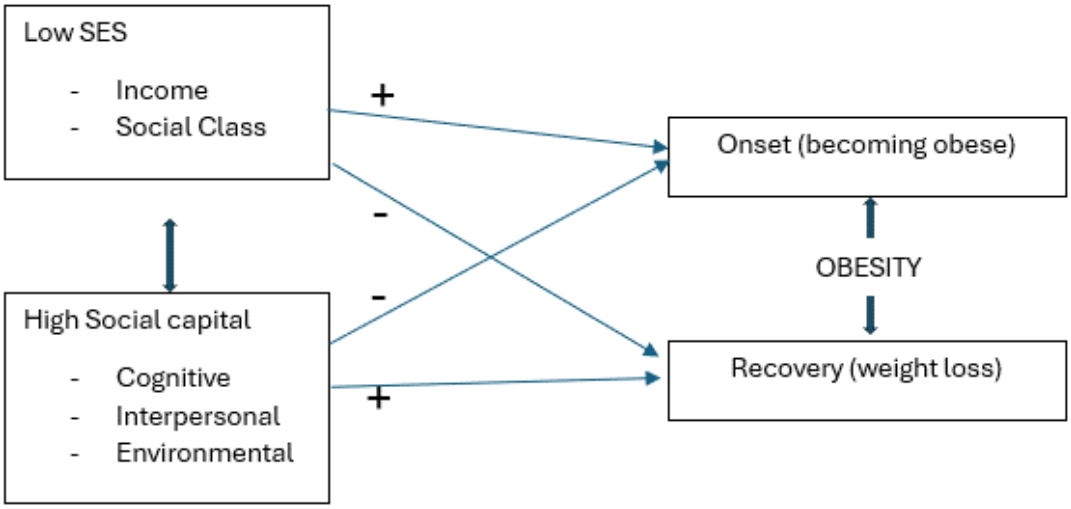


Figure 3-5: A tentative model proposed that lower levels of SES increase the risk of becoming obese but reduce the likelihood of weight loss.

3.4. Chapter Three - Summary

The consequence of inequality is a drop in the standard of health. Social determinants of health are made up from the social, cultural, political, economic, commercial, and environmental factors that shape the conditions in which people are born, grow, live, work and age. Those in highly deprived neighbourhoods often experience poorer health, dying earlier when compared to people living in the richest neighbourhoods. The Index of Multiple Deprivation from 2019 maps deprivation scores across the country down to smaller community levels.

Socioeconomic status is produced from a combination of education, income, and location, resulting in those people with a lower socioeconomic status usually living in more deprived areas. Furthermore, having less access to financial, educational, social, and health resources than those with a higher socioeconomic status. Health and social inequality are often experienced by those with low socioeconomic status and higher levels of deprivation, this is known as socioeconomic deprivation. Reductions in life expectancy of those in highly deprived areas compared to places with low levels of deprivation were shown by the Marmot reports. Sir Professor Marmot

suggests this gap between the health of the richest and poorest across England is increasing.

Social capital is a complex construct, the ten most common elements that arose from the key definitions were: social norms, relationships, community, values, reciprocity, co-operation, trust, networks, possessions, and resources. This suggests that relationships, culture, and networks impact our community (local networks). That where we live (neighbourhoods), the physical, human possessions and contacts we have will all have a role in our levels of social capital. Further still, resources, trust, values, and norms (social cohesion) can impact our relationships, networks, and reciprocity within our social capital communities. Social capital research and the risk to obesity is limited, even more so for England populations, allowing study 1 to make a start on answering some of the questions regarding obesity.

4. Chapter Four - Overview and rationale for the thesis

The original plan in this PhD was to focus on the outcomes and patient experiences of treatment at the Rotherham Institute of Obesity (RIO). This service was closed during the PhD. Nevertheless, the rationale for choosing initially to study treatment in Rotherham is still relevant for the thesis, and informs the choices made in the analyses and methods throughout the thesis. Therefore, this chapter discusses deprivation in Rotherham, evidence from previous research on outcomes for RIO services, and justifies the decision to carry out focus groups in Hertfordshire.

4.1. Deprivation in Rotherham

England can be broken down by counties, for example the research in this thesis for Study 2 (Yorkshire) and Study 3 (Hertfordshire). The next level down is local authority district of which there are 333, they are commonly the organisations that oversee bin collections etc. Middle layer super output areas are the next level down, they are a geographical hierarchy that was designed to improve the reporting of statistics across England and Wales (NHS Data Model and Dictionary, 2022). Lower than this is the lower layer output area (LSOA) that is commonly used across health research and policing as it focuses on 936 areas all consisting of approximately a population of 1,500 people (NHS Data Model and Dictionary, 2022). The final level is postcodes, used by postal services, these often do not match up with other boundaries in place of higher levels (Office for National Statistics, 2019). Postcode data can cause problems with analysis due to the need for the full postcode, partial postcodes are too broad to be used when conducting analysis. Public services such as local authorities instead use LSOA strategically, allowing for information to be shared with the public (Misistry of Housing, Communities & Local Government, 2019).

Region 5 of the England map marked in red is Yorkshire and the Humber. Inside this region, to the south of Yorkshire is the town of Rotherham (Figure 4-1). Rotherham is

the home of the Rotherham Institute for Obesity (RIO). Over the time being observed within the RIO data, 2015 saw the release of the Index of Multiple Deprivation.

Figure 4-1: A map of England showing Rotherham in red within the region of Yorkshire and the Humber

The close-up map of Rotherham shown below (Figure 4-2), shows Income deprivation by ward (English Indices of Deprivation 2015). Rotherham council focus on ward areas when reporting data, the darker the colour of the ward the lower that ward scored for income deprivation. This showed Sitwell, Dinnington, Brinsworth and Catcliffe, Anston and Woodsetts to have the lowest income deprivation percentages by ward.

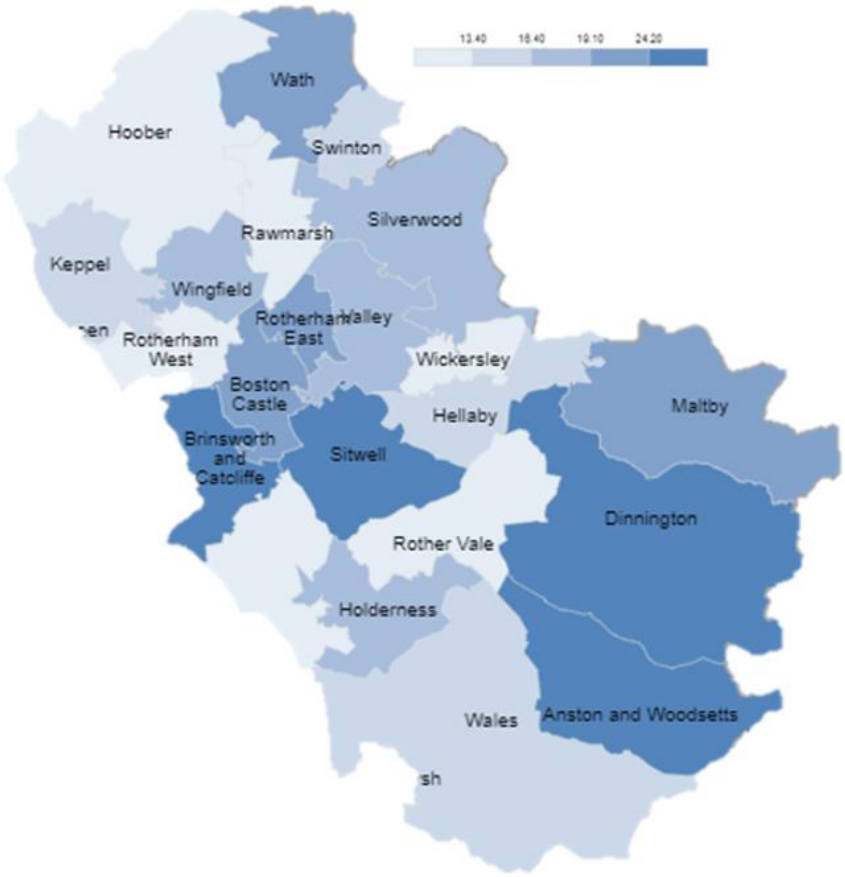


Figure 4-2: Rotherham by Income deprivation, English Indices of Deprivation 2015

When comparing Rotherham ward's income deprivation (2015) values to the English average value, 13 of the 22 Rotherham wards had a value below the English average. Silverwood, Brinsworth and Catcliffe scored similarly to the English national average. The remaining seven Rotherham wards had a value higher than the English national average as shown below in Figure 4-3 (Rotherham.GOV, 2021).

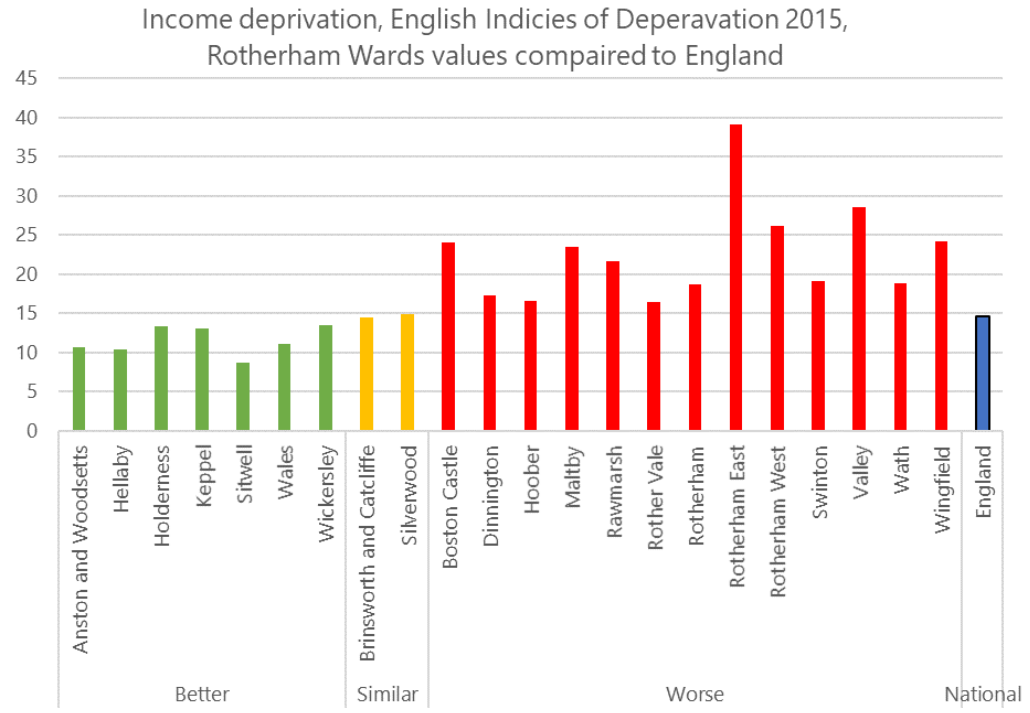


Figure 4-3: Income deprivation (2015) for Rotherham wards, compared to the national average

A further update for Income deprivation, English Indices of Deprivation came in 2019. The data from 2019 puts 16.8% of the population of Rotherham as income deprived, this ranks Rotherham as 45th out of the 316 local authorities in England. Rotherham is made up of 167 neighbourhoods, 58 were among the 20% most income deprived in England. While 15 of Rotherham's 167 neighbourhoods, were in the 20% least deprived areas across England.

When comparing Rotherham ward's income deprivation (2019) values, this again compared wards to the English average value, 14 of the 22 Rotherham wards had a value under the English average. Holderness ranked similarly to the English national average. The remaining seven Rotherham wards had a value higher than the English national average as shown below in Figure 4-4.

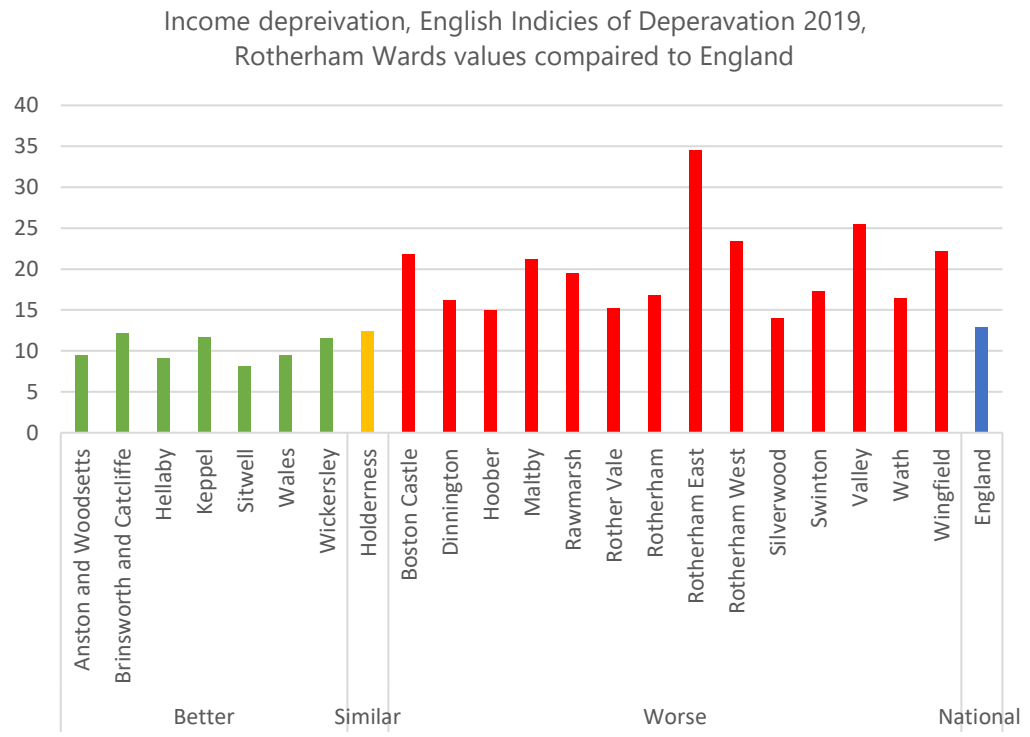


Figure 4-4: Income deprivation (2019) for Rotherham wards, compared to the national average

Overall deprivation scores are shown for Rotherham (Figure 4-5) 2015 (left) and 2019 (right) using ArcGIS maps of the different indexes that are measured within the indices of deprivation (Communities.Gov.UK, 2021). The darker the area the more deprived this area is, with the lightest areas indicating the specific area is less deprived. Much of Rotherham is covered by the darker areas, visually supporting the data that Rotherham is below the English national average of deprivation. Lighter areas in 2015, in the top left, have become darker between 2015 and 2019. The darker area in the middle remains consistent, with the darkest area becoming larger in 2019.

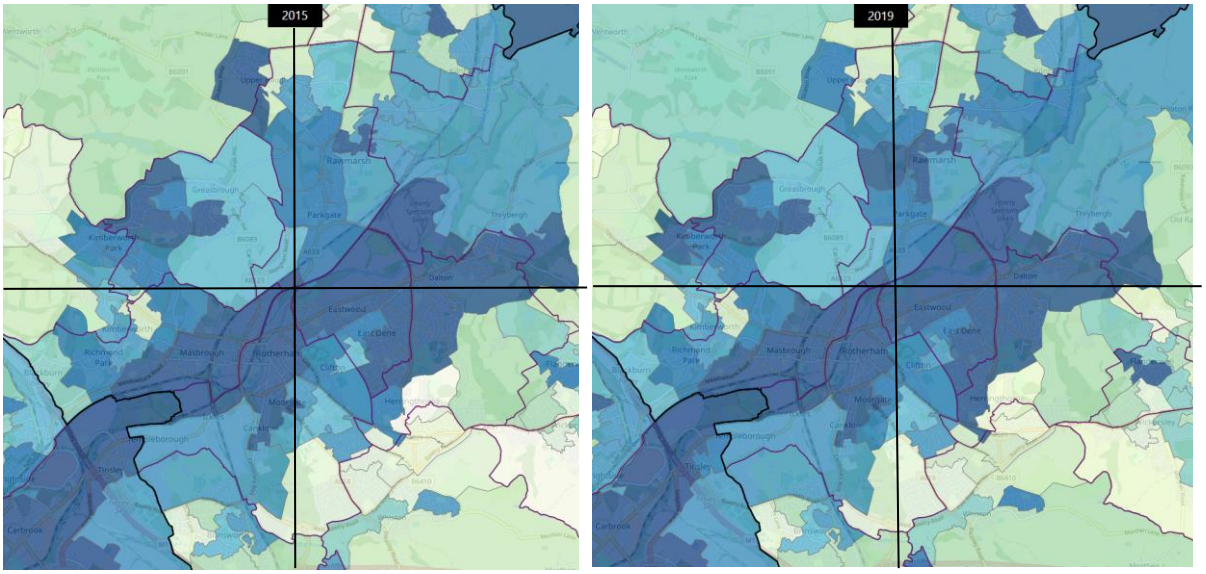


Figure 4-5: Map of overall deprivation scores for Rotherham 2015 (left) and 2019 (right)

The next part of the deprivation index explores Income deprivation (Figure 4-6 below, 2015 left and 2019 right). This is achieved by measuring the proportion of the population experiencing deprivation relating to low income. This measure also includes those out-of-work, and those in work who have low earnings. Rotherham was covered by darker areas in 2015, with this increase in 2019 shown in the right quarter, with areas becoming darker. The bottom left quarter in 2015 showed a patch of lighter blue surrounded by darker areas, this has become dark in 2019.

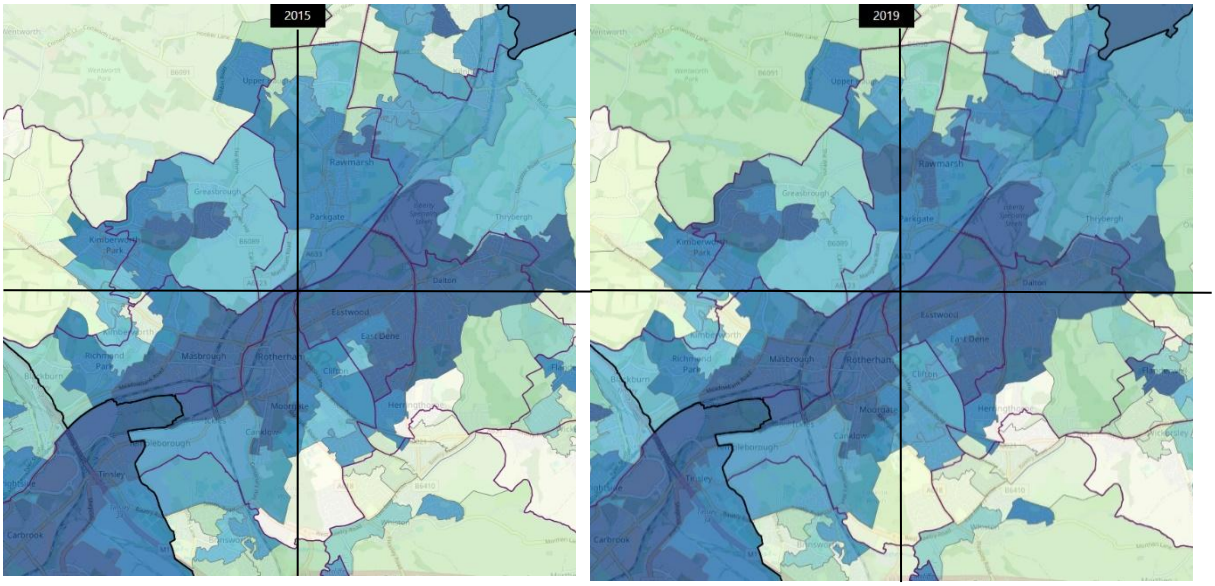


Figure 4-6: Map of Income deprivation for Rotherham 2015 (left) and 2019 (right)

The next pair of maps (Figure 4-7) explore the deprivation index with the added lens of Employment deprivation. This measures the proportion of the working-age population that are involuntarily excluded from the labour market. In 2015 (left) Rotherham is showing consistency with the darker areas previously shown. Again by 2019 (right), the top right section has become darker with the bottom right seeing a darker area that was not seen in 2015.

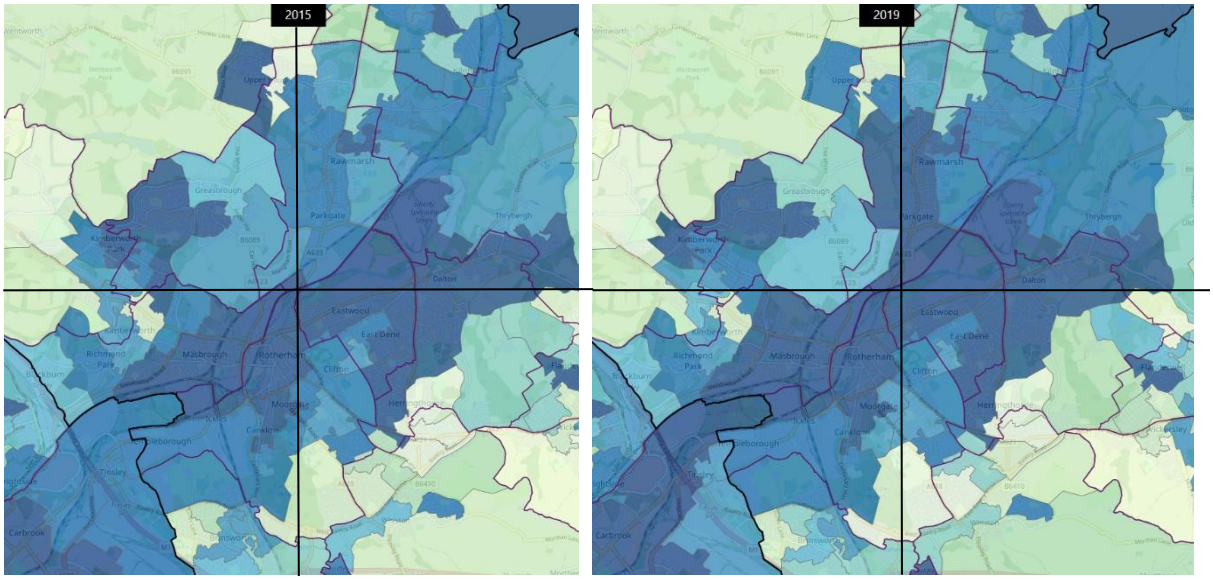


Figure 4-7: Map of Employment deprivation for Rotherham 2015 (left) 2019 (right)

The next measure explored from the deprivation index is Education, skills, and training domain. This measures the lack of attainment and skills in the local population. They remained consistent between 2015 and 2019 (Figure 4-8) with many of the same areas either remaining light or dark. Interestingly the area is a mid-blue colour mid-way up on the right side and moved from blue in 2015 to a lighter colour on 2019.

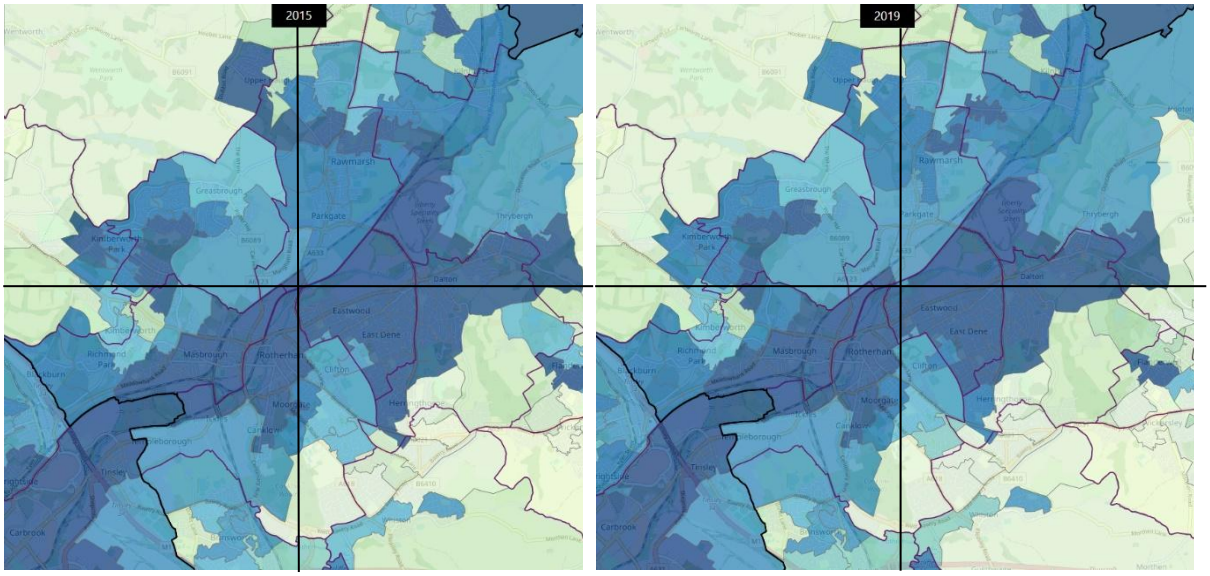


Figure 4-8: Map of Education, skills, and training deprivation for Rotherham 2015 (left) 2019 (right)

The worst measure from the deprivation index for Rotherham is the health deprivation and disability measure. This measures the risk of premature death and the impairment of quality of life through poor physical or mental health. Rotherham was mostly covered by a darker colour across the area (Figure 4-9). By 2019, the top half of the map became darker, this can also be seen in the bottom left quarter. In the middle at the bottom of the map, an area went from light blue to see improvement becoming an even lighter colour. The remaining right quarter also saw areas becoming darker since 2015.

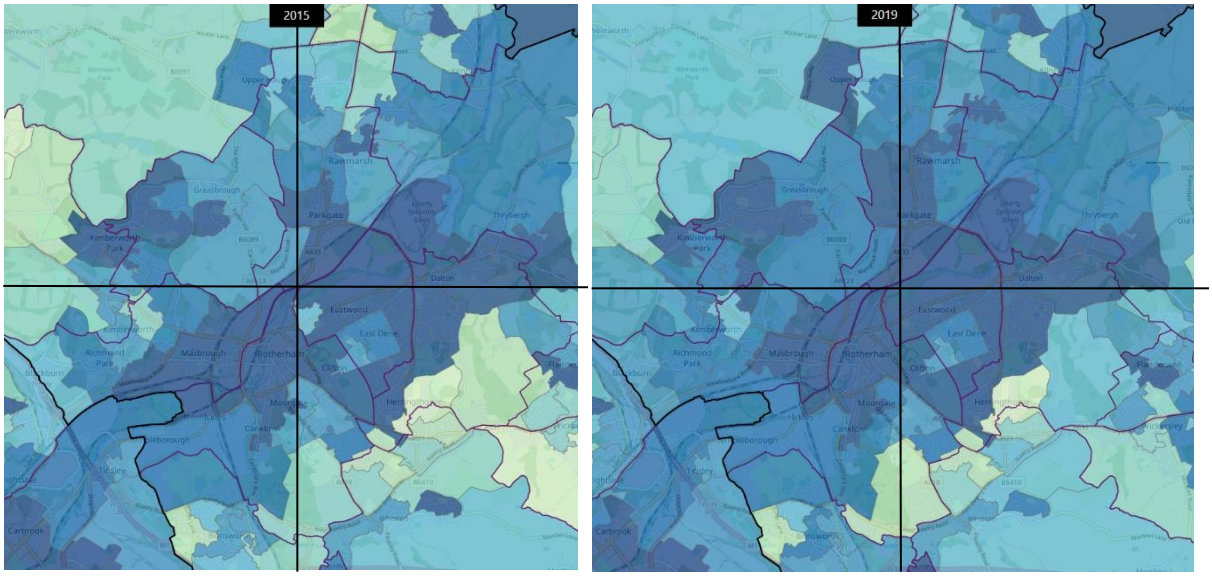


Figure 4-9: Map of Health deprivation and disability measure for Rotherham 2015 (left) 2019 (right)

A big change is seen in the deprivation index measuring Crime in Rotherham. This measures the risk of personal and material victimisation at a local level (Figure 4-10). 2015 shows light areas both at the top and bottom of the map, with lighter areas in the middle of the map and the top left. However, much of the map at the top had become darker by 2019. This trend continued, with some light areas at the bottom of the map becoming a very dark blue. The darker areas in the middle leaked out to the surrounding areas.

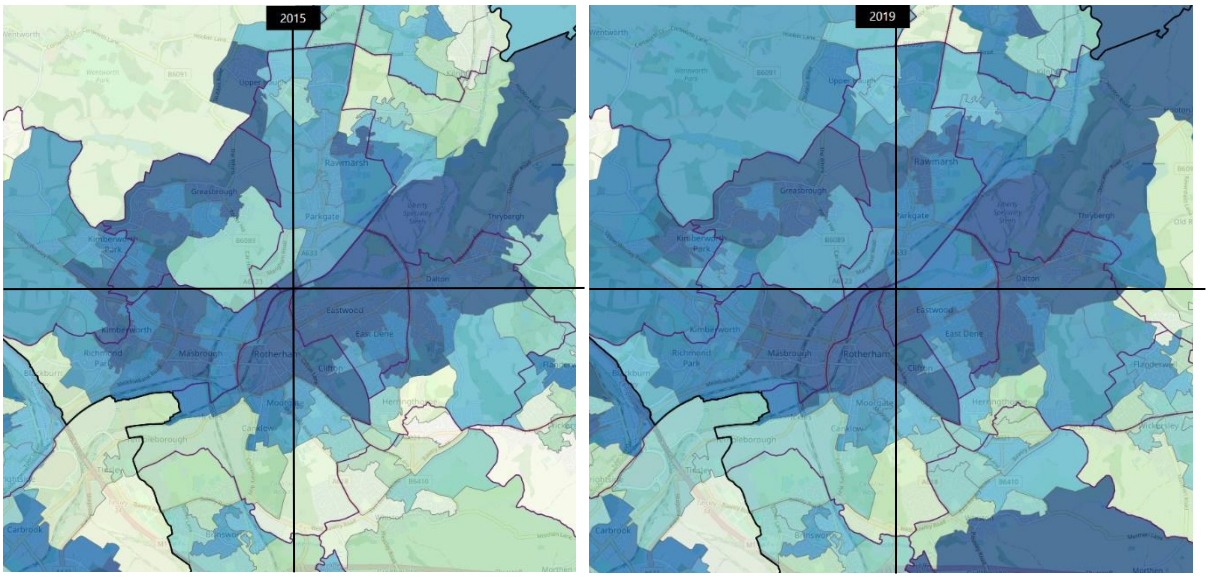


Figure 4-10: Map of Deprivation measure for Crime in Rotherham 2015 (left) 2019 (right)

The deprivation index next measures the Barriers to housing and services in Rotherham (Figure 4-11). This measures the physical and financial accessibility of housing and local services. Much of Rotherham is shown in a lighter colour, with darker areas in the top left, a small area top right, and bottom left, a darker area in the middle at the bottom with a light blue area along the right edge. However, by 2019, the area in the top left has seen an increase in deprivation with more areas becoming darker. Interestingly, the bottom left saw some blue areas become lighter with the main dark area in 2015 becoming even darker in 2019. Again, an improvement is seen along the right side of the map with this area becoming lighter.

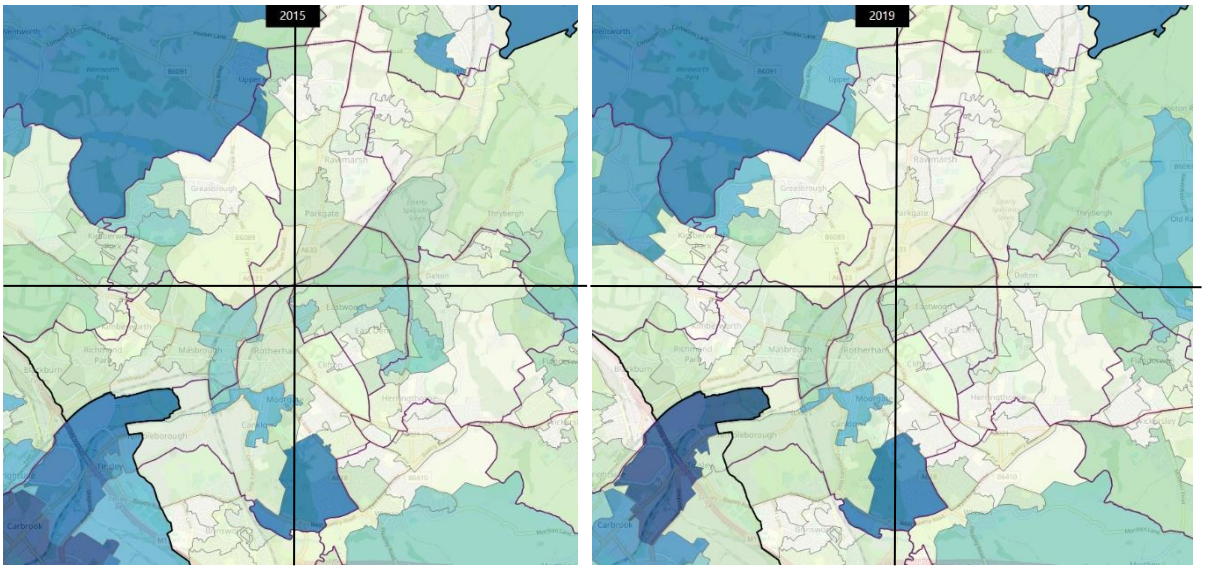


Figure 4-11: Map of Deprivation measure for barriers to housing and services in Rotherham 2015 (left) 2019 (right)

The next measure within the deprivation index measures the living environment. This measures the quality of the local environment in Rotherham (Figure 4-12). Much of the map is lightly coloured in 2015, with a darker area in the top left and darker areas across the bottom half of the map. In 2019, the top left has become darker, as has the bottom left. However, the bottom right has seen the darker areas become light, as has the central map areas. The other areas across the map in 2019 have remained consistent and light.

Figure 4-12: Map of Deprivation index measures for the living environment in Rotherham 2015 (left) 2019 (right)

The next two measures of the deprivation index explored the age group of the young (under 15's) and the older generation (over 60's) concerning income deprivation. Firstly, the income deprivation affecting children index measures the proportion of all children aged 0 – 15 living in income-deprived families (Figure 4-13). In 2015, Rotherham has lighter areas in the top left and bottom right, with darker areas from the bottom left to the top right. In 2019, the top left and the bottom right remained consistent with the trends in 2015. The darker areas running from bottom left to top right saw an increase in deprivation in 2019, in particular those central in the map and in the top right quarter.

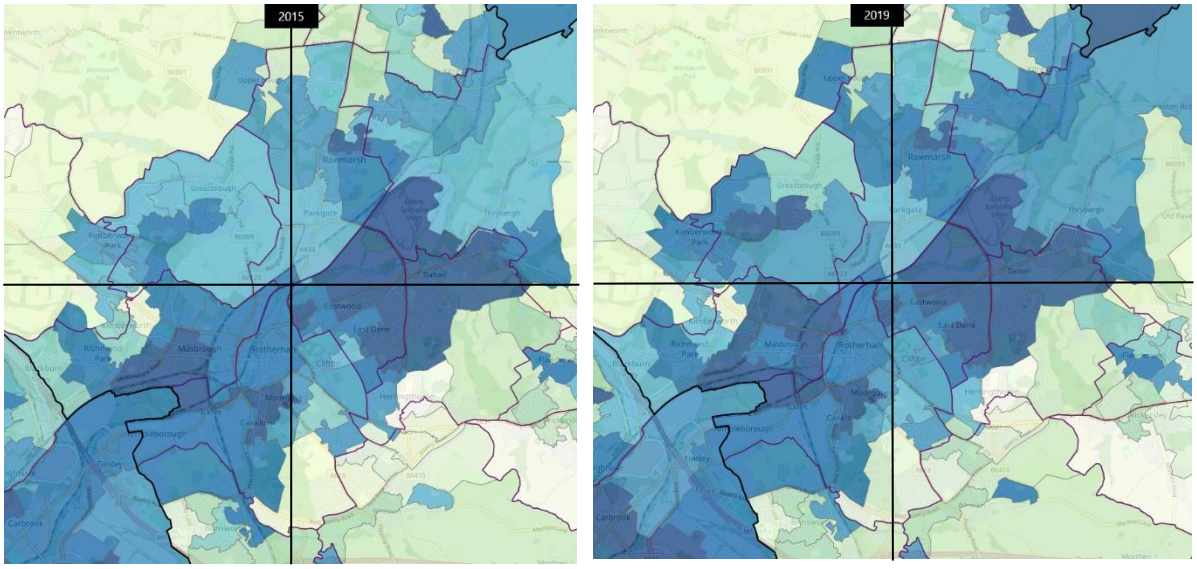


Figure 4-13: Map of Deprivation index by age group of the young (under 15's – living in deprived families) concerning income deprivation for Rotherham 2015 (left) 2019 (right)

Secondly, Income deprivation affecting older people index is explored in the maps (Figure 4-14). This measures the proportion of all those aged 60 or over who experience income deprivation. 2015 map showed lighter areas in the top left and bottom right, with the darker areas in the bottom left and centrally across to the top right. By 2019, the darker areas are beginning to increase, with the top left becoming darker. The bottom right of the map has become darker, with further darker increase centrally across the map from bottom left to top right. However, the bottom right has remained consistent, except for a small area that has become darker which is surrounded by light areas.

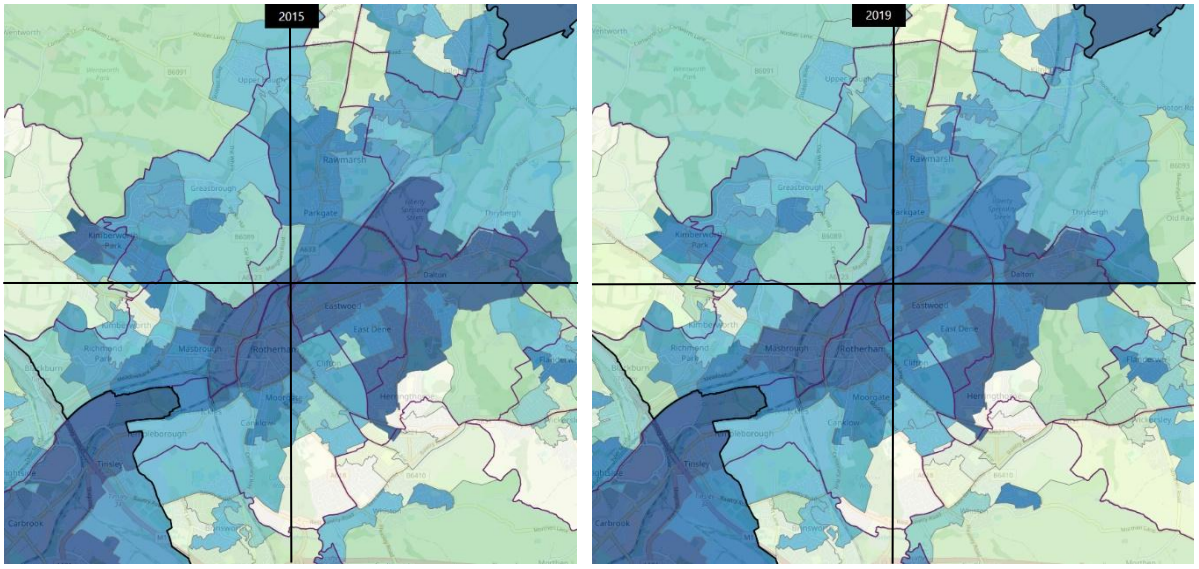


Figure 4-14: Map of Deprivation index by age group of the young (over 60's – living in deprivation) concerning income deprivation for Rotherham 2015 (left) 2019 (right)

4.2. RIO Location

The RIO was based within the ward of Boston and Castle with a referral catchment area of Rotherham and surrounding areas. Figure 4-15 and Figure 4-4 show that income deprivation based on deprivation for 2015 and 2019 was worse when compared to the national average across England. The ward homed 14,500 people according to a 2017 estimate, this ward has a younger age profile with 61% of residents under the age of 45 years. The highest percentage age group was 25-44 years with 28.3% of the population being in that range (Rotherham Council , 2020).

A breakdown of the age profile group and percentage for Boston and Castle is as follows:

- Aged 0-15 - 21.1%
- Aged 16-24 - 11.9%
- Aged 25-44 - 28.3%
- Aged 45-64 - 22.8%
- Aged 65+ - 15.8%

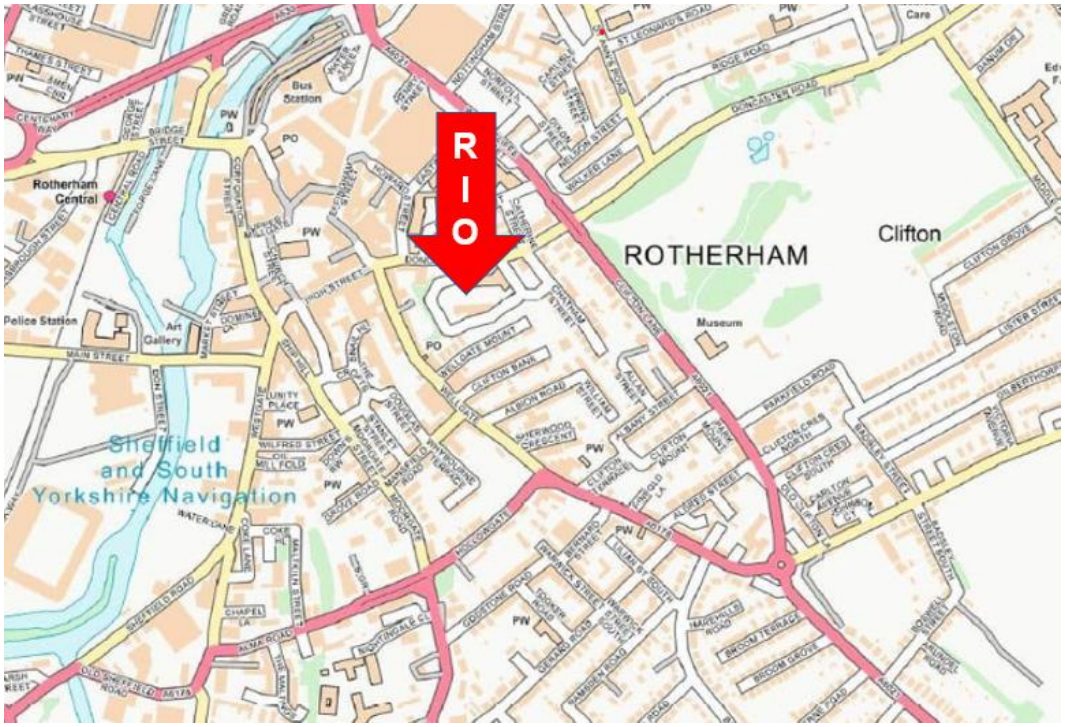


Figure 4-15: RIO in Boston and Castle ward located in Rotherham, South Yorkshire

According to the 2011 census, 63.2% of residents are white British in Boston and Castle. The ward also contains the highest BME community in Rotherham, 36.8%, this is almost five times higher than the other ward averages (2011 Census, ward population estimates: Office for National Statistics, 2011); (Rotherham Council , 2020).

- 63.2% of residents are white British.
- 36.8% BME community

Many jobs in the Rotherham Borough are located within Boston and Castle ward, this is due to its location in relation to the town centre and hospital. Public services account for the highest percentage of jobs with 28.3% of employment in this ward and 14% in production industries. The reductions in employment during the 2010s have resulted in a 6% reduction in employment within the ward (Rotherham Council , 2020).

Boston and Castle have a higher than average rate of child poverty in the borough of Rotherham; with Rotherham again worse than the national average for England (Child poverty data: HM Revenue and Customs, 2016); (Rotherham Council , 2020). In 2018, 18.5% of working-age residents in Boston and Castle were claiming some form of benefit. The highest benefit being claimed was employment and support allowance at 8.6% of the working age ward population, this was is above the Rotherham average, with carers allowance the second highest at 3.9% (Department for Work and Pensions (via NOMIS), 2018); (Rotherham Council , 2020).

A breakdown of benefits and pensions claimants in percentage for Boston and Castle:

Working Age Population (16-64 years)

- Employment & Support Allowance 8.6%
- Carers Allowance 3.9%
- Job Seekers Allowance 2.2%
- Income Support 2.0%
- Universal Credit 1.7%

State Pensioners (65+)

- Pension Credit 20.1%

Poor health is above average for Boston and Castle in 2011 (2011 Census, ward population estimates: Office for National Statistics, 2011), and disability although in line with the average for Rotherham, was much higher than the national average of England. One in ten Boston and Castle residents claim a disability benefit, slightly below the Rotherham average but again much higher than the national average. Overall, general health is bad or very bad at 8.3%, compared to 7.6% for Rotherham and 5.5% for the national average for England (Local Health Indicators: Public Health England (Rotherham), 2011)

- Boston and Castle have 22.4% of people experiencing long-term illnesses and disability (Rotherham's average is 22%, and the national average for England is 17.6%)

The highest level of education for Boston and Castle compared to Rotherham borough and the national average for England according to the 2011 census (2011 Census, ward population estimates: Office for National Statistics, 2011) is:

- Degree or diploma 21.6% (Rotherham 17.4%, England 27.4%)
- No Qualifications 31.2% (Rotherham 29.8%, England 22.5%)

Recorded crime and ASB rates in the Boston and Castle ward are over twice the Rotherham borough average. This can be partly explained due to its proximity to the town centre where 64% of crimes and 55% of ASB in the ward are recorded (Rotherham Council , 2020).

- Recorded Crime (2018/19): 3,376 (232.8 per 1,000 population) (Rotherham 98.6)
- Recorded ASB (2018/19): 860 (59.3 per 1,000 population) (Rotherham 24.3)

Boston and Castle ward is made up of several LSOAs. The overall location has a higher deprivation rate than the Rotherham average, with some areas among the most deprived areas in England. However, there are also differences within the ward (Rotherham.gov.uk, 2017).

- E010007677 Canklow is the most deprived area in Rotherham, this area is also one of the most deprived areas in England.
- E01007714 Town Centre to the north is also very deprived within the northern quarter of the Boston and Castle ward and is within the most deprived 3% of England.
- E01007767 Clifton also has very high deprivation levels.

RIO is situated within the town centre LSOA, this has an overall rank of the 13th of 194 lowest LSOAs in Rotherham (Communities.Gov.UK, 2021); (Rotherham.gov.uk, 2022). According to the latest deprivation index scores, this location is also:

- 15th lowest for income deprivation
- 89th lowest for education, skills, and training deprivation
- 113th lowest for health, deprivation, and disability
- 77th lowest for crime deprivation
- 14th lowest for barriers to housing and services deprivation.
- 57th lowest for living environment and deprivation.

Overall, three-quarters of the Boston and Castle ward residents live in the most deprived 30% of England.

The Rotherham Institute for Obesity

The Rotherham Institute for Obesity (RIO) was an NHS tier three weight management centre based in the centre of South Yorkshire. At the start of the research this service was a fully funded NHS tier three weight management centre, RIO had their funding cut causing the NHS service they provided to be shut in 2017 (Rotherham Advertiser, 2017).The RIO programme was 6 months and included education via nutritional advice, cooking skills, physical activity, and lifestyle changes. RIO had a multi-discipline team working with service users on-site, including a gym and was available to be used by those on the RIO programme.

4.3. The RIO Programme

The Rotherham Institute for Obesity (RIO) programme took place over a 6-month period and used a tailored approach to cater to service users individual requirements (Capehorn D. M., 2011); (RIO NHS, 2015). The programme included nutritional advice for a healthy diet, cooking skills and tailored advice for physical activity and a healthy lifestyle. RIO also had an on-site gym and an exercise therapist who offered personal training and bespoke exercise programmes for all levels of obesity. Further support

available from RIO included behaviour change advice from trained obesity nurses and talking therapists to allow for sustained lifestyle improvements. As well as this each person on the programme had access to a Cognitive Behavioural therapist, to work alongside the weight loss advice to help with behaviour change and wellbeing improvement (Capehorn D. M., 2011).

4.3.1. Body measurements at RIO

At each appointment during the programme, service users had their weight measurements taken using specialist equipment which captured full bio-impedance markers, identifying specifically the weight of muscle, fat, bone, and fluid (Boyden C. , 2017). This allowed the RIO team to build a detailed picture of an individual's weight and lifestyle issues. At certain points, each person was also required to complete well-being questions and other surveys (Boyden C. , 2017).

Further assessments were undertaken using blood tests, investigating underlying metabolic problems or other co-morbidities associated, such as gene or gut hormones that are associated with obesity. These conditions could then be treated by RIO using (Lighter Life, 2016) Very Low-Calorie Diets (VLCDs), specific weight loss medications (Saxenda, Mysimba and Xenical), and in extreme cases Bariatric surgery.

Talking Therapies

RIO considered talking therapies as one of the most important elements of the 6-month programme. This is often overlooked at other levels of the weight management pyramids and particularly in other tier 3 weight management centres (Boyden C. , 2016). However, the psychology behind why people over-eat or eat when they are not hungry was a key part of RIO's programme (Capehorn D. M., 2011). RIO believed that talking therapies could help overcome any present comfort-eating or habit-eating issues. This was shown in RIO's experience that initial weight loss is easier than being able to keep weight off. As a result, behaviour change is essential for sustained weight loss. Talking therapies were offered to all attendees

but only compulsory for those seeking gastric surgery to help prevent weight regain (Boyden C. , 2016).

Weight loss medications

In some cases, RIO could prescribe individuals with weight loss medications to help aid the weight loss process (Capehorn M. , 2016). Medications were to be taken whilst working on behaviour changes and interventions to help keep the weight off. Many weight loss medications are available, however, RIO would only prescribe those medications that had been proven with evidence to be effective, safe, and approved in the UK, to the relevant people (Capehorn M. , 2016).

The medications RIO would consider prescribing were:

- Saxenda (Liraglutide 3.0mg daily injection)
- Mysimba (Naltrexone 8mg / Buproprion 90mg twice daily prolonged release)
- Xenical (Orlistat 120mg three times daily tablets)

Diabetes

Often people on the RIO programme had other conditions that were related to or affected by obesity (Capehorn M. , 2016). RIO had a keen interest in metabolic conditions, with skilled and experienced staff offering personalised advice on diabetes care (Capehorn M. , 2016). Service users with Type 2 diabetes were offered a range of different medications, including tablets and injections, that would have different effects on weight. RIO could also advise on whether current diabetes medications were *"weight-friendly"*, and whether they would benefit from a change in therapy to aid their condition and weight loss (RIO NHS, 2015).

Very Low-calorie Diets – Lighter Life

The RIO was a *"Mentor Centre"* for the commercial weight-loss company Lighter Life, which offers a range of products to help with weight loss (Lighter Life, 2016). These include Lighter Life Total, which is an example of a nutritionally complete Very Low-

Calorie Diet (VLCD) of drinks, soups, and snacks. These are medically approved by the National Institute for Clinical Excellence (NICE) and provide less than 800 kcals of food per day but are nutritionally complete, to allow for healthy weight loss over short periods (LighterLife, 2016). RIO's experience of weight loss from using VLCDs was shown to achieve similar weight loss results to that of bariatric surgery (RIO NHS, 2015); (Capehorn M. , 2016).

Bariatric Surgery

For 8 years RIO provided this service for the NHS for the whole of the Rotherham population and was one of only a few specialists in *"Tier 3"* weight management centres (RIO NHS, 2015). RIO provided all the services in the UK recommended by the 2013 NHS Commissioning Board Clinical Policy for Complex and Specialised Obesity Surgery (Department of Health, Obesity and Food Branch, 2013). RIO helped advise individuals on whether they might be a candidate and benefit from weight loss surgery (such as a gastric band, sleeve gastrectomy, or gastric bypass surgery), and offered support before and after the procedure (Capehorn D. M., 2011).

Group sessions

The RIO ran educational group sessions held on site during the programme on many topics including:

- Cooking skills
- Eating for health vs eating for weight loss
- How to read food labels
- The role of emotional eating and breaking bad habits
- Understanding diabetes and pre-diabetes
- The metabolic system – am I at risk of health problems?
- The role of physical activity
- Dispelling the myths of weight loss
- Weight loss medications – what is available?

- Bariatric surgery – is it an option for me?

These sessions were run by the RIO team and also arranged for experts in different fields to come and teach new skills to service users (Capehorn D. M., 2011); (RIO NHS, 2015).

4.3.2. RIO Practice Population

Between 2009-2017, the Rotherham Institute for Obesity consisted of 11 dedicated members of staff, led by the clinical lead for obesity in the area shown in Table 4-1 (RIO NHS, 2015). Each member played an important role to help and support patients attempting to lose weight. The health professionals included a GP, exercise therapists, talking therapists, obesity specialist nurses and health care assistants who worked to educate, encourage, and support patients during their weight loss plans (Capehorn D. M., 2011).

Table 4-1: RIO Health Professionals and their responsibilities.

RIO Health Professional(s)	N	Responsibilities
General Practitioner (GP)	1	The assessments for medication, surgery, and weight loss camps where appropriate
Supervisor	1	Arranged appointments and liaised with referrers and other organisations
Exercise Therapist	1	Provided personalised training, engaging patients with appropriate physical activities
Health Trainer	1	Provided motivation and help for patients with setting achievable goals
Talking Therapist	2	Provided Cognitive Behavioural Therapy (CBT), Neuro-Linguistic Programming (NLP), Emotionally Focused Therapy (EFT), and Life Coaching to assist in weight loss, along with Hypnotherapy and group sessions
Obesity Specialist Nurse (OSN)	3	Provided the initial triage appointments, delivered basic nutrition and weight management advice
Health Care Assistant	2	Weighed and measured each patient attending an appointment along with follow up appointments with advice and support
Other(s) including part-time staff	-	Specialist Dietitians and Cook and Eat Dietitians were available for complex dietary needs.

The catchment area for RIO referrals was Rotherham and the surrounding areas. Once referred to RIO, each patient was first assessed before being offered their course of treatment or intervention. These forms of treatment included exercise therapy at the practice gym, and lessons on how to cook (Capehorn D. M., 2011) (RIO NHS, 2015).

4.3.3. History of RIO Research

RIO conducted internal projects and studies to help raise awareness and understanding of the issues being faced by their service users. One study explored *'Who are the biggest losers?'* which examined the different effects of weight loss on the different demographics attending RIO (Fulton, Cooper, & Capehorn, 2012). They found all patients at RIO had an equal chance of losing weight, however, a difference was observed between age groups, with younger age groups most likely to lose weight.

The talking therapy team analysed the effects of talking therapy and weight loss for those attending RIO (Boyden, Wilson, & Capehorn, 2015). They found no significant difference in weight loss between those service users receiving and not receiving talking therapy, successful weight loss being seen in both. However, those who received talking therapy were more likely to have been struggling to lose weight previously, so for those service users to achieve the same level of weight loss as those that didn't receive talking therapy was deemed a positive outcome.

Further analysis of subjective well-being scores showed all groups other than those who identified as carers, permanently sick or students achieved significant weight loss after attending the RIO programme. Those in the most deprived areas had the lowest baseline well-being scores, however, over the course of the programme these were shown to increase. (Boyden, Fallows, & Capehorn, 2014).

The RIO gym saw a 10% retention in service users continuing to take part in regular physical activity at the end of the 6-month programme period, and is a success compared to a 90% drop out for those attending a gym who quit within 3 months (Walker, Kaill, & Capehorn, 2013).

RIO explored and tested a small intervention called a Malory band which was worn around the waist of participants and used as a psychological trigger to stop eating. A small sample of 72 people were given the Malory Band. Results suggested this was a

successful weight loss aid that was initially desired by users. However, by week 12 there were dramatic dropout rates as service users could not tolerate wearing the band on a day-to-day basis. The participants body weight and waist circumference had significantly reduced, but this was not significantly different to that observed in the control group. Therefore, the improvements seen may have been due to the participants attending RIO rather than wearing the band (Steele & Capehorn, 2016).

A further study observed the changes to cardiovascular fitness levels in an obese population (attending RIO) after initiating exercise. Walker et al, 2016, hypothesised that fitness would increase after starting exercising. The results added support for the inclusion of exercise in a weight management programme for obese individuals. Obese individuals have a greater risk of heart complications but the improvements in cardiovascular fitness observed in this study suggest exercise can reduce the risk of mortality associated with poor fitness and obesity. It was also observed that RIO participant's exercise became more manageable, to the extent that participants could exert themselves more, whilst their heart rate remained more stable (Walker, Reale, & Capehorn, 2014).

A topic that was often mentioned among service users and health professionals at RIO was, whether people were more likely to struggle to lose weight at the end of October, during the festive periods and around the New Year. RIO's study exploring this question suggested that on average patients attending RIO still maintained weight loss during these periods. However, on average weight loss was reduced, and nearly as many patients gained weight during this period as those that lost weight (Steele, Senior, & Capehorn, 2014). The RIO team also investigated whether alcohol consumption could affect obesity levels, aiming to identify if there was a relationship between reported alcohol consumption and BMI in patients attending the RIO. Of the 225 adults, 41.5% consumed more than the national average, with males drinking more than females. They found that binge drinking had a relationship to BMI scores,

however, this was weak with further analysis required (Reale, Walker, & Capehorn, 2013).

Over the years a topic that has been discussed is whether *'low-fat'* foods are *'better'* for you compared to *'regular fat'* foods. Results suggest that low-fat foods do appear on average to help reduce calorie intake and therefore may be encouraged as part of a weight loss strategy. However, appropriate food choices may still require reading nutritional information on the food labels as 10% of low-fat foods still have more, or the same calories and 40% contain more sugar (Steele, et al., 2015). Another intervention explored by RIO were commercial low-calorie liquid diets. The results suggested that the Pro800 liquid diet was well tolerated, provided significant weight reduction, improvements in blood pressure and body composition and was therefore to be considered a valuable weight loss intervention in certain RIO cases (Carter, Steele, Bacchus, Senior, & Capehorn, 2015).

Scales values although an important indicator does not present the whole picture. Body composition changes in participants who miss their weight targets can also be of great importance. RIO findings suggest that by the definition of Key Performance Indicators for weight loss targets, patients attending RIO who did not reach a minimum of 5% loss of excess weight at 6 months were considered *"failures"* by commissioners. This analysis showed that many of these patients demonstrated other positive changes in body composition that may convey health benefits. RIO concluded that alternative KPIs should be considered when assessing *"success"* (Walker, Steele, Kaill, & Capehorn, 2013).

Some early service evaluations were carried out by the RIO team exploring how the service performed in 2010. Of the 1,624 adults in who were referred to RIO in 2010, 96% of those lost weight with 71% either meeting or losing more than their weight loss targets, along with the 97% of these service users recorded that they were satisfied with their experience. Based on 2010 costs, this result equated to a cost of £454 per success. One evaluation identified a reduction in the need for bariatric

surgery >50%, seeing a non-invasive intervention (RIO programme) achieve a substantial cumulative weight loss for all adults. In 2010, RIO was well used by the healthcare community and was popular with patients. The dropout rate for service users was unknown as RIO did not have data recorded for this due to people still being able to attend the site location to see their GP. RIO was successful in its aim to maintain or reduce weight, and initial evaluation suggested that it was a cost-effective form of intervention (Capehorn, Carter, & Senior, 2011). The second service evaluation compared data collected by RIO from 2010 to 2011. Of the referrals across 2010 and 2011, 93% lost weight, 66% achieved better results than their RIO weight loss targets, 72% lost more than 5% of their excess body weight and 18.6% lost more than 10% of their excess body weight. This study concluded that RIO was successful in its multi-discipline team approach to reduce weight, and 2011 results appeared to show an improvement when compared to 2010 (Senior, Carter, & Capehorn, 2012).

The RIO on site gym grew, with exercise therapy being provided. A sample of 381 participants took part in a minimum of 6 sessions with exercise therapists, whose aim was to educate and motivate service users. RIO assessed improvements in fitness levels by using three tests (step test, wall press-up and stand-up/sit down "squat" test) performed at the beginning, and the end of the fixed 6 sessions with the exercise therapists. Results showed significant improvement between baseline and end measurements, RIO concluded that these results supported the benefit of moderate and achievable amounts of physical activity in collaboration with the RIO programme (Walker, Kaill, Churchward, & Capehorn, 2013).

To further understand the service users' needs, RIO surveyed patient satisfaction with exercise therapy. Of the responders, 19% stated that it had changed their lives, with 69% of patients stating that exercise therapy had helped them to implement lifestyle changes. RIO concluded that the use of exercise therapy, as part of the RIO approach, appeared to be popular with service users and was subjectively found to be a useful

part of their weight management and behaviour change programme (Walker, Kaill, & Capehorn, 2012).

4.3.4. Focus group's location

After the closure of RIO an alternative location was sought to conduct the focus groups, on people who had either attended or were at the time attending tier 2, 3 or 4 weight management services. The LSOA area of Welwyn Hatfield 007A was selected due to the similar deprivation issues faced in this area when compared to Rotherham, there are also several weight loss clubs in the vicinity shown in Figure 4-16 and Figure 4-17. LSOA level was used due to the greater population size across Hertfordshire.

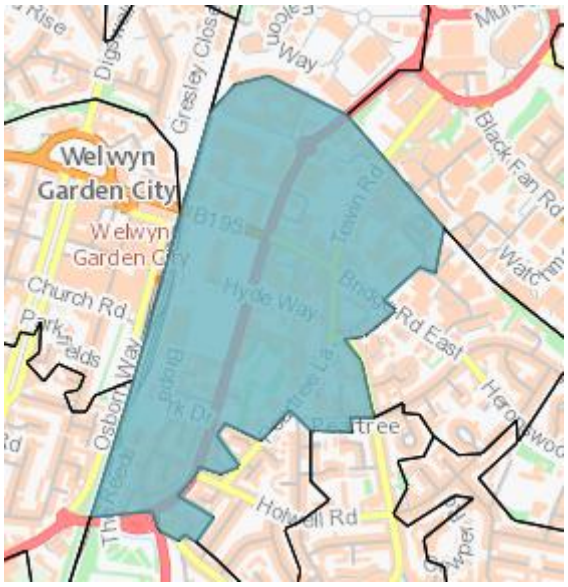


Figure 4-16: LSOA map of Welwyn Hatfield 007A located in Hertfordshire

Hertfordshire is considered an affluent area, situated within the home counties just 20 miles from London. However, in 2015 Welwyn Hatfield 007A was ranked 18th most deprived LSOA in Hertfordshire and by 2019, had moved to the position of 19th from an overall 960 LSOAs.

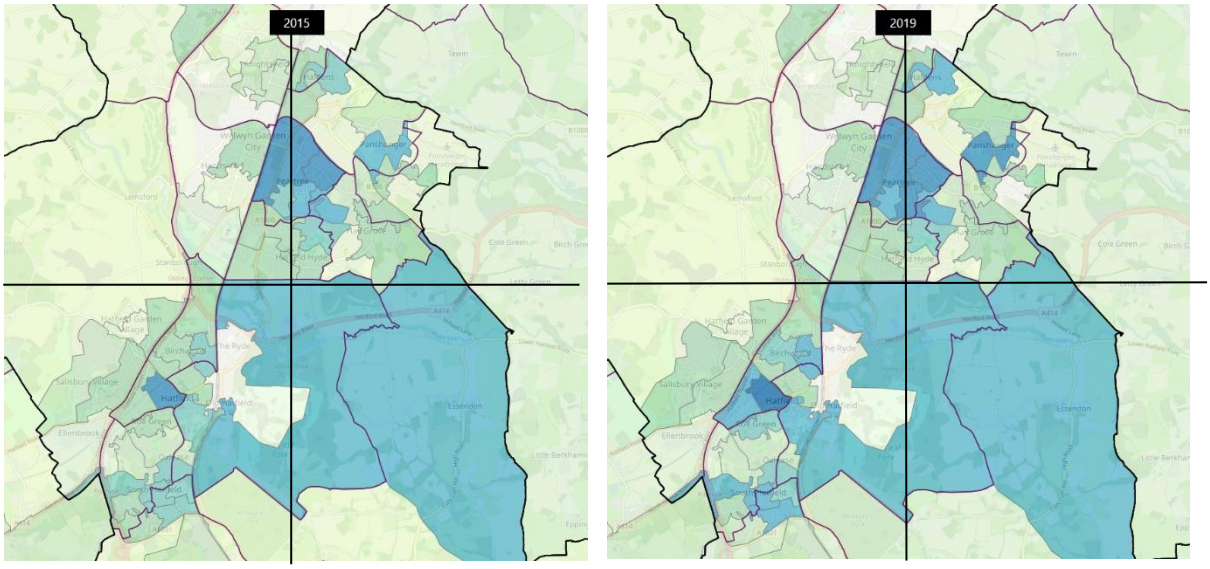


Figure 4-17: Map of overall deprivation scores for Welwyn Hatfield 2015 (left) and 2019 (right)

Overall deprivation scores are shown above Figure 4-17 for Welwyn Hatfield 2015 (left) and 2019 (right) using ArcGIS maps for indices of deprivation (Communities.Gov.UK, 2021). The darker the area the more deprived this area is, this can be seen in where Welwyn Hatfield 007A is located. Much of the surrounding areas of Welwyn Hatfield were lighter areas. The darker areas from 2015 (left) continued with areas near to these getting darker by 2019 (right), particularly in the bottom left of the map and middle/top right of the map.

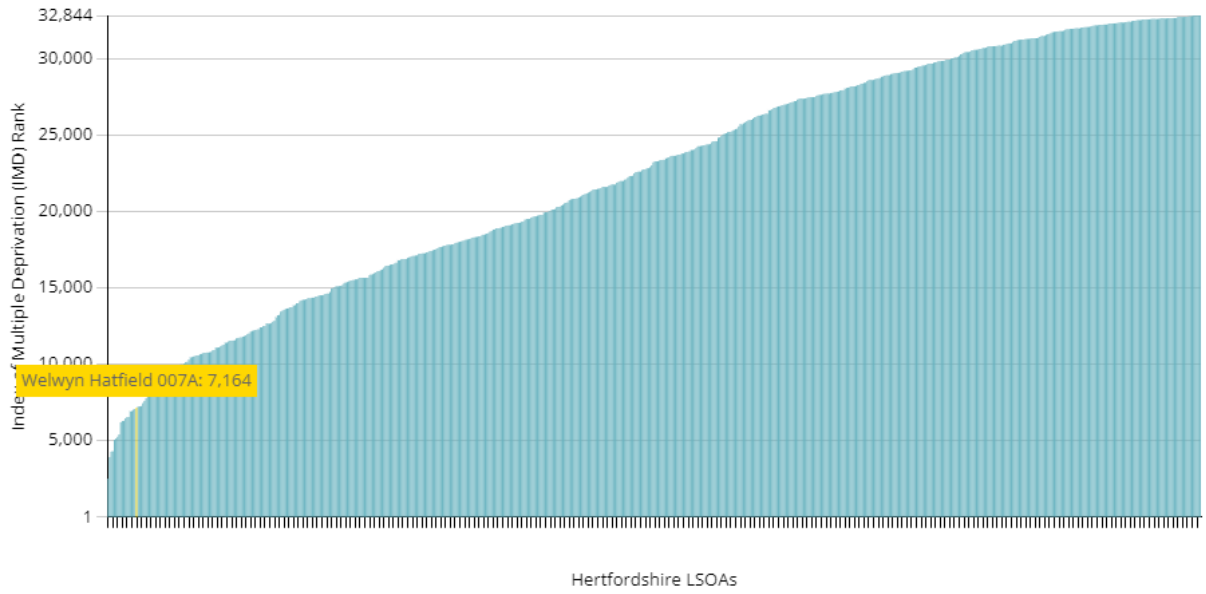


Figure 4-18: How Welwyn Hatfield 007A compares nationally with its neighbours for the index of multiple deprivation (Herts Insight , 2021) The lower the score the higher the level of deprivation

Welwyn Hatfield 007A and the surrounding areas suffer from high levels of deprivation shown in Figure 4-18 (Ministry of Housing Communities & Local Goverment, 2019). The data shows that this area is, of 960 LSOAs, the:

- 20th lowest for income deprivation
- 5th lowest for employment
- 36th lowest for education skills and training
- 7th lowest for health and disability
- 464th for crime (potentially skewed due to the location of Police HQ)
- 359th barriers to housing
- 365th living environment

According to the local analysis of the deprivation index, this puts Welwyn Hatfield 007A in decile 3 (out of 10, 1 being the worst) for neighbourhoods in England and 7,164 out of 32,844 nationally shown in Figure 5-18 (Herts CC Indices of Deprivation in Hertfordshire, 2021).

4.4. Chapter Four - Summary

The Rotherham institute for obesity was an NHS tier 3 weight management centre in Rotherham had their funding cut in 2017 leading to the closure of their NHS facing services. They offered a programme that encompassed multiple different approaches for service users, to help them in their weight loss journeys (Talking therapies, medications, very low-calorie diets, and group sessions).

Rotherham (the home of RIO) is a highly deprived area for most of the factors contained within the Deprivation Index. RIO was situated in the ward of Boston and Castle and more specifically the town centre LSOA. This was ranked the 13th most deprived LSOA (of 194) in Rotherham.

Due to the closure of RIO a new location for the Focus group interviews within this thesis was sought. An area of Hertfordshire with high areas of deprivation and lower incomes along with people accessing tier 2, 3 and 4 weight loss services was adopted.

5. Chapter Five – Methodology

Methodological Approach

The overarching target for this thesis and my future career is to add further foundations and then build bricks to the wall of improving the lives of vulnerable people across England. Population Health is known as an approach that aims to improve physical and mental health outcomes (England.NHS.UK, 2021). This is achieved by promoting positive improvements to well-being that in turn reduce health inequalities across the country and the entire population.

Lifestyles and social factors are crucial to long-term health. However, research still suggests that the health inequality gap is increasing in England and across Europe (Smith, 1996); (Detollenaere, Desmarest, Boeckxstaens, & Willems, 2018). These findings can vary, as each area is uniquely different due to the local history of decisions made for social policy, culture, and location. Each area, region, and country will have their individual issues that are a result of the decisions that have been made over time (Gostin, Boufford, & Martinez, 2004).

When feeling unwell or if health becomes an issue, people will seek help and advice from NHS health professionals. The methods used within medicine can sometimes feel as though and be viewed as a one size fits all solution (Pyne, et al., 2005). As a result, people with certain illnesses can fall through the net due to the complex nature of their individual health issues and needs. However, population health and social epidemiology use data collected to actively investigate different trends in populations with different conditions, illnesses, and circumstances across the country (Honjo, 2004). By investigating different populations and complex illnesses and health issues across the nation down to the local areas; will lead to better understanding and more effective interventions and treatments for people.

5.1. Structure and Aims of Thesis

The overarching aim of this thesis is to examine the contributions of socio-economic status and social capital in the aetiology of obesity. The individual aim of each study is stated in the relevant chapter describing each study. However, broadly, this thesis achieves the overarching aim using mixed methods encompassing analysis of a national (English) health data set, the follow-up of patients in a Tier 3 treatment for obesity in a deprived area of England, and the lived experience of people who received a weight management intervention for obesity.

So far, the thesis structure has introduced the social context of obesity in England. It has looked at how the issues of obesity have grown over time, how this has been measured and tackled with government policy to NHS and private sector interventions. The thesis has also explored the complexity of social inequality, health inequality and social capital, the measurements for obesity and work undertaken to intervene.

The next phase of the thesis research addresses the topic of the *'socio-economic status and social capital in the aetiology of obesity'*. The thesis follows a mixed methods approach to explore the research questions and theme throughout. This research approach involves collecting and analysing both qualitative and quantitative data to add additional context to each of the findings (Schoonenboom & Johnson, 2017). The current research focuses on three different data sources relating to three different levels of analysis (national, service, and individual).

Study 1: Health Survey for England 1991-2008. (National level)

Study 2: The Rotherham Institute for Obesity service user outcomes. (Service level)

Study 3: Focus group discussions (2017). (Individual level)

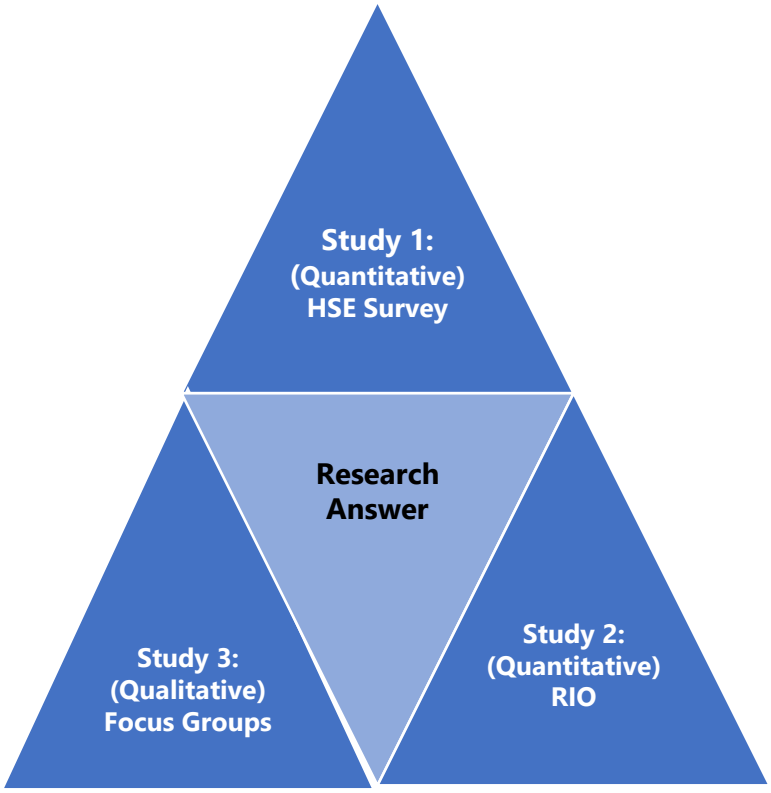


Figure 5-1: The triangulation of the methodologies being used in the current research

Using a mixed-method approach, the investigation will be able to produce a better understanding of what is happening by triangulating the findings from the three studies (Figure 5-1). The aim of the idea of building a triangulation of the methodologies (Denzin, 1978) is to achieve a full and comprehensive answer from the data. Exploring multiple approaches, observations, methods, and data sources, is a benefit and will help to overcome any potential pre-held beliefs or bias that could occur from using one single methodology (Driscoll, Appiah-Yeboah, Salib, & Rupert, 2007).

This approach will give the best possible conclusions for understanding *Socio-economic Status and Social Capital in the Aetiology of Obesity*. However, it is important to acknowledge the (Kuhn, 1970) concept of *'paradigm'* which points to a group of beliefs that dictate how researchers and scientists conduct studies in particular areas. Bryman (Bryman, 2016) points to two different versions of the debate of quantitative and qualitative research. Firstly, the epistemological version,

suggesting that mixed methods is not possible. Secondly, the technical version which gives greater prominence to the strengths of data collection and analysis techniques of both quantitative and qualitative research. Bryman suggests that the technical (second) version is seen as the leading research strategy, and it views mixed methodology as compatible.

The three studies triangulate and build towards the thesis conclusion that investigates *Socio-economic Status and Social Capital in the Aetiology of Obesity* across English populations. The research in Study 1 (survey) and 2 (treatment outcome) deploys mixed quantitative and qualitative analysis methods to *"add meat to the bones"* (Blackwell, 2022) with Study 3 adding people's personal experiences to the initial analysis.

5.1.1. Social Epidemiology

Social epidemiology methodology is used to investigate and address the thesis research questions and themes (Morabia, 2004). Social epidemiology is a relatively new branch of epidemiology that focuses on the effects of social conditions, factors and characteristics that have an impact on a population's health (Honjo, 2004). This method of research works on the assumption that any given advantages or disadvantages across society in different areas and regions, will have an impact on the distribution of health, disease, and inequalities (Kawachi & Subramanian, 2018). More simply, to understand if those in wealthy areas of society will have better health than those in poorer more disadvantaged areas who, in contrast, are likely to have poorer health.

5.2. Research Questions

The research questions being investigated across this thesis are:

Study 1: Does the level of socio-economic status and social capital influence the risk of becoming obese?

Study 2: Can a tier three Weight Management service reduce levels of obesity and improve well-being in an area of England with high levels of deprivation?

Study 3: What is the role of socio-economic status and social capital in people's attempt to reduce obesity?

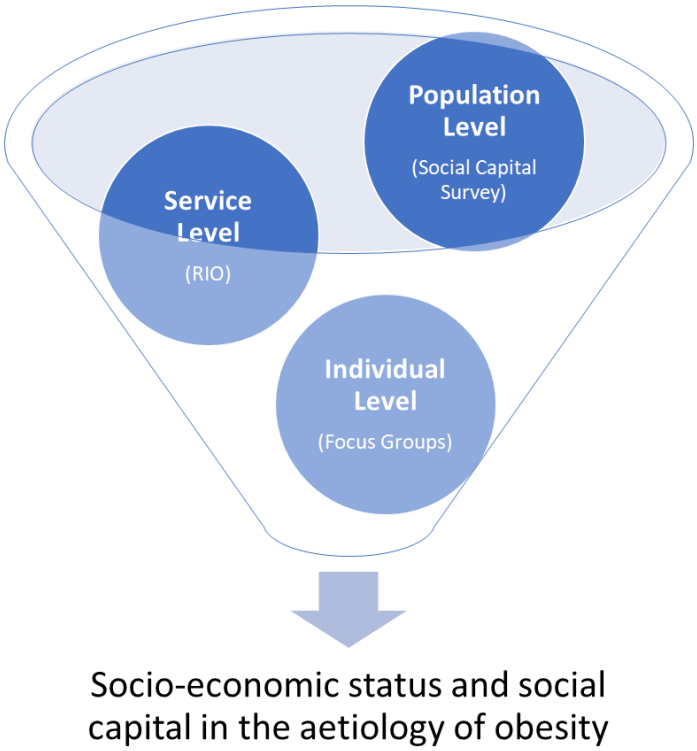


Figure 5-2: Socio-economic status and social capital in the aetiology of obesity

These questions will be addressed (Figure 5-2) across the following analysis chapters in three studies.

6. Chapter Six - Study 1: Social Capital

Study 1 is a time series dataset collected from the Health Survey for England (HSE) covering the years 1991-2009. The English sample comes from annual data collections that were merged to form a larger dataset of 18 years. The survey was originally commissioned by the Department of Health, until 2005 when this was passed to the NHS Information Centre for Health and Social Care. Each of the completed annual survey datasets are held by the NHS Digital website as Open Access (NHS Digital, 2019).

The HSE annual survey data is sponsored by the Information Centre for Health and Social Care and the Department of Health. The HSE survey is been carried out by the Joint Health Surveys Unit of NatCen Social Research and the Research Department of Epidemiology and Public Health at University College London (UCL) since 1994 (Higgins & Marshall, 2012); (NHS Digital, 2019). Colleagues at the University of Manchester brought together the different HSE dataset years into one large sample for 1991-2009 (Higgins & Marshall, 2012). The dataset contains body measurements, socio-economic measurements, together with social capital questions that are recommended by world-leading social capital researcher Kawachi (Kawachi, 2008).

6.1.1. Study 1 aims

As discussed earlier, lower levels of socioeconomic status increase inequality which in turn produces a drop in the standard of health. This is shown with those living in highly deprived neighbourhoods, often experiencing poorer health when compared to people living in the richest neighbourhoods. What is currently not fully understood, however, is how social capital influences the impact of socioeconomic status on the risk of obesity.

Although there is some evidence that social capital is related to obesity, the picture is mixed with some social capital variables increasing the risk, and others decreasing it. In addition, most research is conducted outside the UK and, in many cases, with a

limited range of social capital indicators included. Therefore, the Aim of the present study, is to examine the relative contributions of socioeconomic status and social capital in determining the risk of obesity, using national data for England.

Study 1 - Research question: Does the level of socio-economic status and social capital influence the risk of becoming obese?

6.1.2. Methodology

Each year the Health Survey for England (HSE) invitations are sent out to households across England, requesting a time to be interviewed to complete the HSE (NHS Digital (HSE), 2019) (NHS Digital, 2019). The invitations are sent out using a random sample design. The random sampling used came from selecting primary sampling units, based on English postcodes. The HSE collects the data in two stages. Firstly, an Interview and then if participants agree to stage two, a nurse will visit to collect specific health measurements.

The main topics of interest within the HSE include obesity and socioeconomic status variables. Along with this there are general classification variables: ethnicity, sex, age, height, weight, Government Office Region, and multiple questions relating to social capital (NHS Digital (HSE), 2019).

The HSE data collection began in early 1991 and has been carried out annually since then. Over the years the survey collects the same consistent information, with extra questions being added when required. These survey questions include information on disease, conditions, and they are revisited at the appropriate interval to allow for any potential changes to be monitored. An interview with each eligible person in the household is followed by a nurse visit (Higgins & Marshall, 2012).

6.1.3. Survey Preparation

Preparation for the analysis involved each variable being checked for any potential input issues that can often occur with data collection across the public sector. Any

irrelevant or duplicate variables are removed from the dataset, to allow for easier analysis of the relevant data.

New variables were created, with BMI scores calculated, before being grouped using the WHO classifications (World Health Organisation, 2022). The weights were grouped as follows; underweight (BMI <20), healthy weight (BMI 20-24.99), overweight (BMI 25>) and obese (BMI 30>). The social questions were then recoded, taking out missing data and recoding the answers given into the same consistent answer choices, this will allow for consistency across the analysis. This is shown in the data journey in Appendix 11.3.

The health survey for England social capital questions analysed are as follows:

1. This area is a place where neighbours look after each other.
2. This area has good leisure things for people like me.
3. This area has good local transport.
4. This area is a place I enjoy living in.
5. The problem of teenagers hanging around on the streets.
6. Problem vandalism, graffiti/deliberate damage to property.
7. Ease of getting to the supermarket.
8. Ease of getting to the post office.
9. Do people try to be helpful?
10. People take advantage of you.
11. Can people be trusted?
12. Women's institute or townswomen's guild or women's group.
13. Group for elderly or older people (e.g., lunch club).
14. A religious group or church organisation.
15. Charity, voluntary or community group.
16. Youth group (e.g., scouts, guides, youth club).
17. Parent-teacher association or school association.
18. Sports club, gym, exercise, or dance group.
19. Education, arts, music, singing group (incl. evening classes).
20. Political parties.
21. Trade unions (including student unions).
22. Environmental groups.
23. Social club (including working men's club, rotary club).
24. Another group or organisation.
25. Tenants' or residents' group or neighbourhood watch.

The question set was reduced to 12 questions within the analysis, combining the group membership questions highlighted in grey (questions 12-25) in to one variable

"group or organisation". The words marked in **bold** below indicate the abbreviations in the analysis. This makes the questions about group membership and not the type of group, it also makes the question set smaller.

Updated question set used in the analysis:

1. This area is a place where **neighbours** look after each other.
2. This area has good **leisure** things for people like me.
3. This area has good local **transport**.
4. This area is a place I **enjoy** living in.
5. The problem of teenagers hanging around on the **streets.**
6. Problem **vandalism**, graffiti/deliberate damage to property.
7. Ease of getting to the **supermarket.**
8. Ease of getting to the **post office.**
9. Do people try to be **helpful**?
10. People take **advantage** of you.
11. Can people be **trusted**?
12. **Groups** or organisations (combing group membership questions).

The government regions recorded in the dataset were then recoded to reflect the nine regions across England which allows for a breakdown to compare these across the country.

6.1.4. Participants

In total, the data set contains 51,060 completed survey entries for the England population that answered the social capital survey element of the HSE. The breakdown of the characteristics is shown in Table 6-1. The sample is an adult population, age 18 years and above living in England.

6.1.5. Ethics

The Health and Human Science Ethics Committee at the University of Hertfordshire confirmed that the present research is ethical and formal approval was not required (Appendix 11.1 Study 1 and Study 2 Ethics.).

6.1.6. Procedure

Each year the HSE survey interview invitations are sent out to private households across England. The HSE employs questionnaire-based answers with physical measurements of height, weight, smoking, drinking, general health, and social factors covered each year. An interview with each eligible person in the household is followed by a nurse visit (Higgins & Marshall, 2012).

The HSE survey sample originally contained 206,000 participants, however the present sample is reduced to only take forward the sample that completed the social capital part was added to the survey more recently by the HSE. As a result, under investigation in this chapter is a sample of 51,060 individuals. Broken down by sex the data contains n = 28,426 females and n = 22,634 male participants, totalling n = 50,060 overall.

6.1.7. Study 1 Data analysis

The analysis starts with descriptive analysis of the population who completed the survey. Exploring the participants age, sex, ethnicity, social class group, income, and BMI.

The 12 social capital questions are then taken forward (As described in survey preparation) to be modelled using regression analysis; with a further two elements of social class and income quintiles being used to identify whether low social capital increased the risk of becoming obese for all regions of England.

The results of the logistic regression model with odds risk ratios were reported for the variables that showed a significant effect on the outcome of obesity.

The Dependent Variable (DV) is risk of being obese

Independent Variable (IV) are the social capital measures (neighbours, leisure, transport, enjoy, streets, vandalism, supermarkets, post office, helpful, advantage, trust and groups). Social Class, using the national socio-economic NS-SEC three classes classification presented in Chapter 3, and the Income quintiles.

The final part of the study 1 analysis produces a breakdown of BMI scores with percentages using the national dataset. However, given the rationale presented in Chapter 4, the analysis is repeated using only the subsample from Yorkshire and the Humber since this is the region includes Rotherham

Analysis is conducted using SPSS (SPSS, 2017).

6.2. Study 1 Results

The HSE data has a sample of 76,350 participants in total. The differences of BMI group prevalence across England and Yorkshire and the Humber are shown in Table 6-1. Nationally the percentage of obesity recorded is 22.5%. This makes obesity an issue for almost 1 in 4 people across England. Region is shown in the first column, with the BMI categories across the top, using the WHO criteria showing underweight, healthy weight, overweight and obese with the percentage of people per category.

However, 25,290 did not take part in the social capital survey. The remaining sample of 51,060 who completed both body measurements and the social capital survey demographics of responses for the social capital questions under investigation are shown below in a detailed breakdown of ethnicity, self-reported social class, income quintiles, and BMI categories of the survey participants in Table 6-2.

Table 6-1: A breakdown of BMI scores with percentages, nationally and by region

Region	Underweight <18.5 (%)	Healthy weight 18.5-24.9 (%)	Overweight 25- 29.9 (%)	Obese 30>(%)
England	1,211 (1.6%)	28,730 (37.6%)	29,225 (38.3%)	17,184 (22.5%)
Yorkshire and the Humber	138 (1.7%)	3,074 (37.8%)	3,026 (37.2%)	1,904 (23.4%)

Table 6-2: Descriptive characteristics of survey respondents for Social Capital questions

Descriptive Characteristics		Female (n=28,426)	Male (n=22,634)	Total (n=51,060)
Age	Means (SD)	47.97 (18.13)	47.69 (17.67)	47.40 (18.60)
Ethnicity	White	26,387	20,916	47,303
	Mixed	263	184	447
	Asian or British Asian	1,018	979	1,997
	Black or Black British	533	395	928
	Chinese or another ethnic group	225	160	285
Social Class	Higher managerial, administrative, and professional occupations	8,504	8,667	17,171
	Intermediate occupations	11,526	9,126	20,652
	Routine and manual occupations	6,855	4,008	10,863
	Never worked and long term Unemployed	1,541	833	2,374
Income Quintiles	Under £10,655	3,921	2,553	6,474
	£10,655 - £16,900	4,114	2,910	7,024
	£16,900 - £26,787	7,950	3,543	11,493
	£26,787 - £41,864	8,260	3,913	12,173
	Over £41,864	8,383	4,162	12,545
Grouped BMI	Underweight (<19.9)	448	229	677
	Healthy weight (20-24.9)	10,324	6,439	16,763
	Overweight (25-29.9)	8,270	9,337	17,507
	Obese (30>)	5,872	4,841	10,668

6.2.1. Survey analysis

Regression Analysis

England: Logistic regression was performed at a national level to ascertain the effects of social capital measures (neighbours, leisure, transport, enjoy, streets, vandalism, supermarkets, post office, helpful, advantage, trust and groups), social class and income on the likelihood of peoples risk of being obese (Field, 2016); (Field, 2017). The logistic regression model for England was statistically significant, $\chi 2(19) = 244.20$, $p < .001$. The model explained 1.3% (Nagelkerke R2) of the variance in obesity and correctly classified 63.6% of cases.

Aspects of both social capital and SES were uniquely predictive of obesity. Specifically, regarding social capital effects, those enjoying where they live and living in a place where neighbours take care of each other were 1.38 and 1.09 times, respectively, as likely to exhibit obesity than those that did not. By contrast, good local transport (.89), people are helpful (.91), can people be trusted (.92) and good leisure (.93) where they live were associated with participants being less likely to be obese.

Social economic status measured by social class and income. All three levels of social class (NS-SEC three classes classification) show an associated increased likelihood of exhibiting obesity the lowest of the three classes (routine and manual occupations) were 2.02 times more likely to experience obesity than those that were unemployed. While the highest class (managerial, administrator and professional occupations) were 2.24 times more likely than unemployed people to experience obesity.

People who earn higher levels of income (in the quintiles) showed a reduced associated likelihood of exhibiting obesity. Those in the £26,787-£41,864 quintile (.88) and those earning over £41,864 (.79). A further breakdown of the analysis can be seen at Appendix 11.4.

Additional Analysis: Yorkshire and the Humber

As Rotherham was described as the *"Obesity capital on England"* in the introduction, hence the reason for the development of the RIO at this location. Further separate analysis of focusing on the region of Yorkshire and the Humber population (home to RIO) using the model and indicators of social capital and social class were undertaken. The regression results along with odds risk ratios of becoming obese are reported below.

The logistic regression model for Yorkshire and the Humber was statistically significant, $\chi 2(19) = 36.19$, $p = .01$. The model explained 3.4% (Nagelkerke R2) of the variance in obesity and correctly classified 62% of cases. The responses for the variable "Can people be trusted?" where they live, were less likely to be obese (.77).

All three levels of social class show an associated increased likelihood of exhibiting obesity. The lowest of the three classes (routine and manual occupations) were 2.00 times more likely to experience obesity than those that were unemployed. While the highest class (managerial, administrator and professional occupations) were 2.28 times more likely than unemployed participants to experience obesity.

The level of income showed no significance.

6.3. Study 1 Summary

The 12 social capital questions were modelled, together with income quintiles and social class to identify if low social capital increased the risk of becoming obese for England.

This showed those enjoying where they live and living in *a place where neighbours take care of each other* were at an increased likelihood of exhibiting obesity than those that did not. Furthermore, all three levels of social class showed an associated increased likelihood of exhibiting obesity when compared to those that were unemployed.

The results in Appendix 11.4 show the risk ratios and significance values for the different elements of social capital, income, and social class. This showed England had a significant increased likelihood of obesity for social capital elements *enjoy* and *neighbours* but a decreased likelihood of obesity for social capital elements, *transport, leisure, helpful, trust*. Furthermore, there was a decreased likelihood of obesity for those in the top two income groups (income 3 and 4) when these were compared to the lowest income group (<£10,655). There was also an increased likelihood of obesity observed when comparing social class groups (1), (2) and (3) to the unemployed group.

Interestingly in the additional analysis for the Yorkshire and the Humber region, this showed regional differences existed across Yorkshire and the Humber for social capital, income, and social class:

Yorkshire and the Humber showed a significant increase in likelihood of obesity when looking at all three social class levels compared to the unemployed. However, there was a decreased likelihood in obesity for the social capital measure trust.

Social capital elements: groups and organisations, teens, vandals, shops, and advantage produced no significant effect in likelihood of obesity nationally and Yorkshire and the Humber.

6.4. Study 1 discussion

These findings suggest that higher levels of income reduce the risk of being obese, this is reflected nationally for England. As those with lower incomes live in poorer areas that experience social and health inequality, the people living in these areas will be at greater risk of obesity compared to those with higher incomes living in more affluent areas.

The social capital elements:

1. This area is a place where **neighbours** look after each other.
2. This area has good **leisure** things for people like me.
3. This area has good local **transport**.
4. This area is a place I **enjoy** living in.
5. The problem of teenagers hanging around on the **streets.**
6. Problem **vandalism**, graffiti/deliberate damage to property.
7. Ease of getting to the **supermarket.**
8. Ease of getting to the **post office.**
9. Do people try to be **helpful**?
10. People take **advantage** of you.
11. Can people be **trusted**?
12. **Groups** or organisations (combing group membership questions).

An increased risk of obesity is shown for the two social capital elements; *enjoy where you live* and *a place where neighbours look after each other*. At first, this appeared to be the opposite of what might be expected for areas linked with an increased risk of obesity. One hypothesis could be that the perception of where someone lives can be very different for the person living there compared to someone viewing that area from the outside. Those in poorer areas can still enjoy where they live, both inside their home and out, one explanation for this could be that people are often considered *'creatures of habit'*, defined as *'someone who always wants to do the same things in the same way'* (Cambridge Dictionary , 2023). This may suggest that people

enjoy what they are used to, so living in a particular location and being used to those surroundings, shops, work environments, friends and family could make the area an enjoyable place to live overall.

However, to speculate, those living outside the area may consider that *'enjoyable'* place, a not very desirable location and not want to live there themselves. Additionally, the deprivation index may classify an area as highly deprived, but if that is something that people are used to, they may still find that place an *'enjoyable'* place to live.

Furthermore, the data showed that those living in a place *where they felt that neighbours looked after each other* were at an increased likelihood of being obese. In poorer areas there is less likely to be a large amount of green space, and instead further housing takes this space. In these locations, this would mean that housing would be smaller and closer together (Hay B. , 2022); (McIntyre & Gayle, 2022). This potentially gives people more opportunities to come in to contact with their neighbours for example, taking in parcels and crossing paths when coming in and out of the house, in a way that more affluent locations with larger amounts of space between neighbours would not. This could also fall under the *'Proximity Effect'* which is related to the amount of time and contact people have with each other (Festinger, Schachter, & Back, 1950). Positive correlations have been shown between the amount of time spent together and friendships, this may explain the feeling that neighbours look after each other.

In contrast, evidence in Sweden suggested that getting on with your neighbours was positively associated with reducing obesity (Björk, et al., 2008). A systematic review of the relationship between neighbourhood social capital and obesity found some association exists (Carrillo-Álvarez, Kawachi, & Riera-Romaní, 2019). However, this was dependent on the measures and covariates used in the study design, Carrillo-Álvarez et al (2019) concluded that further work in this area is required.

This appears to suggest that cultural differences apply and could be in place at a lower level, for example LSOA and post code levels in England.

The analysis showed that on a national level for England, all levels of social class indicated an increased likelihood of obesity when compared to those that were unemployed. Further work is required in the area of social class to determine why this may be. It is possible this could be an example of the perceptions of social class changing. Jobs and social class have evolved over the years. In the past professionals such as teachers would be considered middle class, however now when compared to a footballer (originally considered working class) they would take home much less income. Younger generations are now considering social class to be linked to levels of income and not social status as previously seen in older generations (Chakelian, 2022); (Biressi & Nunn, Class and Contemporary British Culture).

A decreased risk of obesity is shown for those with *good local transport*. Again, this can be attributed to more affluent areas, such as town and cities with good road, bus, and rail networks. Good transport gives people the opportunity to gain further and better education, work further away due to increased career paths and gain higher incomes.

In contrast, the South West, South East and London have good transport links (roads, rail, airports, and ferries) increasing the populations opportunity to have better employment, increased income, and leisure opportunities (Better Transport, 2015). This could create a two-tier system with the *'haves'* (those with high social capital in towns and cities) and the *'have nots'* (those with low social capital) living two very different lives.

Do people try to be helpful and *can people be trusted* both decreased the likelihood of obesity.

Wu, et al (2018) found that network diversity and generalized trust were associated with a lower risk of obesity. However, individuals with a higher number of social ties

had a greater risk of being obese. This raises complex cultural differences across the world and the impact these will have on an individual's social capital. Xue & Cheng's (2017) findings showed an association between *social trust* and a lower likelihood of obesity. However, they also found harmonious social relationships were associated with a higher risk of obesity.

The social capital and obesity study conducted by Poortinga et al (2006) in an England population, found *social trust* did produce an association with obesity, but in an opposite way to what would be expected. In contrast, people had higher levels of trust, they were at a lower risk for obesity, in findings by Carrillo-Álvarez et al (2019). These findings again varied depending on the other elements of social capital measured.

England is unique in its national and regional makeup, often with rich areas within a small distance to poorer areas, in villages, towns and cities. However, as Marmot reports, the health gap between the richest and poorest is getting wider across communities in England (Marmot, 2020).

Regional differences are seen in social capital, this may not be unexpected, as Marmot previously found differences in social inequality, with life expectancy in the North East to be lower than the richest areas of London (Marmot, 2020).

On this basis, the reduction of opportunity and income in some areas, for example, areas by the coast that rely on seasonal work, historically coal mining or steel manufacturing areas, would be more likely to be areas of high deprivation. With the findings in Study 1, low-income levels would mean that these types of area would be more likely to be areas with high levels of obesity.

6.4.1. Study 1 - Methodological Strengths and Limitations

The area of social capital is a new concept with no currently agreed upon definition (Kawachi, Kim, Coutts, & Subramanian, 2004). This is overcome by the analysis of the key concepts within social capital shown in Figure 3-4. Currently the area of social

capital is limited there is no agreed approach that can be replicated. However, the dataset contains body measurements, socio-economic measurements, together with social capital questions that are recommended by world-leading social capital researcher Kawachi (Kawachi, 2008). Although not a validated measure, there is no agreement on what should be measured and therefore the measure used here is comprehensive.

A further limitation comes with secondary analysis of existing data set rather than bespoke questions. By contrast to this, large numbers within the data add strength to the analysis with the data collected by a trusted source survey data is sponsored by the Information Centre for Health and Social Care and the Department of Health. The survey questions used in HSE ask people's perceptions of whether they enjoy where they live. On occasion people can say they are proud of where they live, but behind closed doors be unhappy with the area. This is a downside of self-report surveys (Northrup, 1997).

The study is cross-sectional making it difficult to draw inferences about the direction of the relationship. It is unknown whether being overweight or obese could influence social connections. However, obesity at the higher level of BMI scores may increase isolation that could limit participants engagement with social groups (such as: Men/Women's groups, charity, voluntary, community, sports clubs, gym, exercise, dance, environmental group etc.)

In contrast to other studies a strength of the study is the HSE employs questionnaire-based answers with physical measurements of height and weight overcoming any possible issues around self-reporting for these measures. An interview with each eligible person in the household is followed by a nurse visit (Higgins & Marshall, 2012).

SES is examined within the study. However, additional factors you such as employment, marital status, medical conditions, parental history and feeding practices may be interesting to control for. This could be better achieved with a

prospective study, across lifespan. This would evaluate the development into obesity by people who were not initially obese, as well as the development into weight loss by people who were initially obese. Given the age at which people start to become overweight, participants might need to be recruited at a young age such as childhood or Adolescence which makes such a study difficult to do and is outside the scope of the present study. The mean age of participants is 47 years of age, with the onset and social circumstances prior to the onset of becoming overweight and obese unknown. However, the present study can inform which measures might be included in a future prospective study.

6.4.2. Study 1 Conclusion

In conclusion, these findings confirm that the level of social economic status impacts the risk of becoming obese. However, the level of social capital has an independent impact on that risk. The picture is mixed with some aspects increasing the risk, while others decrease the risk of obesity.

7. Chapter 7 – Study 2: The RIO

As discussed earlier, a key element of this thesis is an evaluation of a Tier 3 obesity intervention in Rotherham, a highly deprived area of the UK with a high prevalence of obesity. This Chapter describes and evaluates this intervention. The rationale is provided elsewhere (Chapter 4) so this Introduction describes the intervention and other treatment features.

Study 2: RIO Tier 3 Weight Management Centre

The Rotherham Institute for Obesity (RIO) programme was a 6-month tailored programme (RIO NHS, 2015). As part of the programme service users had multiple types of body measurements taken at each appointment during their time on the programme, these are as follows.

- Height
- Weight
- Body Mass Index (BMI)
- Index of Central Obesity (ICO)
- Waist circumference
- Full bio-impedance (fat mass, fat-free mass, visceral fat, bone mass, muscle mass, fluid)
- WHO-5 Self-report instrument measuring mental well-being

Weight measurements were taken using specialist equipment which captured full bio-impedance, identifying specifically the weight of muscle, fat, bone, and fluid.

Clinical manager at RIO believed that to get the most detailed picture of the issues presented was by using multiple body measurements (Capehorn D. M., 2016). The benefit of monitoring all the body measurements consistently meant that RIO staff could focus on any positive achievement during the process to encourage and motivate the service user to keep achieving their individual goals.

7.1. First appointment at RIO

During first appointments, everyone had their body measurements taken along with their well-being (WHO-5) scores. The RIO process was discussed, detailing what would be involved over the coming months, along with starting the education process by explaining food intake and how to understand food labels. During the programme, everyone was taught about "*per cent of daily values*" that are displayed on the food labels of most items available in shops. This per cent is based on an "average person" defined as a female eating 2,000 calories and a male 2,500 calories per day. However, those on the RIO programme were above "*average*" and may have needed more or fewer calories than 2,000/2,500 respectively to lose weight (Boyden C. , 2016); (RIO NHS, 2015).

RIO used a calculation based on height, weight, age, sex, and level of physical activity to get the rate of calories required to lose weight and still eat healthily for each service user (RIO NHS, 2015). The Basal Metabolic Rate (BMR) is the amount of energy (calories) a body needs while resting (Harris & Benedict, 1918). This accounts for about 60% to 70% of calories burned in a day. In general, men have a higher BMR than women.

One of the most accurate methods of estimating basal metabolic rate is the (Harris & Benedict, 1918) Equation 3:

Adult male*:*

66 + (6.3 x body weight in lbs.) + (12.9 x height in inches) - (6.8 x age in years) = BMR

Adult female:

655 + (4.3 x weight in lbs.) + (4.7 x height in inches) - (4.7 x age in years) = BMR

Equation 3: Basal metabolic rate equation by (Harris & Benedict, 1918)

Calories Needed to Lose Weight

Everyone on the RIO programme was taught that there are approximately 3,500 calories in a pound of stored body fat (Boyden C. , 2017). As a result, if 3,500 calories are subtracted each week through diet, exercise, or a combination of both, this would lead to losing one pound of body weight per week (On average 75% of this is fat, 25% lean tissue). If a 7,000-calorie deficit is made an individual will lose two pounds and so on (Boyden C. , 2017). Those on the RIO programme were free to choose the way a calorie deficit could be achieved, either by calorie reduction alone, reducing calorie intake daily, saving calories each day for a treat, or having two very low-calorie days to get back those days where calories have been over the amount; or by a combination of eating less and moving more (RIO NHS, 2015). But everyone had to aim to maintain the calorie rate calculated for them, either daily or weekly and in a consistent way. This combination of healthy eating and physical activity is best for achieving and maintaining a healthy weight.

7.2. Follow up appointments at RIO.

The Rotherham Institute for Obesity (RIO) programme took place over a 6-month period and used a tailored approach to cater to service users individual requirements (Capehorn D. M., 2011); (RIO NHS, 2015). The programme included nutritional advice for a healthy diet, cooking skills and tailored advice for physical activity and a healthy lifestyle. RIO also had an on-site gym and an exercise therapist who offered personal training and bespoke exercise programmes for all levels of obesity. Further support available from RIO included behaviour change advice from trained obesity nurses and talking therapists to allow for sustained lifestyle improvements. As well as this each person on the programme had access to a Cognitive Behavioural therapist, to work alongside the weight loss advice to help with behaviour change and wellbeing improvement (Capehorn D. M., 2011).

At each follow-up appointment (4 weeks, 8 weeks, 12 weeks, and 6 months), all body measurements were retaken. Furthermore, well-being (WHO-5) surveys were re-taken after 12 weeks and 6 months (RIO NHS, 2015). This allowed the RIO team to monitor the progress each person was making and overcome any issues that may arise.

The measurements that were taken at each appointment:

- Weight
- Body Mass Index (BMI)
- Index of Central Obesity (ICO)
- Waist circumference
- Fat mass
- Fat-free mass
- Visceral fat
- Bone mass
- Muscle mass
- Fluid

- Blood Pressure

This meant that RIO specialists could monitor in detail the progress being made by each service user (Capehorn D. M., 2011). If for example a person *"gained weight"* at one appointment, the specialist could look at the previous scores which may have shown muscle mass had increased and waist circumference had reduced (Boyden C. , 2017). So instead of just observing a negative from the scales, a non-scale victory would have been shown, and this would have helped the service user to experience the positive enforcement of the work being done by the programme. This encouraged service users to keep going and overcome potential knocks along their road of weight loss.

7.2.1. Study 2 Aims

Although there are treatments that can reduce weight, these are often effective only in the short-term and use a limited range of outcome measures. Furthermore, evaluations of treatments have generally not considered the socio-economic context, in spite of the fact that socio-economic status and social capital may be important factors in obesity.

As discussed in the earlier chapter lower levels of socioeconomic status have been shown to have the consequence of inequality in turn producing a drop in the standard of health. This is shown in those living in highly deprived neighbourhoods often experiencing poorer health when compared to people living in the richest neighbourhoods. What is currently not fully understood is the effectiveness of a tier 3 weight management centre reducing obesity in an area of low socioeconomic status (level of income and social class) and high levels of obesity. No claim is made in relation to individuals' SES or social capital, merely examining the effect of intervening in an area of high deprivation.

Therefore, the Aim of this study is to investigate a tier three weight management centre that is situated in a highly deprived location in the north of England.

[In terms of the tentative model described in the Introduction, the aim of this study relates to the factors involved in weight loss]

Study 2 – Research question: Can a tier three Weight Management service reduce levels of obesity and improve well-being in an area of England with high levels of deprivation?

7.2.2. Design

This study used a retrospective quantitative approach, on the Rotherham Institute for Obesity (RIO) data set. The information was collected by the RIO weight management centre for people attending the service between 2009-2015. This information was collected at each appointment by a member of the RIO team (Team, 2016). Over time the same consistent information was collected, height, weight, waist circumference and well-being scores. Further information and questions were added by the service to the data collection process, this included sex, year, ethnicity, illness, exercise, and body measurements.

7.2.3. Procedure

Data collection

The team at the Rotherham Institute for Obesity (RIO) recorded all the information for each service user attending appointments over time into an Excel spreadsheet. To attend the service each person had to be classified as obese by having a BMI >30. There were two methods of referral to RIO, from a GP or a self-referral could be made before an assessment took place making sure the person met the BMI>30 levels.

The information included within the data sets included Age, Sex, Height, Weight, Waist size and a Health questionnaire (WHO-5) (World Health Organisation, 1998); (Measure Wellbeing, 2017).

The information was manually inputted by each member of the team as and when required into an Excel spreadsheet. The RIO team explained the risks and issues around the data they had, during which time the researcher was also able to develop my working relationships with the RIO team and teach the RIO team more efficient ways of recording data using examples from other work I had undertaken at the health service for clinical research.

As a result of multiple people entering data over a period of six years, a few spelling mistakes, and capitals being used when they should be lower case for example. Further errors and inconsistent variable entries occurred as the service had developed different short-time research questions that data was collected for. Working with the RIO team these minor issues were resolved, with all the information collected being of an excellent standard.

7.2.4. Data Preparation

Six separate years of service user's data were collected by the RIO team within Excel spreadsheets. At each appointment, attendees were weighed, measured, and completed a WHO-5 questionnaire (Measure Wellbeing, 2017); (World Health Organisation, 1998). The information held within the spreadsheet was non-identifiable data, with any identifiable information excluded.

During meetings at RIO, the team explained that they had issues with recording data in the early days of the service (Team, 2016). However, over the years they had improved this and missing data had been reduced. A further issue was raised regarding the Tanita measuring device (shown at 17 seconds in this video clip (QTV, 2011) that RIO had, this device recorded 32 weight measurements that could be used for health intelligence modelling. On further inspection of this device, the RIO team explained that they did not save this data digitally, they instead printed off a paper version that was then placed into the service users GP notes making this unavailable for the sample to be collected by RIO (Team, 2016) (Appendix 11.7). The digital version of this information would have allowed for more sophisticated modelling and

analysis. Work was underway to gain this information through extra funding, however the service closed, and only basic information was available.

The six separate years of datasets required merging and a degree of data cleansing to check that none of the information held was corrupted or contained errors. This included making sure string and numeric variables were correct and not in the wrong columns. Each variable name was matched to other corresponding variable names, that had been used over the six years, to be merged where appropriate. In each of these variables, the data was checked for any corruptions (strings changed to numeric) and consistency across datasets. When an issue arose, for example, a too-high BMI of 165, the RIO team were contacted to check that element of the dataset and correct any human errors made. Any corrections carried out were made clear in the data dictionary (Appendix 11.6).

Once the six years of datasets were merged to build one large dataset, again, care was taken to make sure the variable names were consistent, any labels matched up with the other years and each spreadsheet was saved in the same format. Once any issues were overcome the merge of the years was complete.

A new variable was created, coding whether a service user was a first referral service user (Group 1) or a multiple referral service user (Group 2). This meant that analysis could be conducted to determine whether the programme was successful in both circumstances.

A re-coding of sex was also made with the string version of the variable removed. The dates were updated to a consistent format across the dataset. New variables were computed, using attendees' height and weight measurements, and BMI scores were calculated for each appointment. Changes in BMI, weight loss, waist measurements and questionnaire scores were also calculated from baseline to the different appointments.

Finally, well-being scores were calculated using the World Health Organisation (WHO) Five Well-Being Index (commonly known as the WHO-5). The WHO-5 is a short self-reported measure of mental well-being (World Health Organisation, 1998) (Measure Wellbeing, 2017) which consists of five statements:

1. I have felt cheerful and in good spirits.
2. I have felt calm and relaxed.
3. I have felt active and vigorous.
4. I wake up feeling fresh and rested.
5. My daily life has been filled with things that interest me.

Service users give a personal rating between 1-5 for each statement on the scale below (concerning the most recent two weeks).

- All the time = 5
- Most of the time = 4
- More than half of the time = 3
- Less than half of the time = 2
- Some of the time = 1
- At no time = 0.

The total raw score, ranging from 0 to 25, is multiplied by 4 to give a final score, with 0 representing the worst imaginable well-being and 100 representing the best imaginable well-being (World Health Organisation, 1998). The WHO-5 does not require any permission for usage and is free of charge, therefore this scale was used widely across health services (CORC Child Outcomes Research Consortium, 2020).

7.2.5. Study 2 Data Analysis

Each RIO service user with a BMI>30 was classified as obese, their body measurements were recorded at each assessment, the initial analysis produced descriptive information for the RIO population, as shown in Table 7-1.

The clinical key performance indicator for RIO was set by the local commissioners, this was the target for service users to reach a minimum of 5% loss of excess weight at 6 months. Service users who did not meet the 5% loss of excess weight target were considered *"failures"* by commissioners.

However, it was important to conduct analysis of the changes in body composition that may convey health benefits. RIO concluded that alternative KPIs should also be considered when assessing *"success"* for service users (Walker, Steele, Kaill, & Capehorn, 2013). Keeping this in mind, further analysis is broken down by BMI categories, displayed using a line graph for each measurement point across the RIO programme. The analysis is testing the effectiveness of the RIO methods by looking at the percentage differences in weight loss, waist circumference, BMI, and WHO-5 at each measurement period conducted by the RIO team.

The data will be investigating whether RIO service users are losing weight using multiple body measurements at each stage of the course of treatment. This is consistent from baseline to 4 weeks, 8 weeks,12 weeks and 6 months using paired t-tests.

Continuous values in the text and tables are presented as mean (Standard Deviation; SD) and categorical data as percentage (N =), unless otherwise stated. Differences between baseline programme measurement point and programme re measurements were compared by paired sample t-tests. Therefore, for each comparison, we only compared those with observations at both time points, overcoming missing data (Simkus, 2022); (Field, 2013). The criterion for statistical significance was $P < 0.05$.

This method of data analysis also allows for some consistency across other analyses that have been conducted across tier 3 services who also used paired t-tests Jennings et al (2014). Further comparable methods were used to measure the success of a Norfolk tier 3 weight management programme using a KPI of 5% loss of excess weight, from baseline to subsequent measurements, consistent with Brown et al,

(2017) and Alkharaiji, et al (2019) systematic reviews of tier 3 weight management centres in the UK.

A post hoc Bonferroni correction test was undertaken to control for type 1 errors (Haynes, 2013); (Weisstein, 2004).

The service users' wellbeing scores recorded using the WHO-5 scores from baseline measurement to end of the programme was analysed to determine if these scores are improved in an area with high levels of deprivation.

Additional Analysis:

Although not related directly to the research question, additional analysis of the available data provides useful information for service users at first referral and multiple referral to the RIO programme. This is achieved by splitting the data into two groups, first-time referrals (Group 1) and multiple referrals (Group 2), these will be used to determine if service users can still effectively lose weight with RIO in subsequent referrals over the time periods of baseline to 4 weeks, 8 weeks,12 weeks and 6 months.

The analysis is not comparing groups Group 1 and Group 2. Instead, the analysis will explore the differences between pre and in programme measurement points and post-programme measurements using paired sample t-tests from week 1 (Baseline) to measurement point. This analysis will be carried out separately for Group 1 (first referrals) and Group 2 (multiple referrals).

- Week 1 (Baseline) – Week 4
- Week 1 (Baseline) – Week 8
- Week 1 (Baseline) – Week 12
- Week 1 (Baseline) – 6 Months

Post hoc Bonferroni tests are then untaken to control any type 1 errors made during the analysis. This is achieved by adjusting the p value, as required using the Pearsons 2 coefficient.

The results are further split by BMI categories to show the differences across the different categories of service users attending RIO. The line charts give a visual representation plotting the results.

As the data is collected from an above-average obese population of patients, it could be that the data may have a skewed distribution, instead of a normal *'bell curve'* distribution. For this reason, the skewness of the distribution was calculated using Pearsons 2 coefficient. Anything with a coefficient between 0.4 and -0.4 are reported as normally distributed due to these being reasonable cutoffs for large samples (Doane & Seward, 2011). As a result, both parametric Means and Medians are reported. In any case where the Pearsons coefficient is between 0.4 and -0.4 (normally distributed) the means are to be used and are shown in **Bold** within the Tables. Where the data has a skewed distribution, Medians are to be used and are shown in **Bold**.

The Dependent Variables (DV) are:

- Weight
- BMI measurement (Doane & Seward, 2011)
- Waist circumference
- WHO-5 Wellbeing score

Analysis is conducted using SPSS (SPSS, 2017).

7.2.6. RIO Participants

Each participant with a BMI>30 was classified as obese. All participants attending a weight management programme had body measurements recorded at each assessment. There were 7,375 participants in total, 5,287 Females and 2,066 Males,

with BMIs between 30 and 93.5, Aged between 18 and 56 years old, a detailed breakdown of service users is shown in Table 7-1.

7.2.7. Ethics

Ethical approval obtained from the Health and Human Science Ethics Committee at the University of Hertfordshire is shown in Appendix 11.1 Study 1 and Study 2 ethics.

7.3. Study 2 RIO Results

The RIO sample under investigation in this chapter includes 7,353 individual appointments. Table 7-1 gives a detailed breakdown of attendees as shown below with age, sex, ethnicity, referrals, occupation, and BMI broken down.

Table 7-1: Descriptive characteristics of RIO service users

	Descriptive Characteristics	Female (n = 5,287)	Male (n = 2,066)	Total (n = 7,353)
Age	Mean (SD)	46.40 (36.46)	51.07 (12.91)	47.71 (31.73)
Ethnicity	African	19	5	24
	Asian or Asian British – Bangladesh	2	1	3
	Asian or Asian British – Indian	28	13	59
	Asian or Asian British – Other	12	3	15
	Asian or Asian British – Pakistani	158	48	206
	Black or Black British African	10	2	11
	Black or Black British Caribbean	5	2	7
	Black or Black British Other	3	1	4
	Multiple Heritage – Asian and	2	3	5
	Multiple Heritage – Black Africa	1	0	1
	Multiple Heritage – Black African	1	0	1
	Multiple Heritage – Black Caribbean	2	0	2
	Other – White	1	0	1
	Other Ethnic Group	10	3	13
	Other Multiple Heritage	4	2	6
	Other White	45	13	58
	White – British	4,970	1,967	6,615
	White – Irish	14	3	17
Referrals	Group 1 (First referral)	3,390	1,290	4,680
	Group 2 (Multiple referrals)	1,897	776	2,673
BMI	Mean (SD)	42.03 (7.57)	41.71 (7.51)	
	Waist Size (cm)			
	Mean (SD)	118.36 (15.03)	131.07 (15.90)	
	Height (cm)			
	Mean (SD)	162.17 (6.92)	17.93 (7.59)	

Of the total 7,353 referrals, 4,680 were a RIO service users first referral. Further referrals are shown in Table 7-2. Group 1 (first referrals) consists of 4,680 service users, service users with further referrals (multiple referrals) were grouped together to make Group 2, consisting of 2,673.

Table 7-2: The frequency and percentage breakdown for the number of referrals at RIO

No. of referrals	Frequency	Percentage (%)
1	4,680	63.6
2	1,663	22.6
3	636	8.6
4	238	3.2
5	88	1.2
6	33	0.4
7	12	0.2
8	3	0
Total	**7,353**	**100**

RIO's key performance indicator of a 5% loss of excess weight is shown in Table 7-3 below broken down by year. This showed that overall, 3,520 (48%) service users achieved at least 5% loss of excess weight from baseline and the 6-month end point of the RIO programme. This percentage was consistent over the years the programme was available, ranging from 44% to 51% of service users achieving success as defined by the RIO's programme.

Table 7-3: RIO success and fail rates (KPI - 5% loss of excess weight from baseline to 6 months).

Year	Fail (%)	Success (%)	Total (%)
2009	170 (56%)	135 (44%)	305 (100%)
2010	841 (52%)	780 (48%)	1,621 (100%
2011	841 (49%)	859 (51%)	1,700 (100%)
2012	757 (55%)	629 (45%)	1,386 (100%)
2013	589 (52%)	551 (48%)	1,140 (100%)
2014	508 (54%)	434 (46%)	942 (100%)
2015	127 (49%)	132 (51%)	259 (100%)
Overall	**3,833 (52%)**	**3,520 (48%)**	**7,353 (100%)**

Table 7-4 considers all RIO service users and shows that when compared to baseline there was a significant reduction in weight (KGs), BMI and waist circumference at each measurement point of the programme. This shows that RIO was successful in reducing weight in KGs, BMI and reducing waist circumference sizes.

Table 7-4: Body measurement changes for all RIO service users from baseline to measurement point by Mean (SD)

Measurement	Baseline	Week 1-4	Week 1-8	Week 1-12	Week 1 – 6 Months
Weight in Kgs	120.79	120.10	117.99	118.61	113.10
	(25.80)	(26.68)	(26.60)	(25.88)	(26.60)
		p<.001	p<.001	p<.001	p<.001
BMI	43.12	42.75	42.44	41.89	40.53
	(8.53)	(7.54)	(9.86)	(7.87)	(7.76)
		p<.001	p<.001	p<.001	p<.001
Waist	125.73	125.25	123.31	123.14	118.37
circumference	(16.58)	(17.75)	(17.26)	(17.58)	(17.02)
		p<.001	p<.001	p<.001	p<.001

To prevent data from being incorrectly assumed to be significant a post hoc Bonferroni correction was undertaken, suggesting that a significant result would now be a p-value less than 0.0125. this suggest that the results were for weight, BMI and waist circumference all remain significant.

The following analysis looks at the breakdown of body composition measurements and wellbeing scores for first referral and multiple referrals.

Service users Percentage Change in Weight

Table 7-5 shows the number of valid measurements recorded along with the number of missing data points for Group 1 (first referrals). The mean, median and standard deviation of the weight change are shown.

Table 7-6 shows the same set of results for Group 2 (multiple referrals). The mean and median are highlighted in bold for both Tables 7-5 and 7-6. Each column compares the percentage weight change between the baseline measurement (Week 1) and each repeated measurement (Week 4, 8, 12, and 6 months). A positive

percentage change in weight indicates a decrease in the weight being observed. This is broken down further by BMI categories as shown in a visual representation in Figures 8-1 and 8-2.

Table 7-5: Percentage change in weight (KGs) between each measurement - Group 1 first referrals

		Week 1-4	**Week 1-8**	**Week 1-12**	**Week 1 – 6 Months**
N	Valid	3,723	3,273	4,667	1,946
	Missing	957	1,407	13	2,734
Mean		**1.46**	**2.38**	2.32	11.56
Median		1.29	2.18	**1.70**	**5.97**
(SD)		(2.66)	(2.82)	(3.94)	(17.92)

The percentage change in weight between each measurement for Group 1 Table 7-5 shows that the sample size was large at 3,723, this was highest at the third measurement (12-weeks). Missing data was due to issues with the system in place used to record information, an unknown dropout rate can also be expected. The changes in the percentage change in weight show that weight loss began slowly but remained consistent across the first three measurements for group 1. Over the 6-month period the mean change in weight of all valid service users was a reduction of 11.56%.

Table 7-6: Percentage change in weight (KGs) between each measurement - Group 2 multiple referrals

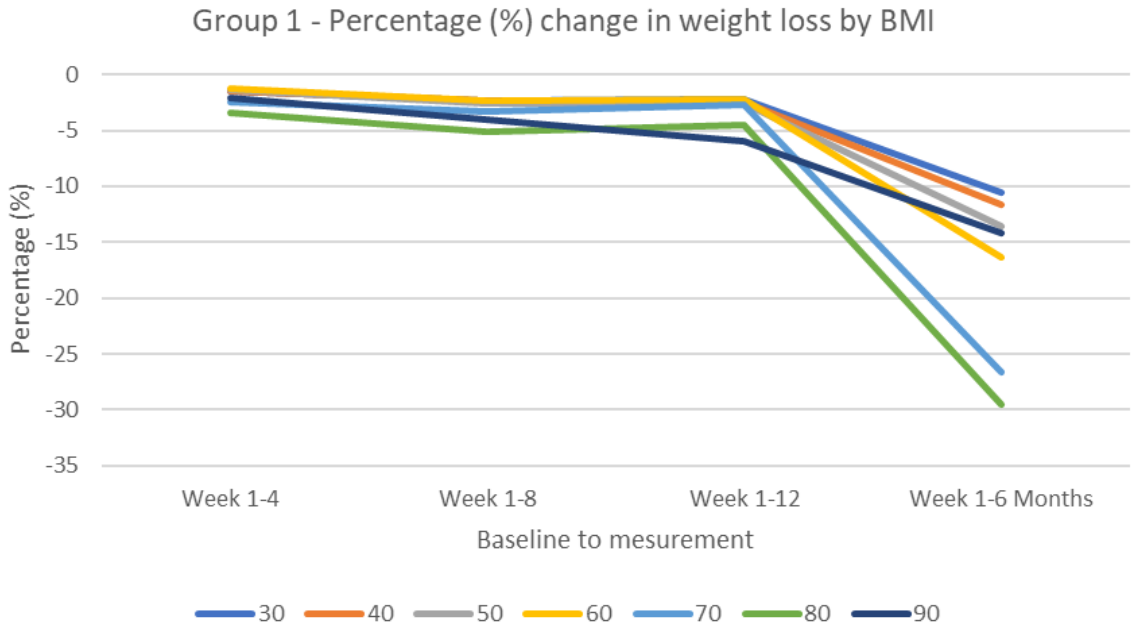
		Week 1-4	**Week 1-8**	**Week 1-12**	**Week 1 – 6 Months**
N	Valid	2,273	1,996	2,670	1,302
	Missing	400	677	3	1,371
Mean		**0.75**	**1.24**	1.28	11.38
Median		0.63	1.01	**0.59**	**4.33**
SD		(2.96)	(2.78)	(3.29)	(19.87)

The percentage change in weight between each measurement for Group 2 Table 7-6 shows a reduction in weight over time, this can be seen with both the mean and median scores from baseline to 6 months.

The percentage change in weight showed that weight loss was a slower process between baseline and 6 months but remained consistent across the first three measurements for Group 2. Over the 6-month period the mean change in weight of all valid service users was a reduction of 11.38 %.

This suggests that weight loss was successful for both first and subsequent referrals, making RIO a successful tier-three weight management service using non-invasive psychological, and educational interventions.

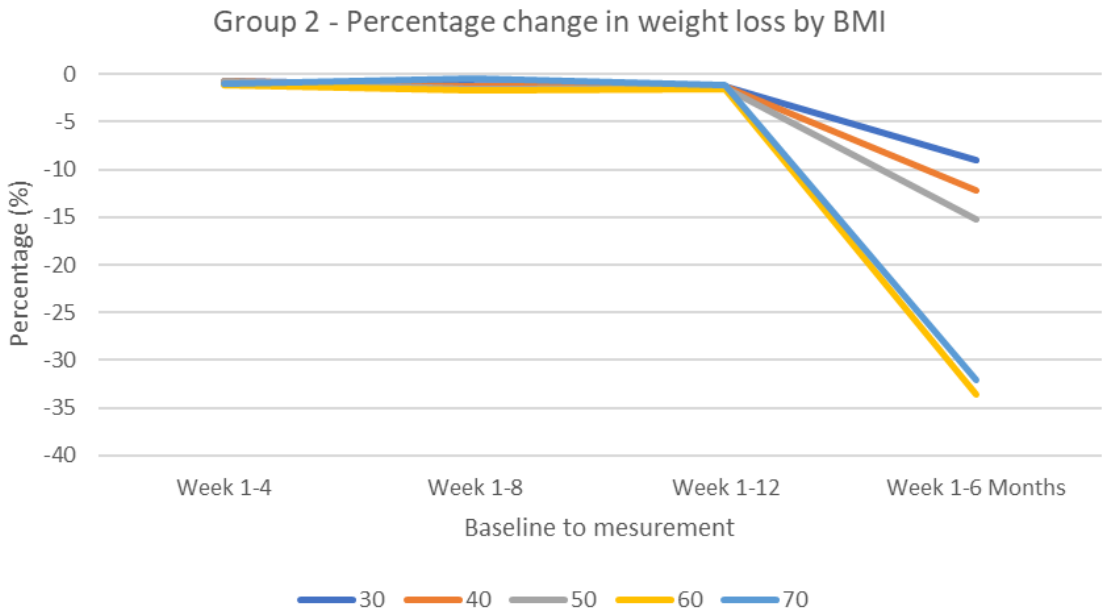
The results of this analysis are broken down further by BMI categories (30, 40, 50, 60, 70, 80 and 90) for Group 1 first referrals (Figure 7-1) and Group 2 multiple referrals (Figure 7-2).



All results are baseline to measurements point, for visual purposes a line chart shows this by broken down by BMI category. These results do NOT shown between group comparisons.

Figure 7-1: Percentage change in weight by BMI score for group 1 first referrals

Figure 7-1 shows that weight loss was being achieved from the start of the programme. Week 8 began to see the weight start to drop, however, by week 12 change in weight is clear. Each BMI category dropped; the green line showing BMI between 80-89 saw the largest drop along with service users with a BMI between 70-79, while the remaining categories of 30-39, 40-49, 50-59 and 60-69 all saw positive changes in weight at the 6-month measurement.



Missing BMI categories due to no service user measurements at these points

All results are baseline to measurements point, for visual purposes a line chart shows this by broken down by BMI category. These results do NOT shown between group comparisons.

Figure 7-2: Percentage change in weight by BMI score for group 2 multiple referrals

A similar trend was shown in group 2 (Figure 7-2). A change in weight loss began slowly from baseline to week 12 measurement. Again, after that measurement point, the percentage drop was greatest for the highest BMI categories of 60-69 and 70-79 at the 6 months measurement. The lower BMI categories 30-39, 40-49 and 50-59 also saw drops at the 6 months measurement point.

Percentage Change in service users' Waist Circumference

Service users at RIO had their waist circumference measured at the initial appointment, before again being remeasured at 4 weeks, 8 weeks, 12 weeks, and 6 months. Table 7-7 (Group 1) and Table 7-8 (Group 2) show the number of valid measurements recorded, along with means, medians, and standard deviations. The means and medians are highlighted within both Tables showing the mean percentage changes in waist circumference measurements between the baseline measurement (Week 1) and each repeated measurement. A positive mean score shown in Tables 7-7 and 7-8 indicates a reduction in waist circumference. This is broken down further by BMI categories shown as a visual representation in Figures 8-3 and 8-4.

Table 7-7: Percentage change in waist circumference between each measurement for Group 1 first referrals

		Week 1-4	**Week 1-8**	**Week 1-12**	**Week 1 – 6 Months**
N	Valid	3,740	3,267	2,800	1,942
	Missing	940	1,413	1,880	2,738
Mean		**0.77**	**2.60**	**3.39**	**5.38**
Median		1.12	2.48	3.33	5.38
SD		18.89	13.16	10.13	12.34

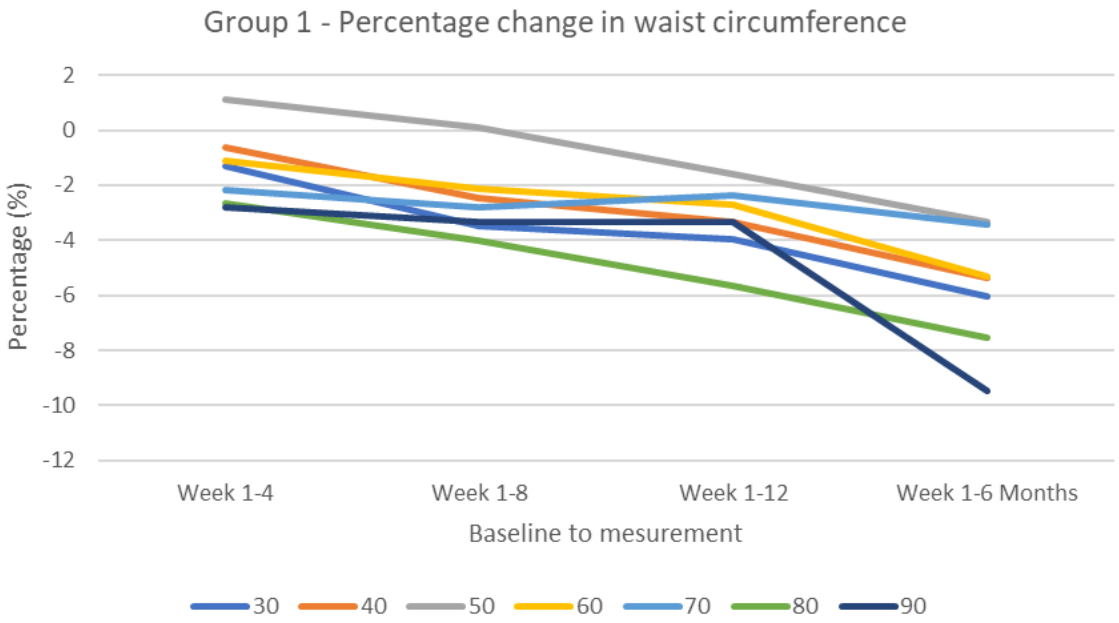
The percentage change in waist circumference between each measurement for group 1 is shown in Table 7-7 above. There is a consistent loss in waist circumference over the recorded time points. A large sample is recorded across all time points with the lowest reaching almost two thousand at 1,942.

Table 7-8: Percentage change in waist circumference between each measurement for Group 2 multiple referrals

		Week 1-4	**Week 1-8**	**Week 1-12**	**Week 1 – 6 Months**
N	Valid	2,248	1,994	1,773	1,297
	Missing	425	679	900	1,376
Mean		**1.10**	**1.92**	**1.43**	**3.33**
Median		0.68	1.30	1.61	2.91
(SD)		(4.96)	(6.47)	(21.13)	(5.01)

The percentage change in waist circumference between each measurement for group 2 is shown in Table 7-8 above. There is a consistent loss in waist circumference over all recorded time points. The biggest change in the first three measurements was in week 8. A large sample was recorded across all measurements with the lowest over one thousand at 1,297 at the 6-month measurement.

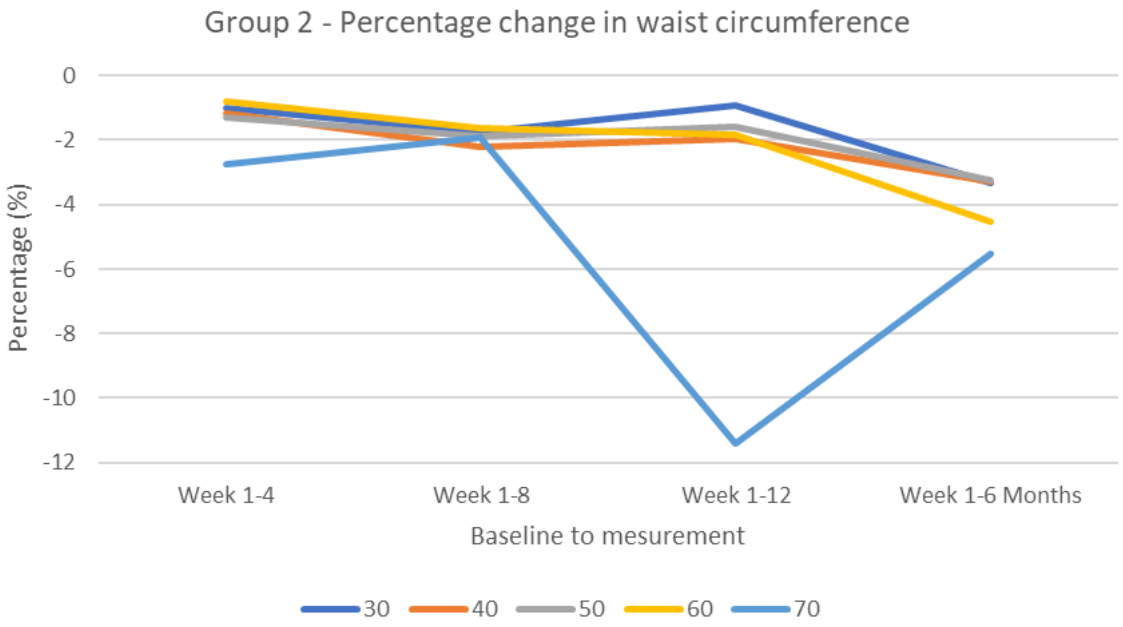
The results were broken down further into BMI categories (30, 40, 50, 60, 70, 80 and 90) for Group 1 (Figure 7-3) and Group 2 (Figure 7-4).



All results are baseline to measurements point, for visual purposes a line chart shows this by broken down by BMI category. These results do NOT shown between group comparisons.

Figure 7-3: Percentage change in waist circumference for group 1 first referrals

The percentage change in waist circumference broken down by BMI is shown in Figure 7-3. This shows that waist circumferences dropped across all BMI categories. The biggest drop is seen in the 90+ BMI category, initially a drop was observed, before a Plato at 8 to 12 weeks, then at this point waist circumference dropped significantly between 12 weeks and 6 months. Those within the 70-79 BMI category saw a drop, before seeing an increase between the 8- and 12-week measurements, then seeing a drop in waist circumference between 12 weeks and 6 months. BMI categories 50-59 and 80-89 saw almost a linear drop in waist circumference measurements. The remaining BMI categories of 30-39, 40-49 and 60-69 saw drops at a steady rate across the course of the RIO programme.



Missing BMI categories due to no service user measurements at these points

All results are baseline to measurements point, for visual purposes a line chart shows this by broken down by BMI category. These results do NOT shown between group comparisons.

Figure 7-4: Percentage change in waist circumference for group 2 multiple referrals

The percentage change in waist circumferences for group 2 is shown in Figure 7-4, no patients met the BMI categories 80-89 and 90+ as these people had lost weight in the previous referrals. BMI category 70-79 showed a slight increase at 8 weeks, and a large drop at the baseline and week 12 measurement: and then a smaller decrease in waist circumference at the baseline to 6-month measurement. This is due to the lower sample size in this category at the beginning of the programme, people from the 70-79 category reduced their waist circumference and moved down into the 60-69 BMI category producing what appears to be an increase, when in fact this is an overall loss. BMI categories 40-49, 50-59 and 60-69 saw a drop at each of the first two measurement points (weeks 4 and 8) before a Plato at week 12. After this those BMI categories saw a drop in waist circumference. The smallest BMI category of 30 saw a fluctuation across the measurements with a decrease at weeks 4 and 8, before a smaller decrease in waist circumference at the baseline to 12-week measurement and a larger reduction at 6 months. As mentioned earlier, this category was similarly

impacted by those in the 40-49 BMI category moving from that measurement to the 30-39 BMI category, before seeing an overall reduction.

The percentage change in service users' BMI scores

Service users at RIO have their BMI calculated at the initial appointment, before being remeasured and recalculated at 4 weeks, 8 weeks, 12 weeks, and 6 months. Table 7-9 (Group 1 first referrals) and Table 7-10 (Group 2 multiple referrals) show the number of valid measurements along with the number of missing data points; a mean, median, and standard deviation are also shown. The mean and median are highlighted within both these Tables for the percentage change in BMI score between the baseline measurement (Week 1) and each repeated measurement. A positive mean score indicates a reduction in BMI scores. This is broken down further by BMI categories shown as a visual representation in Figures 8-5 and 8-6.

Table 7-9: Percentage change in BMI scores between each measurement - Group 1 first referrals

		Week 1-4	**Week 1-8**	**Week 1-12**	**Week 1 – 6 Months**
N	Valid	3,746	3,273	4,667	1,946
	Missing	934	1,407	13	2,734
Mean		**1.43**	**2.38**	2.32	11.56
Median		1.32	2.18	**1.69**	**5.97**
(SD)		(4.02)	(2.82)	(3.94)	(17.92)

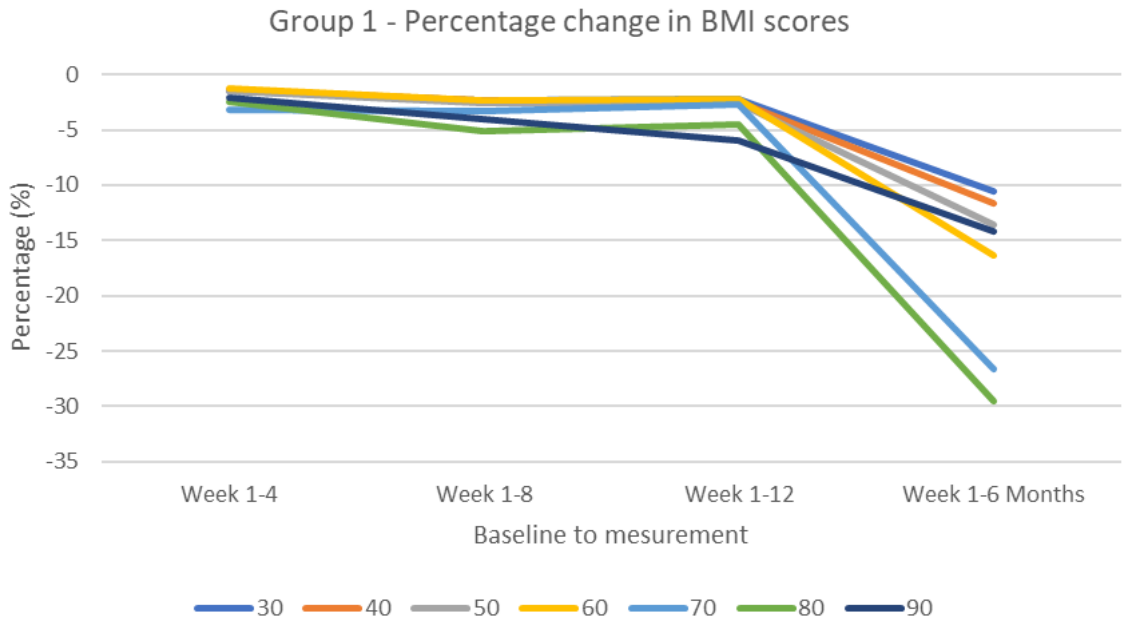
The percentage change in BMI scores between baseline and 4 weeks, 8 weeks, 12 weeks, and 6 months is shown for group 1 in Table 7-9 above. This shows a positive percentage change across all measurement points, meaning that at all points BMI scores were reduced. There was a large sample size across all the measurement points with the lowest just under two thousand, 1,946 at 6 months for group 1.

Table 7-10: Percentage change in BMI scores between each measurement - Group 2 multiple referrals

		Week 1-4	Week 1-8	Week 1-12	Week 1 – 6 Months
N	Valid	2,250	1,996	2,670	1,302
	Missing	423	677	3	1,371
Mean		**0.69**	**1.24**	1.28	11.38
Median		0.60	1.01	**0.59**	**4.33**
(SD)		(2.41)	(2.78)	(3.29)	(19.87)

Table 7-10 shows the percentage change in BMI scores between baseline, 4 weeks, 8 weeks, 12 weeks, and 6 months shown for group 2. This shows a slower rate of positive percentage change across all the measurement points. A large sample size across all the measurement points was seen.

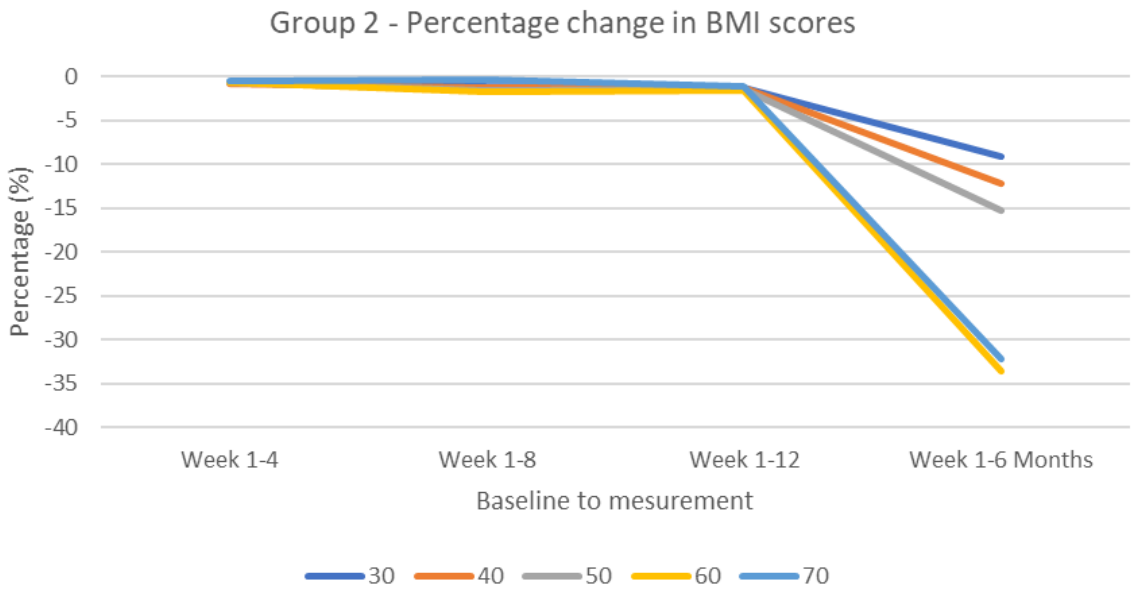
The results are then broken down further into BMI categories for Group 1 first referrals (Figure 7-5) and Group 2 multiple referrals (Figure 7-6).



All results are baseline to measurements point, for visual purposes a line chart shows this by broken down by BMI category. These results do NOT shown between group comparisons.

Figure 7-5: Percentage change in BMI scores for group 1 first referrals

The percentage change in BMI scores for group 1 first referrals is shown in Figure 7-5, all the BMI categories were covered for this measurement. BMI 70-79 and 80-89 saw a slow decrease in BMI until after week 12 measurement when at the 6 months point, they displayed the highest percentage change of all the BMI groups. The 90+ BMI category again had low numbers of service users within the category as these people had moved into the lower categories which helps to explain the lower percentage change observed in this category at the 6-month measurement. The remaining categories of 30-39, 40-49, 50-59, and 60-69 all saw a consistent rate of reduction in BMI until after week 12 measurement when greater drops in scores were recorded.



Missing BMI categories due to no service user measurements at these points

All results are baseline to measurements point, for visual purposes a line chart shows this by broken down by BMI category. These results do NOT shown between group comparisons.

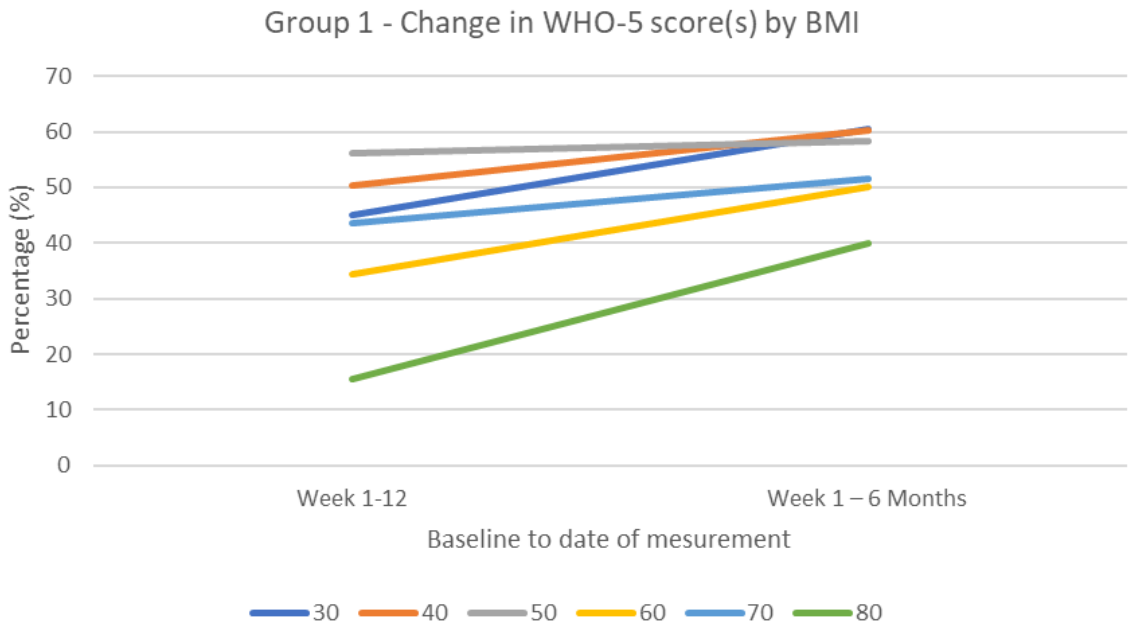
Figure 7-6: Percentage change in BMI scores for group 2 multiple referrals

As seen previously with group 1 first referrals, Figure 7-6 shows that group 2 multiple referrals saw a steady decrease between baseline and 4 weeks, 8 weeks, and 12 weeks before the largest decrease recorded after the 12-week measurement for 30-

39, 40-49, 50-59 and 60-69 BMI categories. The biggest change in percentage scores were seen in the 60-69 and 70-79 BMI categories, at the 6 months measurement point as also reflected in the small categories.

Percentage change in WHO-5 scores

Service users at RIO complete a WHO-5 questionnaire with the results calculated at the initial appointment, 12 weeks, and 6 months. Table 7-7 (Group 1 first referrals) and Table 7-8 (Group 2 multiple referrals) show the measurements scores along with the change score by BMI category between the baseline measurement (Week 1) and each repeated measurement. A positive score indicates an increase wellbeing score. This is broken down further by BMI categories shown as a visual representation in Figures 7-7 and 7-8.



All results are baseline to measurements point, for visual purposes a line chart shows this by broken down by BMI category. These results do NOT shown between group comparisons.

Figure 7-7: The change in WHO-5 scores by BMI categories for group 1 first referral

Figure 7-8 shows the percentage change in WHO-5 scores by BMI category for group 1 first referrals at RIO. The 80-89 BMI category had the lowest scores for

group 1; however, this did increase from baseline to 6 months. This was still the lowest of all the categories but a marked increase from the baseline. The 60-69 BMI category is the next lowest of the groups, seeing an increase in WHO-5 to the levels seen in the 30-39 BMI category at baseline. BMI categories 50-59 and 70-79 saw the smallest changes from baseline to 6 months, however, these groups also had higher existing levels at baseline. BMI category 40-49 had the second highest baseline score before increasing to the highest measurement at the 6 months point.

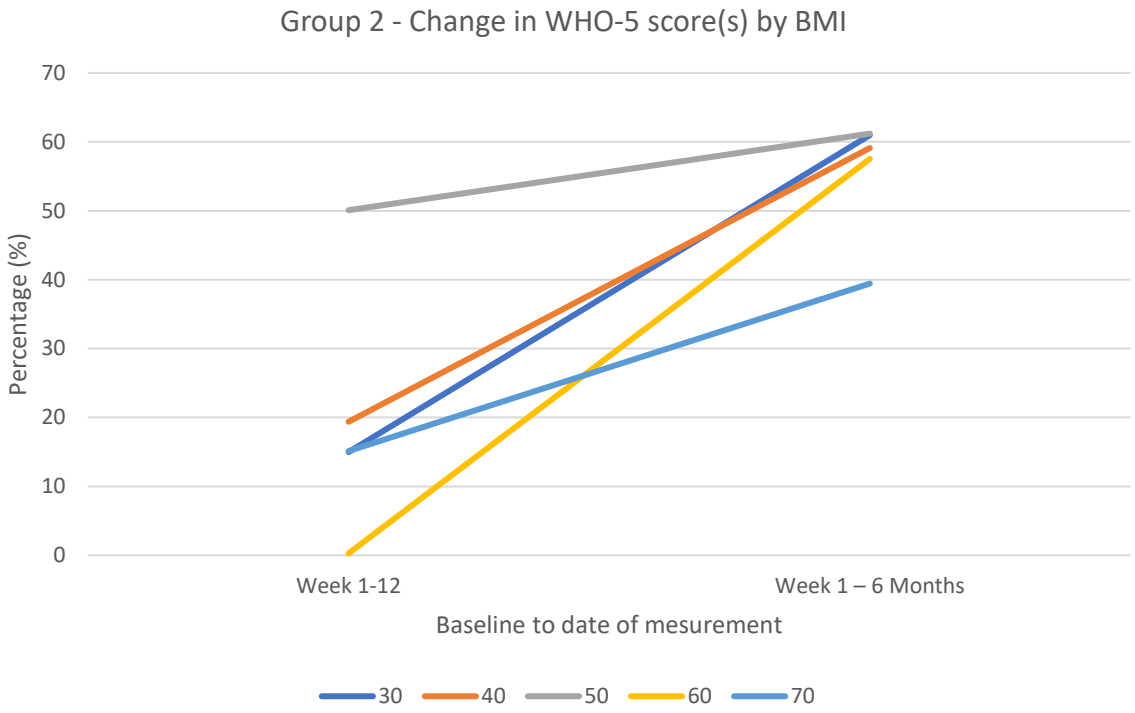


Figure 7-8: The change in WHO-5 scores by BMI categories for group 2 multiple referrals

All results are baseline to measurements point, for visual purposes a line chart shows this by broken down by BMI category. These results do NOT shown between group comparisons.

The change in WHO-5 scores by BMI category for group 2 multiple referrals shown in Figure 8-10 above. There was no 80-89 or 90+ BMI categories for this group as these people had moved down in BMI scores as mentioned in previous measurement sections. The 60-69 BMI category had the lowest baseline score, before reaching almost the highest scores overall at the 6-month point. While the highest BMI

category of 70-79 had the second lowest baseline score this score increased over the 6-month period increased, although this was the lowest increase observed of all the categories for this group. The lowest BMI categories of 30-39 and 40-49 showed a similar increase from baseline to the end of programme score at 6 months, these were the biggest increases outside of the 60-69 BMI category for group 2.

All BMI categories in both group 1 first referrals and group 2 multiple referrals showed a percentage increase in WHO-5 scores from baseline to the end of the RIO programme at 6 months.

7.3.1. Study 2 Results Summary

These results show that the RIO programme was a successful intervention for services users in Rotherham and surrounding areas, the RIO programme successful assisting service users to achieve effective weight loss and improving wellbeing scores in an area of high levels of deprivation.

RIO achieved its target of 5% excess weight reduction for 48% of service users, general weight loss, waist circumference decreases, BMI decreases and WHO-5 wellbeing score increases. These results were achieved across all BMI categories >30. The clinical lead at RIO considered a clinical success of almost half service users achieving the 5% target, especially as this is a challenging group of people to change in a relatively short time who had mostly tried, and failed with previous interventions, with a very high baseline mean BMI of over 40.

The RIO demonstrated successes during the programme, not only during the first referral, but these people maintained their levels before having further success in subsequent referrals. This is shown in Group 1 first referrals and Group 2 multiple referrals analyses across BMI categories.

- Service users lost weight with RIO.
- Service users reduced their waist circumference.
- BMI scores were reduced in RIO services users.

- WHO-5 well-being scores increased during service users' time with the RIO.

Service users in both Group 1 first referrals and Group 2 multiple referrals lost weight with RIO at a similar rate. This shows that weight loss was successfully achieved at both single and multiple referrals to RIO.

Additionally, RIO service users also successfully reduced their waist circumference both those in Group 1 first referrals and those Group 2 multiple referrals showed a reduction in waist size. However, RIO service users achieved a bigger reduction during their first referral to RIO. Service users with multiple referrals also experienced a reduction in waist size, although this was at a slower rate. As a result of these reductions in both weight and waist circumference, RIO service users' BMI scores also reduced. BMI reduction was greater at the Group 1 first referral; however, it was still achieved by Group 2 multiple referrals.

7.3.2. Study 2 Discussion

The RIO was situated in the town centre with a catchment area of Rotherham and surrounding areas. The town centre of Rotherham has an overall rank of the 13th lowest out of a total of 194 LSOAs in Rotherham (shown in chapter 5).

Overall, three-quarters of the city centre (Boston and Castle ward) residents live in the most deprived 30% of England.

Taking this highly deprived area, we can assume by proxy that individuals in this location of Rotherham will experience lower levels of social capital, lower income, and lower social class. As mentioned earlier, it is agreed that social capital is formed from different elements which produce and affect levels of social capital being experienced by individuals. Socio-economic status often reveals inequities such as access to resources, along with issues relating to privilege, power, and control (National Institute of Health, 2022). Low-income and social class link and cause effects to produce a level of social capital experienced by an individual.

The results show that over the course of RIO's six-month programme almost half of service users achieved the clinical KPI of 5% loss of excess weight. This achievement was reflected across other body composition measurements, with service users reducing their waist circumference and BMI scores, while improving their wellbeing scores via the WHO-5 survey. These trends were observed across all BMI categories, and wellbeing scores were maintained and then continued to improve from those service users that went on to subsequent referrals (Group 2). All of this was able to be achieved despite service users living in a highly deprived area. The RIO programme was a successful intervention in assisting patients to achieve effective weight loss and improve well-being.

As detailed in Chapter 4 section *'The RIO Programme'*, Although not designed as social capital intervention, the RIO treatment does, in fact, include elements that could be seen as social capital. This will be considered in more detail in the Discussion. A side benefit of the RIO programme may have been the indirect building of social capital elements, for example resources (education), relationships (encouraging), co-operation, community, and networks. Three of the key parts of RIO programme were educating, encouraging, and creating a community.

Educate

One of the key elements for those attending RIO was the education process. Service users were taught about the things they eat, the number of calories in foods and how much their body needs. Importantly, RIO made it clear that no food was off limits, they were just given a certain number of calories that their body needed to ensure an outcome of steady weight loss. Service users were told that this could be spread out across days or a week. This gave people freedom of choice without feeling like they were unable to have something they enjoyed. Moderation became key with people being empowered to make their own improved choices. One example RIO used was that you could eat a room full of salad or vegetables, so there was no need to ever think you would be hungry or starve.

Encourage

The psychological support achieved from encouragement given to service users by the RIO team was very important. Weight loss is not a linear process, often weight measurements depend on the time of day, when food has been eaten the day before and menstrual cycles for women. Therefore, it was important that RIO focused on the positives during measurements. Someone may not have lost weight (kgs), or as much as they hoped, but the other measurements could be explored and they may have lost centimetres from their waist circumference, be more hydrated than the previous measurement, and lost some percentage of body fat. If service users were attending the onsite gym this would also be celebrated along with muscle gains. All measurements were celebrated, and appropriate support was given when needed. Small amounts of progress and changes in behaviour are all important factors in the weight loss process.

Create community.

A further element of the RIO was helping to create a community that supported each other in their efforts to lose weight. This included providing sessions for group cooking, showing service users new recipes that they could take home and pass on to others. This helped to empower and create support within the community network. This was not planned as a social capital type intervention, as at the time RIO did not realise that they were creating social capital by doing this.

However, creating a safe space for service users, encouraging group participation exercise by going for walks and attending a gym, this would have a positive impact on increasing confidence and developing positive relationships and trust between service users of RIO and in turn the Rotherham community.

7.3.3. Study 2 - Methodological Strengths and Limitations

RIO was one of only a handful of tier 3 weight management services across England. There is no uniform structure for these services, many are developed using the

resources available by the creators of the service without being written up and published for others to follow. The closest service to RIO is based in Norfolk. Norfolk has a much older population and is very rural which is not completely comparable to RIO that is based in a busy town (near the city of Sheffield) but highly deprived area.

A methodological limitation for the present analysis was found during meetings at RIO, the team explained and demonstrated that they had a Tanita body scanning machine (Appendix 11.7). This machine recorded 30 different body measurements each time a service user stepped on at each appointment. This is where the RIO team took the body measurements figures from to add to their own records and which have been used in this research. Unfortunately, instead of connecting a USB drive to save all this information; RIO manually record the limited number of the measures captured with the Tanita machine into a spreadsheet and printed off a paper copy of the Tanita data form (Appendix 11.7 sheet on right) to place in services users' individual medical notes.

If, the Tanita information had been saved digitally, a more sophisticated analysis of the information would have been undertaken. Before the closure of RIO, a bid to get this information collected was attempted. However, this information remained unavailable for this thesis as RIO closed in its original form. As a result, it was also not possible to direct the nature of social capital questions as the researcher would have liked, as well as monitor the quality of the data collection and data entry.

The original plan for the study design was a randomised control trial, this was going to be achieved using the Tanita data with the control sample coming from the GP survey attached to the RIO. Once the service closed a non-randomisation design was used. This is not a limitation specifically as the research question aims to identify whether treatment has a positive effect in a deprived area. Nevertheless, a comparison of a treatment that was designed to address social capital against, a standard treatment would be useful. Alternatively, the existing treatment could be used to determine whether it has a greater effect in areas with less rather than more

social capital. A direct measure of deprivation (e.g. via the use of postcodes) would have meant this analysis could have been done. Unfortunately, low SES had to be inferred by the inclusion of people from a region with high levels of deprivation.

The strength for this study is the analysis used in consistent with another tier 3 weight management centre in England, who used paired t-test and to measurement of 5% weight loss and clinical success. This allows for consistency also study methodologies that can be built upon by future researchers. Given the age at people attending RIO, we can assume some will have children and young adults in the house hold. This is outside the scope of the present study but recruitment of family across a lifespan could give an important insight in to obesity interventions effects on the family group.

7.3.4. Study 2 Conclusion

In conclusion, these findings show that a tier three Weight Management service (RIO) was able to reduce the level of obesity for its service users, as well as wellbeing. The RIO local catchment area is amongst the most deprived areas of England. Despite this RIO achieved its target of 5% excess weight reduction for almost half of service users, for general weight loss, waist circumference decreases, BMI decreases, while increasing WHO-5 wellbeing scores. Therefore, while social and economic deprivation is a risk for obesity, it is still possible to achieve weight loss in these areas.

8. Chapter Eight - Study 3: Focus Groups

An important aspect to understanding *"how"* and *"why"* populations become obese is by asking the people who are currently or have previously suffered with weight issues and have experience using weight management tiers in England (England.NHS.UK, 2021). Across England, weight management centres of all kinds have been created within local communities. These can include both NHS and commercial interventions, each will use slightly different programmes offering help and advice to assist service users to lose weight. (Middleton, Henderson, & Evans, 2014). By reviewing community groups across the country Middleton et al, (2014) found three main types of interventions: physical activity, mental health and weight loss help and support. However, these services are limited with the most common intervention in the early 00's being counselling (Counterweight Project Team, 2004).

The perspectives of older adults attending a weight management centre is explored by Jackson et al (2019). They found that weight issues remain a concern for many older adults, even though they felt that high body weight was more acceptable for older people, compared to younger ages. The participants also mentioned weight having a negative consequence for health, and that losing weight would help improve this. One of the main motivations for participants to lose weight was for appearance and health reasons; but they found it harder to lose weight as they had got older and felt they had received limited guidance on weight management from health professionals. They concluded that weight issues are shown across all age groups and the older age groups should not be neglected from accessing support (Jackson, Holter, & Beeken, 2019). Further research showed education and group support as part of a weight management programme to be effective (Pendlebury, Bushe, Wildgust, & Holt, 2007). Patients attended weekly group sessions that involved weight measurement, discussions, and education. The results showed a statistically significant reduction in weight measurement and BMI scores between baseline and programme end. Pendlebury et al, (2007) concluded that long-term

weight management of obese and overweight patients with severe forms of mental illness was possible through the provision of simple lifestyle advice and support within a group setting.

A review of service users' experiences of attending a weight management service highlighted that the support from peers and health professionals was key to effective weight loss (Spreckley, Seidell, & Halberstadt, 2021). Programmes need to gain an understanding of the individual experiences and challenges faced to develop strategies that enable significant, sustained weight loss management in the long term. Adding to this, that support should consider the ups and downs in life for patients' individual needs. They found patients took attending a weight management service as a chance to reinvent themselves and an opportunity to create a new identity. However, this opportunity was often accompanied by a continuous fear of weight regain as well as criticism from unsupportive peers. Spreckley et al, (2021) concluded that with a clear, structured plan and frameworks, that are supported by a network of peer and health care professionals the majority of weight loss maintenance experience is seen as successful.

Guidelines recommend clinicians intervene in obesity, but it is unclear how people experiencing obesity may react to this. A systematic review of studies interviewing overweight or obese people that had consulted a primary care clinician Ananthakumar et al, (2020) found that patients felt there was a lack of investigation by GPs, as any symptoms they were experiencing were put down to being overweight or obese (Ananthakumar, Jones, Hinton, & Aveyard, 2020). Patients felt that weight issues were discussed less often than they would have liked, with some feeling they were unworthy of medical time. Patients felt that this suggested GPs thought that being overweight was not a serious risk to them; or that GPs were not fully investigating symptoms and there was a possibility they could miss something serious. When GPs did offer advice, this often seemed obvious and assumed that the patient ate unhealthily or was not seriously trying to address their weight issues. On

the other hand, when offered support for weight loss and active monitoring of weight, patients responded positively wanting to take this support. Overall, Ananthakumar et al, (2020) found that patients' negative experiences in consultations related to their perceptions and judgements that *'flippant advice'* and negative experiences are more likely to be commonplace than positive ones.

The experience of obese patients' seeking bariatric surgery in England found some of the burdens of being obese during focus group discussions (Homer, Tod, Thompson, Allmark, & Goyder, 2016). Participants expressed the extent of the burden of obesity that they had experienced. This included: stigmatisation, shame, poor health, decreased physical function, and reliance on medications. These experiences of stigma and shame had been reinforced by previous unsuccessful weight loss attempts. Patients explained that they felt bariatric surgery would be of benefit, resulting in major physical and psychological improvements. However, patients experience of stigmatisation is not tackled as part of the surgery process. As a result, this could lead to unrealistic expectations of the process and could negatively affect postoperative outcomes (Homer, Tod, Thompson, Allmark, & Goyder, 2016).

8.1.1. Study 3 Aims

Although the review above identifies several experiences reported by people in weight loss interventions, studies did not explicitly address issues relating to socio-economic status and social capital. Chapter 6 showed that social capital was uniquely predictive of obesity, even when controlling for low socio-economic status. However, since this was a cross-sectional study, the role of social capital in becoming obese is not known. Furthermore, Chapter 7 showed that a structured intervention could lead to weight loss in a Tier 3 setting in a deprived area of England. The possibility was raised that the intervention may have been effective, at least in part, by the inclusion of elements of social capital. However, the degree to which service users were impacted by social capital in their weight loss, or even the degree to which they were aware of it, is also not known. Therefore, the Aim of the present study is

to understand the perspectives of service users attending weight management centres that are situated in a deprived location. It is important to hear the views of people experiencing issues around obesity, understanding their perceptions and beliefs around how they became obese and what changed to facilitate them to lose weight. The intended Aim is to examine the perceived role of socio-economic status and social capital in becoming and recovering from obesity. However, this is embedded in a wider context to capture participants' experiences in relation to any other factors they perceive to be important.

Study 3 – Research question: What is the role of socio-economic status and social capital in people's attempt to reduce obesity?

8.1.2. Study 3 Focus Groups

Although the research question relates directly to SES and social capital, the interview questions were embedded in the wider context of attending weight management programmes and people's experiences of being and becoming obese. This was to allow the researcher to draw any inferences about the role of SES and social capital based on these experiences more broadly, rather than constraining the questions to be too limiting and directing.

8.1.3. Focus Groups

Participants were invited to take part in the focus group discussions. Those who agreed then completed a short semi-structured interview or focus group discussion with the researcher. No more than five participants took part in each focus group to allow everyone to have space to express themselves. Participants were allocated to groups and scheduled using a random convenience sample process (Appendix 11.11)

Questions Used

The semi-structured questions asked were open questions based on five topic areas relating to weight gain and obesity. Open questions allowed the researcher to start a discussion without leading the participants into a question-and-answer format.

These topics included:

- How/when did they first become obese?
- What difficulties did/does being obese have for them?
- What made them want to lose weight? What have they tried? Why now?
- How has attending a weight loss centre helped?
- If they could suggest a way to help others, what would it be?

The focus group discussions were recorded on an audio recording device and written up in text transcript form. Once in text format, the audio recording was deleted so none of the participants could be identified, fulfilling ethical agreements.

8.1.4. Design

This study used a qualitative approach, interviewing people that had attended weight management services. Deploying semi-structured focus group interviews to ask questions on the following topics: weight gain, weight loss, what has been effective for them and what advice would they give to others.

8.1.5. Participants Recruitment

The opportunist sample of 22 participants were recruited in Hertfordshire by word of mouth, they were aged between 26 and 50 years. Of these, 20 identified as female and 2 as male participants. All self-reported that they had a BMI between 30 and 53 at time of interview and had attended some form of weight loss programme centre agreeing to give feedback about their experiences.

8.1.6. Ethics

The study (and recording, Interviews, and analysis) was approved by the Health and Human Science Ethics Committee at the University of Hertfordshire. Registered protocol LMS/PGR/UH/02925 (Appendix 11.2).

Written informed consent was obtained from all participants with an information sheet also given to participants.

8.1.7. Procedure

Firstly, participants were briefly introduced to the study and informally invited to take part. Once the participant had agreed to take part a focus group was arranged.

Secondly, a formal introduction was then given to participants before the interview took place. Focus groups were conducted in private rooms, where participants were given an information sheet (Appendix 11.8) and a consent form (Appendix 11.9).

Thirdly, after agreeing to take part in and signing the consent form the researcher introduced themselves and the structure of the focus group process. Focus groups lasted between 10-15 minutes in total and were recorded using a voice recorder.

Lastly, once the interview questions had been completed, participants were then thanked for their time and debriefed fully (Appendix 11.10).

8.1.8. Study 3 Data analysis

The voice recordings of the focus groups were transcribed word for word using thematic analysis. This involved the six-stage process of Thematic Analysis set out by Braun and Clarke (Braun & Clark, 2006).

- Getting familiar with the data
- Generating initial codes
- Searching for patens and themes
- Review themes

- Define/Name themes.
- Report findings

This form of analysis allows a step-by-step process to produce findings that directly answer the research questions posed without veering off into other areas that may not be relevant or of importance currently.

The focus groups were transcribed word for word, listening to the recordings multiple times to catch every interaction within the discussions. The transcripts for each focus group were then read out loud and re-read over again to check the accuracy and allow further familiarisation.

The next stage focused on generating the initial codes that were based on the focus group content. This was firstly done manually on each of the focus group interviews, before being repeated to make sure any relevant content or codes were not missed out. The interview transcripts and initial codes were then uploaded and further coded in NVivo (NVivo, 2020) (Hilal & Hilal, 2013). This software programme allows the process of organising and identifying the potential themes across the focus groups.

The following stage aimed to identify any potential codes or themes that shared similar answers across focus groups. Any theme that showed a significant similarity was then counted as a full theme. This continued with the data further organised in sub-themes. After the initial generation of the themes, a thematic coding table was created to show the themes, sub-themes and codes identified from the focus groups.

8.2. Study 3 Results

The analysis and coding of the data produced three main themes on the perspectives of obesity for gaining and losing weight. These three main themes and sub-themes are summarised:

- **5.1 Relationships**
  - *5.1.1 Self-esteem*
  - *5.1.2 Trust*
  - *5.1.3 Loneliness*
  - *5.1.4 Fluctuating and emotional eating*
  - *5.1.5 Growing up*
- **5.2 Health**
  - *5.2.1 Health reasons*
  - *5.2.2 Failed diets*
  - *5.3.4 Weight loss*
- **5.3 Weight loss centre**
  - *5.3.1 Education*
  - *5.3.2 Achievable goals*
  - *5.3.3 Improved eating habits*
  - *5.3.4 Weight loss*
  - *5.3.5 Group support*

The results of the focus group analysis themes are presented visually in Figure 10-1, this shows the links between the themes and sub-themes. The focus group schedule is shown in Appendix 11.11.

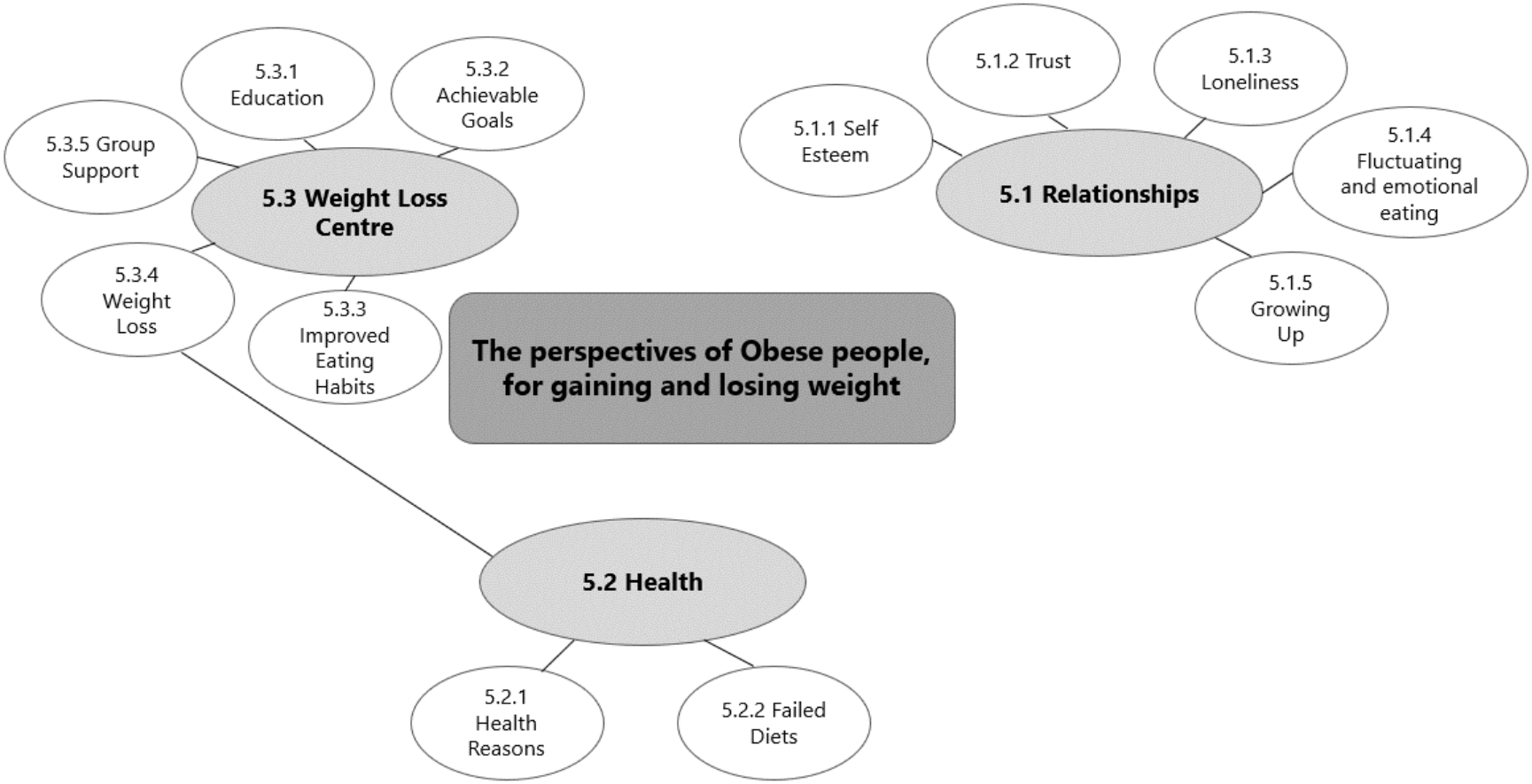


Figure 8-1: Final thematic map showing the main themes and related sub-themes

8.2.1. 5.1 Theme one: Relationships

Theme one revolved around the relationships people had with those around them over time, including '*growing up'*. These breakdowns in relationships led to a cycle that can cause one issue to lead to the next and can continue in any order. The cycle involved a lowering of *'self-esteem'* due to a relationship's breakdown resulting in lowering '*trust*', '*loneliness'* and increasing *'weight gain'*. Once the weight has been gained this causes *'further weight gain'*, again lowering self-esteem and '*loneliness*' and trust then '*feeling hungry*' which was then addressed by eating food.

5.1.1: Self-esteem

Respondents talked about their loss of self-esteem, but a lot fewer about regaining it. The definition of self-esteem used was *'how we value and perceive ourselves… based on… opinions and beliefs about ourselves, which can feel difficult to change… might also think of this as self-confidence'* (Mind, 2022). The loss of self-esteem was caused by various types of relationship breakdown, A, for example experienced this due to a marital breakdown and the need to apply to the courts for contact rights with their children:

> *"My relationship… marriage was emotionally abused I've then physically the last 2 years I put up with it for 7 years for my kids to have a dad……. 5 years single in that time I got my confidence and self-esteem back my kids were destroyed I went through a whole court case to get their dad to have contact…."*

Contrastingly, B suffered bullying with consequent psychological detriment:

> *"Years of emotional abuse at the hands of others, bullying at school. Low self-esteem, zero self-worth, years of simply hating myself, the questioning did I simply deserve to walk on this Earth."*

The feelings of self-esteem being crushed and physically dropping to their knees are expressed by C.

"…an accumulation of bad choices that were a result of my crushed self-esteem led to me ending up on my knees in my room."

After giving birth, D was struggling with the connection to her new baby and her body not being how she wanted.

"I was struggling with breastfeeding, feeling totally horrible with my post-birth body, self-esteem at an all-time low."

Importantly, E describes themselves in two ways, internal and external selves. The inner bully chipping away at their self-esteem, to bring them back down after building small wins. All while externally presenting a confident exterior.

"I have struggled with my inner bully and weight ever since then. I haven't quite managed to successfully build my confidence or self-esteem. I have had periods of feeling strong, but when things are difficult, I slip backwards. I do a good job of presenting as being confident, but that mask is exhausting."

D is now trying to focus on their self-esteem, love themselves more, and reduce the risk of their downfall due to putting on weight.

"I'm trying not to focus on my weight or my body too much at the moment because that has been my downfall every other time. Soooo, this time, my confidence, self-esteem and learning to love myself have to be my focus."

5.1.2: Trust

Respondents discussed how trust-breaking in the past was creating a daily internal conflict and leading them to not take care of themselves. A describes this daily battle triggered by a breakdown in trust.

"I have started being able to be kinder to myself. Just a little, but it's a start. It is such a struggle, but I am determined to put this cycle in the past. In so many ways I've recovered from what happened, but some scars remain. Trust, I don't

really think of myself as a survivor or a victim, I'm just me. But 'me' has been someone I don't take very good care of, and that has to change."

Further insight into trust-breaking leading to unhealthy habits is described by B. They describe not having trust has led them to struggle alone to fix all their problems both in health and relationships.

"I've encountered many tough times that have tested me beyond whatever I thought I may have thought I could endure. I lack trust and keep things to myself, whether it's illness or the breakdown of my relationships, I try to fix things by myself without opening up to anyone."

5.1.3: Loneliness

Loneliness is another point raised by responders. A explains how they withdrew from society, friends, and family to be at such a point where they did not have any help or support.

"I started living my life almost as a recluse, losing all my friends and pretty much-stopping contact with my family. I stayed inside, even in summer, to hide from everyone and everything. I now realise he never showed me any love. There are numerous examples of this for me."

B expresses the fear of loneliness with the viewpoint of becoming alone after their sister's cancer diagnosis.

"…complete loss of any form of self-worth, my sister's battle with breast cancer …thankfully successful… and the fear that I would spend the rest of my days all alone – was a massive challenge, to say the least."

The cause for C's loneliness came from years of putdowns and feeling scared of a bully.

"When I was bullied. This went on for a couple of years and I couldn't tell anyone. I was so scared and felt really alone. I also got really angry - I would

fight with everyone around me. I started eating and shut myself away. Over months I found myself making so many excuses for not eating (in front of people)"

5.1.4: Fluctuating and emotional eating

The triggers behind weight gain were expressed in a mixture of ways by respondents. A expresses how the weight gain slowly started due to a fear of becoming anorexic. To overcome this fear, they began to eat before they became hungry, and this continued into the cycle of fluctuating and emotional eating.

"I slowly started putting on weight. One day I felt my tummy rumble and I absolutely panicked! It was only then I realised I had become so frightened of being anorexic that I was terrified of that hungry feeling - that same feeling that had spurred me on for months had become something to fear and I'd avoided being hungry since... kinda explains the weight gain!

B speaks about the inner voice bullying them into an emotional cycle of eating, feeling ashamed and this then repeating.

"I completely pushed myself the other way and had also got caught in a cycle of emotional eating without realising what was happening. I felt ashamed of myself and often felt I wasn't good enough. I beat myself up so much that my inner voice became a bully."

On the other hand, C has a condition that means they are unable to exercise, which has resulted in going from one bad diet to another.

"It's stressful enough with this condition, I let weight gain, with rubbish ways of doing 'diets' we all know what healthy eating is but doing it every day is really hard, not being able to exercise makes it even harder"

D simply explained that they can't stick to weight loss plans.

"I can't stick to weight loss plans"

E explains that weight gain has been an issue for them with weight fluctuating involving an internal fight to break the weight gain cycle.

> *"My weight fluctuates. I've been a size 8 -14, now I'm getting my head around my awful relationship with food and my need to alleviate tough times with sugar! It's a slow process but I'm starting to break the cycle."*

D battled anorexia and bulimia, but after getting over these has gone to the polar opposite and is gaining too much weight.

> *"Cycled through many years of anorexia and horrible bulimia. Till I discovered exercise. And that helped to a degree. And now I'm just ridiculously overweight with no willpower. Accepting that I've probably done my metabolism harm but no idea what to do about it."*

E lost motivation to lose weight after gaining weight during pregnancy.

> *"Wasn't motivated to take care of my weight anymore, I put on so much weight during pregnancy, I was size 32 at my biggest. When we got engaged and a 34 on my wedding day."*

The feeling of helplessness in gaining weight is expressed by F.

> *"I don't really know why. My weight still goes up and down."*

G explains the weight gain has been up and down over the years and this is associated with her chronic pain condition.

> *"I've been various weights... Unfortunately, I've put weight on again. And it's linked to the increase in my pain from my condition."*

Feeling hungry is a point raised by responders. Equating the feeling of being full to contentment is an issue being battled with by H.

> *"I still equate a full belly with contentment. At times I literally went from eating cardboard to stave off hunger at the bad times, to eating like a lord. So as an*

adult, I have several issues which I wrestle with a not getting to be feel hungry is one of them."

Previously J had starved themselves, so much so that they felt a sense of love for feeling hungry. As a child B saw this as an achievement, picturing 'hunger' eating away at the fat inside them.

"I've spent a lot of time trying to recover from starving myself. During the time I wasn't eating, I grew to love the feeling of being hungry, it really made me feel like I was achieving something. It was as if I could picture the hunger eating away my fat. I should probably say that I wasn't an overweight child at all, but I felt disgusting."

K did not think eating was worthwhile, getting into a cycle of 'good' and 'bad' eating, almost feeling hungry for as long as possible before binge eating.

"I would think I wasn't worthwhile, so I didn't see the point in eating well, and then on a good day I'd eat well, but not enough then binge in a hungry panic."

5.1.5: Growing up.

Respondents talked about growing up, and the impact this had on them. A described seeing mental and physical abuse within the family resulting in losing contact with family members.

"*…things growing up, my dad was very violent and things that he did to my mum, no child should ever have to see. I also suffered years of mental and physical abuse from my dad which resulted in me not seeing him and I've not had any contact with him"*

A lack of connection with a parent is described by B, and effect that was still being felt from this, however, their children were helping to turn this around with the parent-child relationship being the most important thing in their life.

"It's tough but I never had a connection with my mum growing up. The most important thing for me now is my little family, who without them, I actually don't think I would have got out of that hole I was in. I still have blips, moments of darkness but I am much more capable of dealing with them now."

Emotional abuse and bullying made C feel like they were not good enough and that they had brought bad things upon themselves.

"…growing up, I've had to deal with emotional abuse, put-downs, bullying. Which has constantly reminded me that I'm not good enough and that it is my fault that I bring bad things upon myself."

Missing out, and feeling robbed of childhood whilst growing up due to training to become the best swimmer they could, had an impact on D.

"Growing up my brother and I were county-level swimmers, and at a young age, we were training sixteen hours in the pool a week. I started to resent this and looking back I feel I was robbed of my childhood and just being a kid."

8.2.2. 5.2 Theme Two: Health

Theme two revolved around the health of people, more specifically those wanting to become healthy after gaining weight. This could have been due to '*health reasons*', such as health care for themselves, a friend, or a family member, at which point people decide to act and lose weight. During periods of attempting to lose weight people mentioned '*feeling hungry*', empty or deprived and as a result, after losing some weight people found it hard to maintain this due to unrealistic manageable dieting methods. Often a '*failed diet*' led to weight gain further than the level of before the diet started and increased health issues.

5.2.1: Health reasons (Losing weight for health reasons)

Looking after a family member who had become ill, led A to lose a relationship and triggered their health journey and reducing their weight.

> *"Years ago, her health deteriorated quickly, and she suffered chronic fatigue and muscle wastage due to the medication she was on. I stayed at home, giving up moving on with my life because I felt I couldn't leave her while my Dad was at sea. It stunted my relationship with my boyfriend because I didn't see him much. I didn't have much social life…"*

A focus on health, fitness and taking part in events and races has given B confidence and helped to improve their overall fitness.

> *"My weight still goes up and down. I'm working on focusing on fitness instead. Entering events, races and competitions. I'm fit and healthy, can run ten miles, and am generally happy with my looks."*

A car crash changed C's perspective, they are now aiming to be the best they can, feel healthy and not be miserable about weight issues.

> *"We survived a horrific car crash, where we skidded, going through a hedge and rolled the car. I broke a few bones, but my son wasn't injured, thankfully. It put*

life in perspective for me and helped me realise that life is too short to be miserable. I still have wobbly days as I call my weight, but that day made me want to be the best I can be, I am getting there."

After becoming severely ill the most basic task of making a meal would wipe out D's energy. Focusing on healthy eating has helped improve their health.

"It was a nightmare when I was severely ill. Somehow, I just managed to cook a meal from scratch, eat it and then crash afterwards. Despite that my health did gradually improve, by making some changes to my diet over the years helped a lot"

Eating healthy to encourage good immune health has helped E lose weight and life has become better.

"I've lost two and a half stone and my life is more manageable. I do lots of supplements too, I want to encourage immune health, good gut bacteria"

Since F has made the conscious decision to enjoy things in moderation to be healthy, eating well but having a treat occasionally they have become much happier.

"I've made a conscious decision to enjoy everything in moderation as it seems nothing, I eat makes a significant negative impact rather I think you can eat yourself better course within reason by having balanced nutrition that brings both health and happiness".

5.2.2: Failed Diets

Failed diets are a point raised by many responders. A cut out specific types of food which made them feel depressed and miserable.

"I've been on numerous diets. I went on a no-sugar and yeast diet and to be honest the whole experience was miserable and depressing and I saw no benefit. Cutting out foods seems to be the fashion at the moment, but I think it's better

to have a varied and healthy diet. If you're stuck, being denied even a treat can be very depressing."

Failing the keto diet, which involved changing their shopping requirements, cooking from scratch, extra washing up and planning meals, was too much for B with her health condition.

"The Keto diet and I have to say I wouldn't be able to comply with it. I just couldn't manage to adopt such a diet with all the special recipes, extra cooking, washing-up, planning, and shopping it requires. I guess such diets are not really practical for all people with an illness."

C simply explained that diets fail as they bring an added stress to life.

"I've failed load of 'diets' as they don't work! Isn't life stressful enough, let alone, weight gain doing 'diets' we all know what healthy eating is!"

Trying and failing several diets that involved cutting out food groups has led to other issues such as nausea and no weight reduction for D.

"I have tried meat, dairy and gluten-free diets. Only going low on dairy has made me see a difference in my bone strength. I have tried juicing, smoothies, the lot, and removing the fibre from the fruit helps my IBS, but increased nausea. I have seen no real maintained weight drop."

8.2.3. 5.3 Theme Three: Weight Loss Centre

Theme Three focused on the effective weight loss techniques found when attending a weight loss centre. Each person had attended different types of weight loss centres both inside and outside of the NHS. However, when effective *'weight loss'* was achieved, the common sub-themes within these centres were, 'education', *'achievable goals', 'improved eating habits'* and *'group support'*. People were educated on not only the types of food to limit but also what food they could eat instead. This then in turn improved eating habits as people still felt they had enough choice of foods to eat. On top of this, achievable goals were set not just for weight loss, but also for encouraging them to eat different types of fruit and vegetables, drink plenty of water, get enough sleep, stretch, and exercise. The goals set were small and not all at once. Being able to stick to trying to achieve these goals is helped by the support of other group members who are also aiming to achieve similar things. Inspiration from those who had already achieved and were supporting those starting behind them helped people to feel like their goals were more attainable. Being part of a group and working with the centre also meant that if someone had a bad week or fell off the programme, they could get back on without feeling that they were falling and gaining further weight due to the support.

5.3.1: Education

Respondents spoke of the education they received about eating, cooking, exercising, and making better choices. A talked about previously not knowing much about good food, so when trying to lose weight they felt like they were starving and missing out.

> *"I didn't know I could eat so much of the good food before when I tried to lose weight, I felt like I was starving myself and missing out on what everyone else was eating"*

B explained how being shown other food choices, allowed them to eat more but healthier food.

"Being shown the other choices, like, don't eat chips or you can if you want, but one bag is the same as a bowl of veg and chicken. I can now choose more food because I know what it means to my body"

By being constant during the week and making good choices to reduce calories, C feels they can have a treat meal once a week, so they do not feel like they are missing out.

"I now have a treat meal every week, I've been shown that I can save calories up during the week to have a takeaway on a Friday. This means I can still eat with friends and not feel guilty and left out"

Being taught how many calories their body needed daily, D is now able to make better choices, eating within a calorie deficit without skipping meals.

"When I started here, they worked out how many calories my body needed each day and how much I needed to drink. Together we worked out what I could eat each day, so I can make good choices, the best thing is that I don't skip meals anymore"

E was taught to cook from scratch, they can now cook healthy meals for themselves and their family.

"Now I can cook! My parents didn't show me, so we made do with ready meals, but now I make meals from scratch, I also work out while cooking so I make the most of my time"

5.3.2: Achievable goals

By setting achievable goals A is making progress exercising more, moving away from trying to race others and focusing on doing what is best for them.

"I've got goals now, building up my walking each day, if I couldn't do ten thousand before I won't bother the next day. Now I set my own achievable goals, this was really small at the start, my I am only in a race with me"

B admits they have learnt that they were an all-or-nothing type of person, but by breaking down targets and setting achievable goals is helping them achieve.

> *"…I didn't know, but I am quite all or nothing type of person. This kinda explains why I used to give up when things got tricky or hard or whatever. Baby steps nowadays, I've got small target that move gradually to the target"*

One way C likes to achieve their daily goals is to keep changing them, so they stay interesting.

> *"I set daily goals each evening for the next day, I try and mix them up (so many steps, stairs, squats when cooking etc.) so it keeps it interesting"*

The first step is the important one, D had this breakthrough during sessions and while reading.

> *"I read a book that said one step starts the process, it's so true, really backed up what we learn here"*

5.3.3: Improved eating habits

Responders talked about improved eating habits, A explained that their thinking has moved away from dieting to a healthy eating plan, and with no added costs for exercise this has made it more affordable.

> *"It's a healthy eating plan, rather than a diet, that doesn't really involve exercise. It's so affordable too because it's food you would normally buy and alternative ways of cooking it. Believe me, if I can do it anyone can, I don't "do" diets, but it's made me think about food differently"*

B admits to being concerned about falling back into old habits, so making the decision to improve eating habits has made food less scary.

> *"I became so scared of going back to old habits, I slowly started putting on weight. But now I know what I can eat, I've sort of made new habits and food is less scary."*

Improving eating habits in a small way is key for C, who now does not skip meals, eats healthy snacks, and tries to eat low carb.

> *"I have better habits now, nowt special, just little things like not skipping meals, having healthy snacks, knowing calories, trying be keep meals is low carb, some good habits have been learned."*

D has changed their eating habits, which has allowed them to eat whatever they want in moderation, making the correct choices for them.

> *"I've changed my habits a lot, syns (Slimming World indicator of foods to limit) mean I can choose to eat more of the good but also have what I want when I want, just in moderation, now I can easily keep a check on my eating habits…"*

5.3.4: Weight loss

Responders talked about weight loss, with A's weight loss being achieved by reducing carbohydrates and increasing protein intake, this small change has reduced the preparation time for meals and allowed them to batch cook so they can keep to a consistent way of eating.

> *"I was able to lose weight by reducing my carb intake and increasing my protein intake. Not drastically, the way some diets recommend. That also allowed me to reduce my portion sizes and in-between meal snacks because I stayed full for longer. My 'meal prep' is that when I'm up to cooking, I do big batches of things like soup or stew and freeze it in meal-size portions."*

B's weight loss was achieved by sticking to the weight loss programme.

> *"Once I got what I could and couldn't do, I planned my meals each week before shopping, got everything I needed, so I didn't panic and get food outside of home"*

Finding out they could eat as much as they wanted of certain foods changed everything for C to lose weight.

"I never knew I could eat as much meat and veg as I wanted and that would be free, absolute game changer, no need to feel hungry, I am full all the time and losing weight"

Drinking more water, keeping consistent, and overcoming blips have made weight loss easier for D.

"…part of the plan that's new to me is drinking more water makes me feel cleaner I think, helps to, to eat better, stay on plan and not go over calories, or if I do get them back over the next few days"

The ability to be flexible is ideal for E, who flips between different ideas within the programme for weight loss.

"…my weight loss is a roller-coaster when I have a bad day, instead of having three bad meals and snacks in between, I have a bad meal, restart and get back in it on the next meal, knowing my calories means I can get them back later or save them for a night out, I flip the plan around"

F now understands the process for losing weight, consistency and not letting setbacks stop them, trusting the process to progress.

"…my weight, well all our weight am I right, goes up down, left and right, it's only now coming here that I understand stress, exercise, water all sorts affect weight. BUT consistently doing the right things, keeps chipping away and I lose weight, trusting the process, keeping on"

5.3.4: Group support

Responders talked about the group support they both gave and received. A explained how being part of a group that understands and shares the difficulties and fears they face is the support they need to stay on track.

"I became so scared of going back to old habits that I was really focused on looking after myself and cooked meals for everyone in the flat. But I slowly

started putting on weight. But now with this group, I know I have someone to talk to who understands what it's like."

Being part of a group supporting each other, B is focused on the psychology of feeling good while getting the body they want.

"Anyway, I'm staring at the new 2.0 body. I'm doing some psychological 'own it' work with some of the girls from my support group, it's Feel it! Own it, saying that over and over in the morning or when stuff is hard"

Thanks to the group support during a difficult personal time, C kept on track, joined a gym and is in a better place mentally.

"…my baby's dad left no reason he just had enough I was a mess then I joined a gym just before Christmas I took weightlifting seriously and loved it and it sorted my head..... I've had a lot of shit but that's passed now, and I am in a good place now and thanks mostly for support keeping me on track…"

The group support has allowed D to see the light and achieve their target.

"After a fair amount of butt-kicking and a supportive husband, my friends, this group, I have got through it which I never thought would happen. I can see a light and do what I need to achieve my target".

8.3. Study 3: Focus Group Results Summary

After completing the focus groups and conducting a thematic analysis, the three main themes that were produced were Relationships, Health, and Weight Loss Centres. Under these themes were sub-themes with Relationship sub-themes including self-esteem, trust, loneliness, fluctuating and emotional eating and growing up. Theme two, Health included the sub themes, health reasons, failed diets, and weight loss. Finally, theme three weight loss centre, included the sub-themes of education, achievable goals, improved eating habits, weight loss and group support.

Theme one: Relationships, revolved around the relationships people had with those around them over time, including their experiences *'growing up'*. A breakdown in relationships had led to cycles that caused one issue to lead to the next and continue to spiral. This *'cycle'* involved a lowering of an individual's *'self-esteem'* because of a relationship breakdown. Impacting the individual further by lowering *'trust'*, increasing *'loneliness'* and resulting in *'weight gain'* over time. Once the weight had been gained this caused *'further weight gain'*, and again lower self-esteem, further *'loneliness'* and trust issues together with *'feeling hungry'* that the individual fills by eating food and thus the cycle continues.

Theme two: Health, revolved around an individual's health, wanting to become healthy after gaining weight. This could be due to *'health reasons'*, such as health care for themselves, a family member or friend, at which point people decide to act and lose weight because of health threats. During periods of attempting to lose weight people spoke of *'feeling hungry'*, empty or deprived. As a result, after losing some weight people found it hard to maintain this loss due to unrealistic manageable dieting methods. Often a *'failed diet'* led to a bounce with further weight gain to levels higher than before the diet initially started and therefore further health issues.

Theme Three: Weight loss centres, focused on effective weight loss methods found when attending weight loss centres. Each person had attended different types of

weight loss centres both inside and outside of the NHS. However, when effective *'weight loss'* was achieved, the common sub-themes within these centres were, *'education', 'achievable goals', 'improved eating habits'* and *'group support'*. The people were educated on not only the types of food to limit but also what foods they could eat instead. This then in turn improved eating habits as people still felt they had enough of a choice of food to eat. On top of this, achievable goals were set, not just for weight loss but also encouraging them to eat different types of fruit and vegetables, drink plenty of water, get enough sleep, stretch, and exercise. Goals were set small and not all at once. Being able to stick to trying to achieve these goals is helped by the support of other group members who are all aiming for similar targets. Inspiration from those who had already achieved and were supporting those starting behind them also helped people to feel like their goals were achievable. Being part of a group and working with the centre also meant that if someone had a bad week or 'fell off' the programme, they could get back on track without feeling like they had failed and gaining further weight.

In summarising those results that relate most directly to social capital, becoming obese was reported to be related to the absence of social capital in the sense of a lack of social network and a lack of trust. Conversely, successful weight seemed to involve the development of social capital. In concrete terms, this was through access of a social resource. More importantly, however, participants reported the experience of developing group support. Interestingly, during the discussion, although participants had reported the importance of social capital, none appeared to name it directly or to know explicitly what social capital was.

8.4. Study 3: Focus Group Discussion

A breakdown in relationships was a common theme of people's experiences in becoming obese. This reduced social capital for an individual, lowering self-esteem, lowering *'trust'*, increasing *'loneliness'* and resulting in *'weight gain'* over time. The analysis of the focus groups produced links to seven of the ten elements of social capital, these are highlighted in Figure 8-2. Theme one *'relationships'* captured within it the sub-theme of self-esteem, this demonstrates an example of how people value and perceive self-opinions and how the beliefs of those experiencing obesity impact other areas of their lives. Elements of relationships as captured within social capital definitions (Figure 4-1) are social, psychological, cultural, cognitive, and institutional. However, when social capital elements were individually increased people had been able to lose weight. These elements were seen throughout the responses during the focus groups. An experienced psychological abuse in a previous relationship. B's social environment had a huge impact on their experience with weight, due to bullying that they received from peers whilst at school. C was an example of where culture led them to difficulties with obesity after a fear of failing as a mother. The lack of social capital due to these elements were self-identified as the reason these participants have had struggles with obesity.

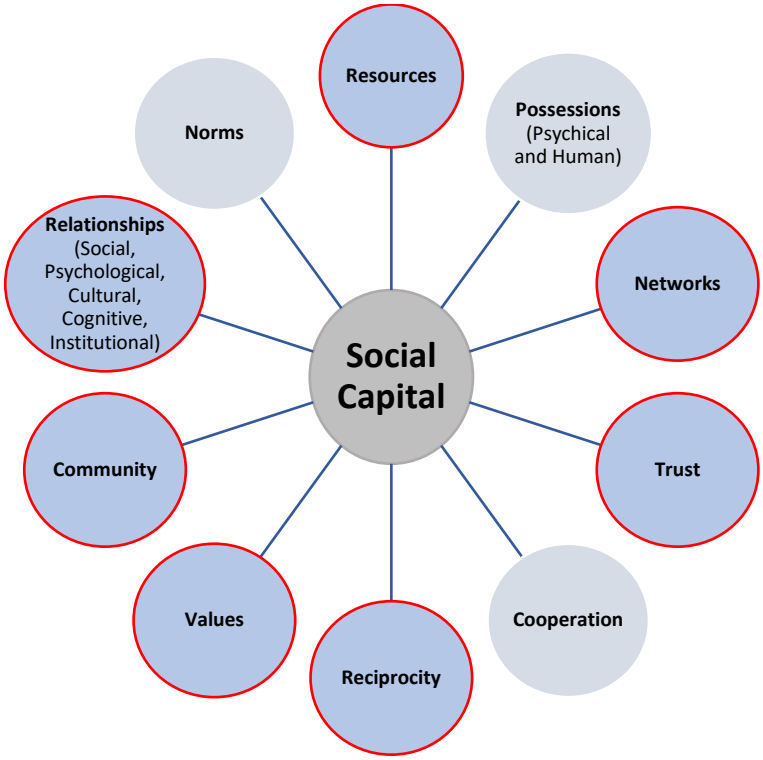


Figure 8-2: Visual highlighting of seven of the ten elements of social capital appearing within the focus group discussions

These are examples of personal social capital at an individual level and are different to the relationship elements of the HSE survey questions that focus on the perspectives an individual's area that they live in. For example, HSE questions related to relationships were:

1. This area is a place where neighbours look after each other.
4. This area is a place I enjoy living in.
9. Do people try to be helpful?
10. People take advantage of you.
11. Can people be trusted?

A further social capital element that appeared as a sub theme of relationships within the focus group analysis was 'Trust'. Some examples of this are from A and B, who both mentioned that a breakdown in trust brought unhealthy internal conflict. Again,

this is social capital on a micro individual level showing a breakdown of trust from personal past relationships that then went on to have an impact on them and their levels of obesity.

Social capital elements such as reciprocity (exchange for mutual benefit), resources, and networks can also be seen within the focus group discussions. This can be seen in the HSE within the relationship related questions as well as question 12 of the survey relating to 'Groups and organisations. Attending weight loss centres gave participants reciprocity with the exchange of support and advice from the group support sessions. D states how without the group she would not have been able to achieve weight loss. Resources are gained from the education received with A learning how to cook, B mentioning that being shown other possible food choices helped them, and C saying that being shown how to be consistent has been useful for them. Although in a highly deprived area, group sessions gave the attendees chances to build new networks and create a community of people all with the same goal of losing weight. The support people get from knowing that people are or have experienced similar issues as they are going through can help scaffold and support them with losing weight, build new relationships and trust with others, reduce loneliness, and improve self-esteem.

This suggests that social capital could be an important factor in gaining (low social capital) and losing (improving social capital) weight. Furthermore, perceptions of the community surrounding an individual may vary in relation to social capital when compared to an individual's personal social capital elements, for example you may trust the general community around but not have much trust in personal relationships. One of these may increase obesity while the other has no impact, but further work is required.

8.4.1. Study 3 - Methodological Strengths and Limitations

A limitation for the study is the sample skewed in terms of sex with the majority Women and very few Men. This is not unexpected with Women more likely to attend primary care compared to men more generally (Wang, Hunt, Nazareth, Freemantle, & Petersen, 2013). The sample may also be skewed in other ways although, as other demographic information was not collected, it is not possible to know for certain. Having conducted the focus groups the researcher can state that most people were of white British ethnicity, between the ages of 32-55 years.

The order of studies meant that the results of studies 1 and 2 were not known at the point of carrying out study 3. The interview might have been redesigned if the results of the other studies were already known, for example asking demographic related questions, asking for body measurement results they had from attending their weight loss centres and adding the social capital survey as the end of the focus groups for consistency across study 1 and 3.

A further limitation is that participants did not all attend the same treatment (and so may be limited in addressing questions arising from study 2). However, this is also a strength on the basis of generalisability beyond a specific weight loss intervention. A strength of the study is by opening the interviews to people away from RIO, the types of weight loss interventions undergone by these participants is likely to be of a type more commonly experienced. Therefore, the themes identified may be more relevant to people attending weight loss interventions more generally.

Another strength is that it addresses limitations of study 1 as it is a retrospective account of experiences over time rather than a cross-sectional snapshot.

8.4.2. Study 3 Conclusion

In conclusion, these findings show social capital in people's attempt to reduce obesity. Becoming obese related to the absence of social capital in the sense of a lack of social network and a lack of trust. Conversely, successful weight loss seemed

to involve the development of social capital. In concrete terms, this was through access of a social resource. More importantly, however, participants reported the experience of developing group support. While the role of socio-economic status potentially plays a role in weight gain, these participants in a deprived area were still able to lose weight with the increases in social capital elements.

9. Chapter Nine – Thesis discussion

The research across this thesis addresses the topic of *'socio-economic status and social capital in the aetiology of obesity'*. The easy message to those that are obese is to *'eat less and move more'*. However, the answer is more complex. Only by understanding how the implications of social factors (social economic status and social capital) may increase the risk of obesity, can we develop successful interventions in English populations in the future.

9.1.1. The Statement of Evidence

The introduction chapters explored the evidence for how obesity has evolved across time in England, how obesity has been classified using body measurements, key interventions for obesity and the impact on health. They also explored the consequence of inequality in a drop in the standard of health. Social determinants of health are made up from the social, cultural, political, economic, commercial, and environmental factors that shape the conditions in which people are born, grow, live, work and age. To how socio-economic status and social capital play a part in influencing the risk of obesity.

On this basis, how can we expect people to adopt a better lifestyle when their social factors are negatively impacted, and when their social environment discourages them from developing healthier habits. The literature shows the complexity of social capital and the multiple factors that influence the risk of people being obese: levels of social inequality, social capital, social class, income and individuals' location of residence and their position on the *'index of multiple deprivation'*.

To recap the research questions and summarise the evidence relating to these:

Study 1: Does the level of socio-economic status and social capital influence the risk of becoming obese?

The modelling of the English Populations dataset shows that lack of social capital (*enjoying where they live* and *a place where neighbours take care of each other*) and lower self-reported income increased the risk of becoming obese. Although SES and social capital are likely to be related (with people on lower incomes living in areas with lower social capital (Han, Chu, Song, & Li, (2015)), clearly these two factors are independent risk factors for obesity. Due to the location of study 2, the analyses were repeated for the Yorkshire/Humber and the results showed *can be trusted where they live* were less likely to be obese, with all three levels of social class showing an associated increased likelihood of exhibiting obesity.

Study 2: Can a tier three Weight Management service reduce levels of obesity and improve well-being in an area of England with high levels of deprivation?

Three of the key parts of the RIO programme were educating, encouraging, and creating a community. The RIO is situated in the town centre with a catchment area of Rotherham and surrounding areas. This is a highly deprived area (the assumption by levels of deprivation is that individuals in this location of Rotherham also experience lower levels of social capital) with lower income, and lower social class.

The RIO programme does not directly have a solution to support people experiencing disadvantaged social factors. However, RIO was able to help obese people to achieve weight loss and improve well-being, even in areas of high deprivation.

One could therefore make a case that the RIO programme implicitly incorporates elements of social capital, for example resources (education), relationships (encouraging), co-operation, community, and networks.

Study 3: What is the role of socio-economic status and social capital in people's attempt to reduce obesity?

In a qualitative study with people who had been through weight loss programmes, findings showed that social capital may play a role both in relation to the development of obesity and in weight loss. For example, lack of social network and trust were reported to play a part in the development of obesity, whereas the development of community in weight loss programmes was recognised as playing a part in weight loss. Of the 10 social capital elements appearing across the literature 7 of them appeared during the focus group discussions.

- Resources
- Networks
- Trust
- Reciprocity

- Values
- Community
- Relationships (Social, Psychological, Cultural, Cognitive, and Institutional)

Integration of the evidence across the three studies:

The link between the three studies across the thesis can be discussed using mixed-method approach, by triangulating the findings from the three studies using Figure 5-1) discussed earlier in the thesis. The idea of building a triangulation of the methodologies (Denzin, 1978) is to achieve a full and comprehensive answer from the data. Exploring multiple approaches, observations, methods, and data sources, is a benefit and will help to overcome any potential pre-held beliefs or bias that could occur from using one single methodology (Driscoll, Appiah-Yeboah, Salib, & Rupert, 2007).

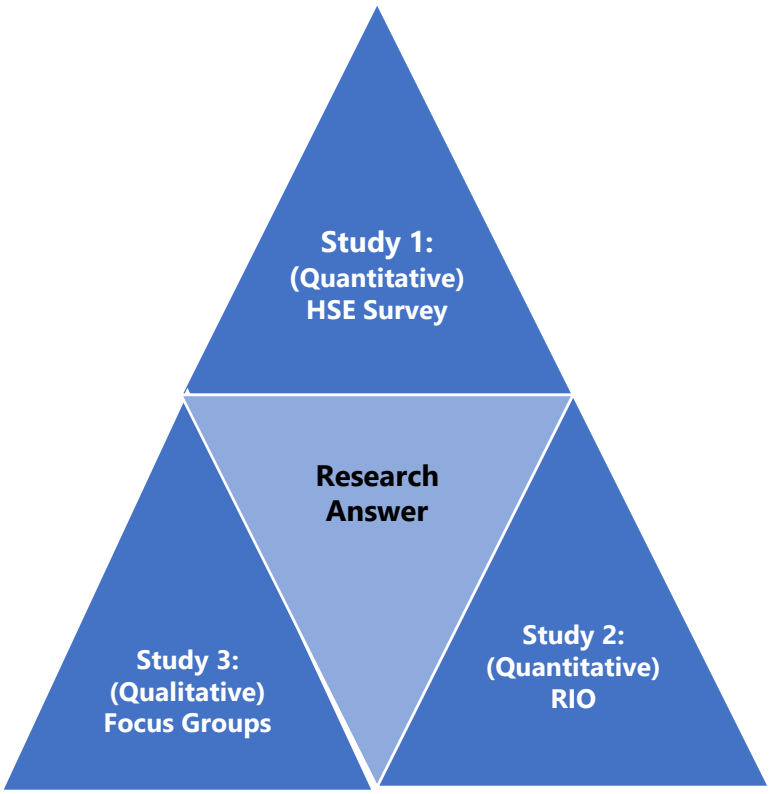


Figure 9-1: The triangulation of the methodologies being used in the current research

Whilst social capital and social economic status appears influential in affecting the risk of obesity, this can be successfully managed as shown by the RIO. Obesity can be reduced by using weight management programmes, which, by their nature, do not directly attempt to influence social capital. However, the RIO's programme showed that the inclusion of elements that tap into social capital can be effective in helping people lose weight and improve their well-being. These types of services should be introduced across the country investing in people's futures.

Interestingly, the focus group produced findings to show that poor social capital are triggers for gaining weight. In future, weight loss programmes should insert effective methods of increasing social capital as this may be useful to weight loss for the longer term.

9.2. Revisiting the tentative model for the role of SES and social capital in obesity.

Based on the three studies described in this thesis (a study on risk factors for obesity, an analysis of an intervention for obesity in a deprived town in northern England, and a study on the experience of weight loss interventions in people who were formerly obese), the proposed model described in section 3.2.3 (Social capital and social economic status links to obesity) can be modified. Broadly speaking, social capital reduces the risk of becoming obese. It also plays a role in increasing the likelihood of weight loss in those who are already obese.

In Chapter 3, a conceptual model, proposed that lower levels of SES increase the risk of becoming obese but reduce the likelihood of weight loss. Conversely, high levels of social capital reduce the risk of becoming obese but increase the likelihood of recovery. Several indicators of both SES and social capital were given since it was not yet possible to determine precisely which are important. In addition, this tentative model was used to guide the design and interpretation of the three studies described in this thesis.

This research has identified that these remain influential in reducing obesity, but that social capital has an unexpectedly greater effect, meaning that obesity is not necessarily inevitable but can be buffered by high social capital in terms of relationships and organised groups, as shown in Studies 2 and 3. The original conceptual model which represented risk factors for obesity this can be modified based on identified directions of links and specific variables. Both aspects of socio-economic status proposed in the original model appear to play a role. However, the broad categories of social capital in the proposed model can be replaced with specific aspects of social capital, namely, Resources, Networks, Trust, Reciprocity, Values, Community and Relationships (Social, Psychological, Cultural, cognitive & Institutional) that come under these categories that were found in this thesis across Study 1 and Study 3. Therefore, this tentative model is replaced by a second conceptual model (Figure 9-1) which represents the relatively increased influence of social capital on obesity reduction.

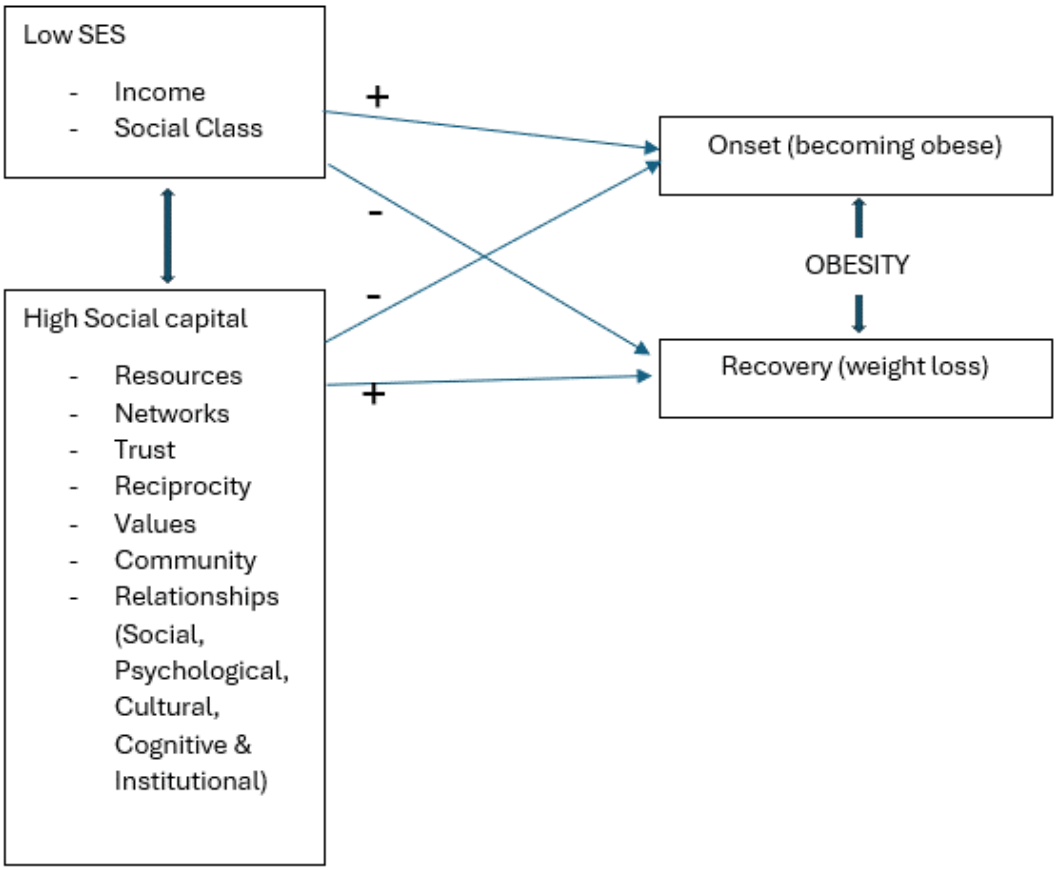


Figure 9-2: New – Increasing social capital can help in reducing obesity in locations with lower levels of socioeconomic status.
[Modified conceptual model resulting from this research]

Put simply, despite the many risk factors associated with low socio-economic status and social capital suggesting a greater risk of obesity, this thesis demonstrates that obesity need not be inevitable in people with lower SES and can be reduced by increasing social capital elements.

9.3. Thesis Strength and Limitations

The strengths and limitations of each individual study are given in their respective chapters. This chapter addresses the strengths and limitations of the thesis as a whole.

A strength for the thesis studies is the methodology, using a mixed methods approach from national, intervention and focus groups population samples. Studies 1 and 2 are quantitative allowing for large samples to be analysed, while the qualitative study 3 adds meat to the bones. All three studies are used in triangulation, each building on the limitations faced during the thesis.

The strength for study 1 that was the first of its kind for England, using survey elements endorsed by world leading social capital researcher. A limitation, however, is the study being cross sectional, this did not allowing the researcher to track responses over time or understand the context of the answer given to the survey question. This was overcome in part by study 3 which is retrospective in nature, providing more detailed information to explain complex issues. This showed the implications of social capital elements increasing and decreasing the risk of obesity. As the participants were blind to the concept of social capital.

A further limitation for study 1 is that it is observational rather than an intervention, so unable to control for other factors that may influence obesity. In contrast Study 2 RIO was an intervention and was able to use the same measures and methods at every time point. The RIO programme can then analysed across the intervention. A further strength for both study 1 and 2 is, that all physical measurements were conducted by a health professional, limiting the possibility of errors from self-reporting. As highlighted here, although each study has limitations, these are mitigated in the thesis by the strengths of other studies.

9.4. Recommendations for further research

Further research into social capital and obesity should be undertaken to focus more locally to determine whether there are different effects occurring within local populations, as these may require different approaches and tailored interventions.

The differences between people's social perception and individual experience of social capital are an interesting factor that should be explored. For example, you may trust the general community around you but not have much trust in personal relationships. Further work is required to understand if and why these differences occur and what they mean for the risks of obesity.

Social capital is a concerning health outcome in local areas and would be an interesting lens when designing and planning further amenities across cities, towns, and villages. For example, are current designs and housing developments negatively impacting individuals and increasing the risk of developing poor health and becoming overweight and obese? Social capital could be considered by understanding the impact of new developments and how they can be improved for new developments yet to be built. For example, these could include incorporating walking routes (loops within housing developments) which may encourage exercise, compared to new build *cul-di-sac* roads. Building housing that negatively impacts new residents could be counterproductive in the longer term.

A further approach could be for studies to take a more naturalistic approach, for example, rather than rely on participants' individual perception of the social capital they have, Researchers could identify areas where there is a consensus that an area has high versus low social capital. This could then be examined in retrospective and/or prospective studies the development of obesity in those areas. Based on Marmot (2010) it would be expected that the impact of a RIO-type intervention would have a greater impact on obesity (including the resulting quality of life and life expectancy) in an area with low social capital than high. However, this should be examined explicitly. In addition, RIO-type interventions could also more explicitly

incorporate ways to address individually perceived social capital. This would be expected to increase their effectiveness further although this would need to be tested in randomised controlled trials.

The remaining tier three weight management centres across the country should use the same question set used in the present study 1, for consistency to see if their patients are experiencing low social capital factors and determine if the programme, they use is helping indirectly. Furthermore, randomised controlled trials for tier three services, using the same survey questions set would be interesting in determining further robust evidence of obesity and social capital.

Further research in to types of social capital interventions are also important with mixed results currently found for health outcomes around the world for groups and individuals (Villalonga-Olives, Wind, & Kawachi, 2018); (Wind & Villalonga-Olives, 2019). Randomised control trials in the area of social capital will build on the present research finding to answer this question.

Social capital and health more widely should also include research into the link with other conditions. For example, is the link between obesity and social capital the same as the link between social capital and other conditions? Would one social capital intervention work for all health conditions?

9.5. Manifesto to reduce obesity based on the evidence

The current approach to tackle obesity by the British government is failing!

This is shown with the numbers of people becoming obese continuing to rise over the course of the last 40 years. Over this time no real dent in the numbers has been achieved by different governments over these generations.

So, instead of continuing the half-hearted approach to obesity, by for example, introducing a *'sugar tax'*, to *'stopping buy one get one free'* offers in shops, and reducing the number of *'fast food'* adverts, the approach needs to be directed at developing interventions which help people to change the scale of the problem.

This thesis and wider evidence have shown Obesity and its link to deprivation and deprived areas is evident. The current research showed that lower social capital along with lower income increases the likelihood of being obese. In turn this raises a question of health equity, providing money and support to the most affected areas so they can improve to the levels of those in richer, less deprived areas. In the updated Marmot (2020) report, suggestion that government intervention would help with this and has been supported in the early part of his research. However, current Prime Minister Sunak (current at time of writing) during his leadership campaign stated that he was trying to undo this.

In this case, in addition to increasing social capital in lived spaces, funding should also be retained to provide RIO-like interventions, especially in areas of relative deprivation. The former would be expected to reduce the development of obesity, and the latter would support weight reduction in those who already are obese. By offering financial support or creating a matrix for change to improve social and health inequality, this research shows introducing a tier 3 weight management centre may be effective in reducing weight gain and limiting obesity even in the most deprived and poorest areas. These contradict the government's argument that certain places should not get extra funding to overcome inequalities when discussing the obesity epidemic across England.

One way to tackle the wider issues for socio-economic status and other social capital variables, could be by reintroducing Labour's formula for NHS funding (pre-2010) (Greener, 2008). This formula included weighting the funding given on the basis of deprivation. A recommendation for a new Labour government to reintroduce this weighting in the formula could include a requirement that at least some funding goes to obesity treatment.

The Rotherham NHS trust **saved "£300,000"** by cutting funding to RIO. One may argue that this did not save money but instead pushed the problem to other areas of the health service with co-morbidity illnesses (Diabetes, Heart disease, endocrine

disease, mobility issues, arthritis to cancers) some of which may have been avoided if RIO was left in operation.

Not only did RIO help people lose weight, but it also increased service users wellbeing. Furthermore, this increase was maintained over the longer term. As the saying goes *"give a man a fish and he'll eat for a day but teach a man to fish and he'll eat for a lifetime"*. The services RIO provided gave people the ability to live healthy lives, improving not only service users' health but all aspects of their lives.

There is no downside to this, only upsides. It would be a relatively low-cost solution, when compared to other interventions, and would be an evidenced based investment in '*RIO's*' across the country. If the decision is to stick with ad campaigns, we may see the cycles of a *sunk cost fallacy*; Policy and campaigns only being implemented to give the appearance that something is trying to be achieved and not directly helping to reduce the number of people living with obesity.

9.6. Concluding statement

Despite the many risks associated with low socio-economic status and low social capital, this thesis demonstrates that obesity need not be inevitable given an appropriate programme of education, exercise, nutrition, and psychological support that may increase social capital. Services such as RIO, a former Tier three weight management centre that were cut during austerity should be reintroduced. Investing in effective weight reduction methods will only be a positive for the local community in terms of well-being, reducing co-morbid diseases and reduction in barriers to work. However, consideration should also be made to the built environment and social resources in order to provide access to greater social capital. These approaches would allow people the chance to live healthier and more fulfilled lives. Funding and interventions should also be focused on areas where they are likely to have the greatest effect those areas with the greatest deprivation and lowest social capital.

10. Bibliography

2011 Census, ward population estimates: Office for National Statistics. (2011). *Census: Office for National Statistics*. London: Office for National Statistics.

80s Actual. (2015, 10 26). *The history of yuppie word*. Retrieved from 80sactual: https://80sactual.blogspot.com/2015/10/the-history-of-yuppie-word.html

Abramowitz, M. K., Hall, C. B., Amodu, A., Sharma, D., Androga, L., & Hawkins, M. (2018). Muscle mass, BMI, and mortality among adults in the United States: A population-based cohort study. *PloS one*, 13(4).

Alberti, K. M., Zimmet, P., & Shaw, J. (2007). International Diabetes Federation: a consensus on Type 2 diabetes prevention. *Diabetic Medicine*, 24(5), 451-463.

Aldi. (2020). *about aldi*. Retrieved from Aldi: https://www.aldi.co.uk/about-aldi

Alkharaiji, M., Anyanwagu, U., Donnelly, R., & Idris, I. (2019). Tier 3 specialist weight management service and pre-bariatric multicomponent weight management programmes for adults with obesity living in the UK: A systematic review. *Endocrinology, Diabetes & Metabolism*, 2(1).

American Psychological Association . (2022, July 11). Retrieved from Socioeconomic status: https://www.apa.org/topics/socioeconomic-status

American Psychological Association. (2022, March 23). *Socioeconomic Status*. Retrieved from American Psychological Association: https://www.apa.org/topics/socioeconomic-status

Anand, S. &. (1994). Human Development Index: Methodology and Measurement. .

Ananthakumar, T., Jones, N., Hinton, L., & Aveyard, P. (2020). Clinical encounters about obesity: systematic review of patients' perspectives. *Clinical obesity*, 10(1), e12347.

ArcGIS. (2022, July). *ArcGIS Desktop*. Retrieved from ArcGIS: https://www.esri.com/en-us/arcgis/products/arcgis-desktop/overview

Arora, T. &. (2020). Health behaviour changes during COVID-19 and the potential consequences: A mini-review. *Journal of Health Psychology*, 25(9), 1155-1163. .

Arteta, M. (2019, 12 15). Press conference. (G. Shreeves, Interviewer)

Asda. (2020). *Groceries Asda*. Retrieved from Asda: https://groceries.asda.com/?cmpid=ahc-_-ghs-_-asdacom-_-nav-_-ghs

ATLAS.ti. (2020, March 24). *Qualitative data insights*. Retrieved from ATLAS.ti: https://atlasti.com/

Bandmretail. (2020). *About us our history*. Retrieved from B and M Retail: https://www.bandmretail.com/about-us/our-history

Barr, B., Higgerson, J., & Whitehead, M. (2017). Investigating the impact of the English health inequalities strategy: time trend analysis. *BMJ*, 358.

Barton, C., Cromarty, H., Garratt, K., & Ward, M. (2022). *The future of coastal communities.* London: Research briefings parliament uk.

Baxter, J. (2002). Families and households. *The Cambridge handbook of social sciences*, 462-479.

BBC. (2017). *1954: Housewives celebrate end of rationing*. Retrieved from BBC: BBC, "1954: Housewives celebrate end of rationing". BBC (2http://news.bbc.co.uk/onthisday/hi/dates/stories/july/4/newsid_3818000/3818563.stm

BBC News. (2003). *BBC News*. Retrieved from Oliver's pukka life as chef: http://news.bbc.co.uk/1/hi/entertainment/2988426.stm

BBC News. (2013). *Findus beef lasagne contained up to 100% horsemeat, FSA says*. Retrieved from BBC News: https://www.bbc.co.uk/news/uk-21375594

BBC News. (2016). *BBC News*. Retrieved from The McDonald's drive-thru at 30: A journey back to an exotic experience: https://www.bbc.co.uk/news/uk-england-38327032

BBC News. (2020). *Coronavirus: Supermarkets ask shoppers to be 'considerate' and stop stockpiling*. Retrieved from BBC NEWS: https://www.bbc.co.uk/news/business-51883440

BDA The Association of UK Dietitians. (2022). *Fad diets: Food fact sheet*. Retrieved from British Dietetic Association: https://www.bda.uk.com/resource/fad-diets.html

Beefeater. (2019). *Beefeater, About Us*. Retrieved from Beefeater: https://www.beefeater.co.uk/generic/About-us.html (accessed 12th January 2019).

Begni, V. S. (2020). Social isolation in rats: Effects on animal welfare and molecular markers for neuroplasticity. *PloS one*, 15(10).

Bennett, N. D. (1995). *Health survey for England 1993*. London: HM Stationery Office.

Better Health, every mind matters. (2022). *Better Health, every mind matters*. Retrieved from NHS UK: https://www.nhs.uk/every-mind-matters/

Better Transport. (2015, January 26). *New research investing rail essential tackling north south divide*. Retrieved from Better Transport: https://bettertransport.org.uk/media/new-research-investing-rail-essential-tackling-north-south-divide/

Biaggi, R. R., Vollman, M. W., Nies, M. A., Brener, C. E., Flakoll, P. J., Levenhagen, D. K., & Chen, K. Y. (1999). Biaggi, Robert R., Michael W. Vollman, Mary A. Nies, Craig E. Brener, Paul J. FlakComparison of air-displacement plethysmography with hydrostatic weighing and bioelectrical impedance analysis for the

assessment of body composition in healthy adults. *The American journal of clinical nutrition 69*, 898-903.

Biressi, A. &. (2013). Class and contemporary British culture. *Springer*, 170.

Biressi, A., & Nunn, H. (Class and Contemporary British Culture). *Class and Contemporary British Culture*. London: Palgrave Macmillan. ISBN 9780230240568.

Björk, J., Albin, M., Grahn, P, P., Jacobsson, H., Ardö, J., Wadbro, J., & Skärbäck, E. (2008). Björk, J., Albin, M., Grahn, P., Jacobsson, H., Recreational values of the natural environment in relation to neighbourhood satisfaction, physical activity, obesity and wellbeing. *Björk, J., Albin, M., Grahn, P., Jacobsson, H., Ardö, J., Wadbro, J., ... & Skärbäck, E. (2008). Recreational values of tJournal of Epidemiology & Community Health*, 62(4).

Bjorntorp, P. (1987). The associations between obesity, adipose tissue distribution and disease. *Acta Medica Scandinavica*, 121-134.

Blackwell, L. (2022, November 11). Research methods used for this thesis .

Borgonovi, F. (2010). A life-cycle approach to the analysis of the relationship between social capital and health in Britain. *Social Science & Medicine*, 71(11), 1927-1934.

Bourdieu, P. (1972). Outline of a theory of practice. Translated by Richard Nice. *Cambridge studies in social anthropology*, 16.

Bourdieu, P. (1977). Outline of a Theory of Practice. *Cambridge university press*, (No. 16).

Bourdieu, P., & Richardson, J. (1986). Social Capital. *Handbook of Theory and Research for the Sociology of Education*, 248.

Bourdieu, P., & Wacquant, L. (2013). Symbolic capital and social classes. *Journal of classical sociology*, 13(2), 292-302.

Boyden, C. (2016). RIO Meeting. (C. f. Research, Interviewer)

Boyden, C. (2016). RIO Meeting. (L. C. Blackwell, & C. f. Research, Interviewers)

Boyden, C. (2016). RIO Meeting. (L. C. Blackwell, Interviewer)

Boyden, C. (2016). RIO Meeting. (L. C. Blackwell, & Center for Health Services and Clincal Research, Interviewers)

Boyden, C. (2017). RIO Meeting. (L. Blackwell, Interviewer)

Boyden, C. (2017). RIO Meeting. (L. C. Blackwell, & Center for Health Services and Clinical Research, Interviewers)

Boyden, C. (2017). RIO Meeting. (L. C. Blackwell, & C. f. Research, Interviewers)

Boyden, C. (2017). RIO Meeting. (L. C. Blackwell, Interviewer)

Boyden, C. (2017). RIO Meeting. (L. C. Blackwell, & Center for Health Services and Clincal Research, Interviewers)

Boyden, C., Fallows, S., & Capehorn, M. (2014). Retrospective analysis of subjective wellbeing index scores, with effect of weight change and demographics in patients attending the Rotherham Institute for Obesity. Chester , England : University of Chester - RIO.

Boyden, C., Wilson, C., & Capehorn, M. (2015). Retrospective analysis of subjective wellbeing and weight loss in patients recieving talking therapies at RIO. *Wellbeing and weight loss at RIO* . Rotherham , South Yorkshire: RIO.

BPS. (2022, 10 14). *Abstact*. Retrieved from British Psychological Society: https://explore.bps.org.uk/highwire_display/entity_view/node/59457/full

Branley-Bell, D. &. (2020). Exploring the impact of the COVID-19 pandemic and UK lockdown on individuals with experience of eating disorders. *Journal of Eating Disorders*, 8(1), 1-12.

Braun, V., & Clark, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2), 77-101.

Braveman, P., & Gruskin, S. (2003). Defining equity in health. *Journal of Epidemiology & Community Health*, 57(4), 254-258.

Bre. (2013). *Report 9: Domestic appliances, cooking & cooling equipment.* London: Department of Energy and Climate Change.

Brewers Fayre. (2019). *Brewers Fayre, About Us*. Retrieved from Brewers Fayre: https://www.brewersfayre.co.uk/Generic-pages/About-us.html (accessed 12th January 2019).

British Heart Foundation. (2022, 01 23). *Heart Matters* . Retrieved from British Heart Foundation: https://www.bhf.org.uk/informationsupport/heart-matters-magazine/medical/measuring-your-waist

Brown, T., O'Malley, C., Blackshaw, J., Coulton, V., Tedstone, A., Summerbell, C., & Ellis, L. (2017). Exploring the evidence base for Tier 3 weight management interventions for adults: a systematic review. *Clinical obesity*, 7(5), 260-272.

Bryman, A. (2016). *Social research methods.* London: Oxford university press.

Burger King. (2019). *Burger King, History*. Retrieved from Burger King: http://www.burgerking.co.uk/about-bk

Burgoine, T. F. (2016). Does neighbourhood fast-food outlet exposure amplify inequalities in diet and obesity? A cross-sectional study. *The American journal of clinical nutrition*, 1540-1547.

Butler, P. (2022, September 18). *Millions forced to skip meals as UK cost of living crisis deepens*. Retrieved from The Guardian: https://www.theguardian.com/society/2022/oct/18/millions-forced-to-skip-meals-as-uk-cost-of-living-crisis-deepens

Caballero, E. (2007). The global epidemic of obesity: an overview . *Epodemiologic Reviews*, 29 (1), 1-5.

Cambridge Dictionary . (2022, 02 02). *Morphology*. Retrieved from Cambridge Dictionary: https://dictionary.cambridge.org/dictionary/english/morphology

Cambridge Dictionary . (2023, Janury 23). *Creature of habit*. Retrieved from Cambridge Dictionary: https://dictionary.cambridge.org/dictionary/english/creature-of-habit

Cambridge Dictionary. (2022, January 5). *Social Capital*. Retrieved from Cambridge Dictionary : https://dictionary.cambridge.org/dictionary/english/social-capital

Capehorn, D. M. (2011, March 28). RIO -Rotherham Institute for Obesity. (N. R. QTV, Interviewer)

Capehorn, D. M. (2016). RIO Meeting. (C. f. Blackwell), Interviewer)

Capehorn, M. (2016). RIO Meeting. (C. f. Research, Interviewer)

Capehorn, M. (2016). RIO Meeting. (C. f. Blackwell), Interviewer)

Capehorn, M. (2016). RIO Meeting. (C. f. Blackwell), Interviewer)

Capehorn, M. (2016). RIO Meeting. (L. C. Blackwell, Interviewer)

Capehorn, M. (2016). RIO Meeting. (L. C. Blackwell, & Research, Center for Health Services and Clinical , Interviewers)

Capehorn, M. (2016). RIO Meeting. (L. C. Blackwell, & Center for Health Services and Clincal Research, Interviewers)

Capehorn, M. (2016). RIO Meeting. (L. C. Blackwell, & Center for Health Services and Clincal Research, Interviewers)

Capehorn, M. (2017). RIO Meeting. (C. f. Blackwell), Interviewer)

Capehorn, M., Carter, D., & Senior, L. (2011). Service Evaluation of the Rotherham Institute for Obesity. *Service Evaluation of the Rotherham Institute for Obesity*. Roterham, South Yorkshire: RIO.

Capehorn, M., Haslam, D. W., & Welbourn, R. (2016). Obesity Treatment in the UK Health System. *Current Obesity Reports*, 5, 320–326.

Carrillo-Álvarez, E., Kawachi, I., & Riera-Romaní, J. (2019). Neighbourhood social capital and obesity: a systematic review of the literature. *Obesity reviews*, 20(1), 119-141. .

Carter, D., Steele, C., Bacchus, M., Senior, L., & Capehorn, M. (2015). Analysis of the use of a commercial Low Calorie Liquid Diet at the Rotherham Institute for Obesity. Rotherham, South Yorkshire: RIO.

Carter, J. L., Carter, J. L., & Heath, B. H. (1990). Somatotyping: development and applications. *Cambridge university press*, (Vol. 5).

Castelow, .. E. (2018). *Food in Britain in the 1950s and 1960s*. Retrieved from Historic UK: https://www.historic-uk.com/CultureUK/Food-in-Britain-in-the-1950s-1960s/

Chakelian, A. (2022, January 25). *The british public is changing its concept of class*. Retrieved from New Statesman: https://www.newstatesman.com/society/2022/01/exclusive-the-british-public-is-changing-its-concept-of-class

Change4Life. (2022). *Change4Life - Eat Well, Move More, Live Longer*. Retrieved from Weight Loss Resources: https://www.weightlossresources.co.uk/healthy_eating/healthy-lifestyle/change-for-life.htm

Change4Life NHS. (2019). *About Change4Life*. Retrieved from Change4Life: https://www.nhs.uk/change4life/about-change4life

Child poverty data: HM Revenue and Customs. (2016). *Child poverty data: HM Revenue and Customs*. London: HM Revenue and Customs.

Chowdhury, S. (2022, October 15). *Cost of living crisis: 1.8 million children facing poorer quality school meals as food costs rise*. Retrieved from SkyNews: https://news.sky.com/story/cost-of-living-crisis-1-8-million-children-facing-poorer-quality-school-meals-as-food-costs-rise-12720797

Church, T. S., Kuk, J. L., Ross, R., Priest, E. L., Biloff, E., & Blair, S. N. (2006). Association of cardiorespiratory fitness, body mass index, and waist circumference to nonalcoholic fatty liver disease. *Gastroenterology*, 130(7), 2023-2030.

Clare, K. (2016). UK Congress on Obesity 2016. Nottenham.

Clark, K. (2016). ASO Citizens' Council. *3rd UK Congress on Obesity* . Nottingham: UKCO.

Clark, K. (2016, September). UK Congress on Obesity. (L. Blackwell, Interviewer)

Colditz, G. A. (1992). Economic costs of obesity. *The American journal of clinical nutrition*, 55(2), 503S-507S.

Coleman, J. (1990). Foundations of Social Theory. *Cambridge, Mass.: Belknap Press. Deutsch*, 302.

Collins Dictionary. (2022, May 1). *Collins Dictionary*. Retrieved from Inequality: https://www.collinsdictionary.com/dictionary/english/inequality

Collins, M. A., Millard-Stafford, M. L., Sparling , P. B., Snow, T. K., Rosskopf, L. B., Webb, S. A., & Omer, J. (1999). Collins, M. A., Millard-Stafford, M. L., Sparling, P. B., Snow, TEvaluation of the BOD POD for assessing body fat in collegiate football players. *Medicine and science in sports and exercise*, 31(9), 13.

Communities.Gov.UK. (2021, September 23). *Indices of Deprivation: 2019 and 2015*. Retrieved from Communities.gov.uk/IMD: https://dclgapps.communities.gov.uk/imd/iod_index.html

CORC Child Outcomes Research Consortium. (2020, July 19). *The World Health Organisation- Five Well-Being Index (WHO-5)*. Retrieved from CORC: https://www.corc.uk.net/outcome-experience-measures/the-world-health-organisation-five-well-being-index-who-5/#:~:text=The%20WHO%2D5%20is%20free,not%20require%20permission%20to%20use.

Counterweight Project Team. (2004). A new evidence-based model for weight management in primary care: the Counterweight Programme. *Journal of Human Nutrition and Dietetics*, 17(3), 191-208.

Cuevas, A., Kawachi, I., Ortiz, K., Pena, M., Reitzel, L., & McNeill, L. (2020). Greater social cohesion is associated with lower body mass index among African American adults. *Preventive medicine reports*, 18, 101098.

Darlington, R. (2014). An alter factual methodological approach to labour history: the case of the British miners' strike 1984–1985. *Labor History*, 55(2), 137-150.

Defra. (2006). *Food and Drink Economics branch, Economic Note on UK Grocery Retailing, Review of the UK food sector*. London: Defra: Food and Drink Econo.

Denman, j. M. (1996). *Unemployment statistics from 1881 to the present day*. London: Labour Market Statistics Group, Central Statistical Office. The Government Statistical Service.

Denzin, N. (1978). Triangulation: A case for methodological evaluation and combination. *Sociological methods*, 339-357.

Department for Environment Food & Rural Affairs. (2015). *Family Food 2015*. London: Department for Environment Food & Rural Affairs.

Department for Work and Pensions (via NOMIS). (2018). *Benefit data: Department for Work and Pensions (via NOMIS)*. London: Department for Work and Pensions.

Department of Health. (2015). *Public Health Responsibility Deal. (final)* . Retrieved from Gov.uk: https://www.gov.uk/government/news/public-health-responsibility-deal

Department of Health and Social Care. (2020, July 27). *Tackling obesity: empowering adults and children to live healthier lives*. Retrieved from Department of Health and Social Care. Policy Paper: https://www.gov.uk/government/publications/tackling-obesity-government-strategy/tackling-obesity-empowering-adults-and-children-to-live-healthier-lives

Department of Health, Obesity and Food Branch. (2013). *Developing a specification for lifestyle weight managment services.* London: Department of Health.

Detollenaere, J., Desmarest, A., Boeckxstaens, P., & Willems, S. (2018). The link between income inequality and health in Europe, adding strength dimensions of primary care to the equation. *Social Science & Medicine*, 201, 103-110.

Deurenberg, P., Weststrate, J. A., & Seidell, J. C. (1991). Body Mass Index as a measurment of body fatness: age-and-sex-specific prediction formulas. *British journal of nutrition* , 65(2) 105-114.

Diabetes. (2022). *BMI*. Retrieved from Diabetes: https://www.diabetes.co.uk/bmi.html

Diabetes UK. (2018). *The 2018 UK sugar tax*. Retrieved from Diabetes: https://www.diabetes.co.uk/nutrition/2018-uk-sugar-tax.html

Diabetes UK. (2022, 01 23). *Diabetes risk and waist measurment*. Retrieved from Diabetes UK: https://www.diabetes.org.uk/preventing-type-2-diabetes/waist-measurement

Dickens, C. (1868). *The Adventures of Oliver Twist.* London: Ticknor and Fields.

DiNicolantonio, J. J., Lucan, S. C., & O'Keefe, J. (2016). The evidence for saturated fat and for sugar related to coronary heart disease. *Progress in cardiovascular diseases*, 464-472.

Doane, D., & Seward, L. (2011). Measuring Skewness: A Forgotten Statistic? *Journal of Statistics Education*, Volume 19, Number 2.

Donkin, A. J. (2014, Febuary 21). Social Gradient. *The Wiley Blackwell encyclopedia of health, illness, behavior, and society*, 2172-2178. Retrieved from Institute of Health Equity: https://www.instituteofhealthequity.org/in-the-news/articles-by-the-institute-team-/social-gradient

Driscoll, D., Appiah-Yeboah, A., Salib, P., & Rupert, D. (2007). Merging qualitative and quantitative data in mixed methods research: How to and why not.

Dunford, L. (2022). The Angel (North London Forever) [Recorded by L. Dunford]. London, Highbury, England.

Durnin, & Rahaman. (1967). The assessment of the amount of fat in the human body from measurments of skinfold thickness. *British Journal od Nutrition, 21*, (3) 681-689.

Durnin, & Womersley. (1974). Body fat assessed from total body density and its estimation from skinfold thickness: measurements on 481 men and women aged from 16 to 72 years. *British journal of nutrition*, 32(01), 77-97.

Durnin, J. V., & Womersley, J. V. (1974). Body fat assessed from total body density and its estimation from skinfold thickness: measurements on 481 men and women aged from 16 to 72 years. *British journal of nutrition*, 32(1), 77-97.

Ehsan, A., Klaas, H., Bastianen, A., & Spini, D. (2019). Social capital and health: a systematic review of systematic reviews. *SSM-population health*, 1.

Eknoyan, G. (2008). Adolphe Quetelet (1796–1874)—the average man and indices of obesity. *Nephrology Dialysis Transplantation*, 23(1), 47-51. .

Eknoyan, G. (2008). Adolphe Quetelet (1796–1874)—the average man and indices of obesity. . *Nephrology Dialysis Transplantation*, 23(1), 47-51. .

Ellis, A., & Fry, R. (2010). Regional health inequalities in England. *Regional Trends*, 42(1), 60-79.

England.NHS.UK. (2019, March 23). *What are healthcare inequalities - deprivation*. Retrieved from England.NHS.UK: https://www.england.nhs.uk/about/equality/equality-hub/national-healthcare-inequalities-improvement-programme/what-are-healthcare-inequalities/deprivation/

England.NHS.UK. (2021, July 27). *Population Health and the Population Health*. Retrieved from England.NHS.Uk: https://www.england.nhs.uk/integratedcare/what-is-integrated-care/phm/

England.NHS.UK. (2022, January 12). *Health Inequalties Hub*. Retrieved from England.NHS.UK: https://www.england.nhs.uk/about/equality/equality-hub/

England.NHS.UK. (2022, January 12). *National Healthcare Inequalities Improvement Programme*. Retrieved from England.NHS.UK: https://www.england.nhs.uk/about/equality/equality-hub/national-healthcare-inequalities-improvement-programme/

Espana-Romero, V., Ruiz, J. R., Ortega, F. B., Artero, E. G., Vicente-Rodriguez, G., Moreno, L. A., & Gutierrez, A. (2009). Body fat measurement in elite sport climbers: comparison of skinfold thickness equations with dual energy X-ray absorptiometry. *Journal of Sports Sciences*, 27(5) 469-477.

Evans, G., & Kutcher, R. (2011). Loosening the link between childhood poverty and adolescent smoking and obesity: The protective effects of social capital. *Psychological Science*, 22(1), 3-7.

Evening Standard. (2021). *Just Eat ups guidance after UK delivery orders soar 733% as it takes on Deliveroo and UberEats*. Retrieved from Evening Standard: https://www.standard.co.uk/business/just-eat-ups-guidance-as-uk-delivery-orders-soar-733-b945940.html

Fagerland, M. (2012). t-tests, non-parametric tests, and large studies—a paradox of statistical practice? *BMC medical research methodology*, 12(1), 1-7.

Fenton, K. (2016). Prevention and treatment of obesity: Setting the Scene. *Research Workshop: Prevention and treatment of obesity: Setting the Scene / the 'need' for research.* Emirates Stadium, London: National Institute of Health Research (NIHR).

Festinger, L., Schachter, S., & Back, S. (1950). Social pressures in informal groups; a study of human factors in housing.

Field, A. (2000). 3: Nonparametric tests (Handout). In A. Field, *Discovering statistics using SPSS for Windows* (pp. 1-6). London : Sage.

Field, A. (2005). Chapter 15: Factor Analysis Using SPSS (Research Methods II) Handout. In A. Field, *Discovering statistics using SPSS (2nd edition)* (pp. 1-14). London: Sage.

Field, A. (2010, July 1). *Chapter 18: Exploratory factor analysis.* Retrieved from Discovering Statistics Using SPSS: https://study.sagepub.com/sites/default/files/labcoatleni_worldwide_addiction.pdf

Field, A. (2013). *Discovering statistics using SPSS: and sex and grugs and rock 'n' roll (4th Edition) Hand out.* London: Sage.

Field, A. (2013). Exploring Data: The Best if Bias (Handout). In A. Field, *Discovering statistics using SPSS: and sex drugs and rock 'n' roll (4th Edition)* (pp. 1-21). London: Sage.

Field, A. (2013). Exploring factor analysis. In A. Field, *Discovering Statistics Using IBM SPSS Statistics* (pp. 665-719). Thousand Oaks, CA: Sage.

Field, A. (2016). *Chapter 19: Logistic Regression* . Retrieved from Discovering Statistics Using SPSS: https://edge.sagepub.com/system/files/chapter19_2.pdf

Field, A. (2017, September 9). *Chapter 19: Logistic regression*. Retrieved from DISCOVERING STATISTICS USING SPSS (handout): https://edge.sagepub.com/system/files/chapter19_2.pdf

Fleming , R., & Chaudhuri, T. (2020). How Expensive is it to lose weight?-The financial cost of one such weight loss program. *Fleming, R. M., & Chaudhuri, T. K. (2020). How Expensive is it to lose weightJournal of Cardiovascular Medicine and Cardiology*, 7(1), 057-059.

Food Standards Agency. (2007). *Food: Using traffic lights to make healthy choices*. Retrieved from Food.Gov: http://www.food.gov.uk/multimedia/pdfs/publication/foodtrafficlight1107.pdf

Food Standards Agency. (2018). *Guide to creating a front of pack (FoP) nutrition label for pre-packed products sold through retail outlets.* London: Department of Health.

Frank, A. (1993). Futility and avoidance: medical professionals in the treatment of obesity. *Jama*, 269(16), 2132-2133.

Fulton, A., Cooper, R., & Capehorn, M. (2012). Who are the biggest losers? Rotherham , South Yorkshire: RIO Poster .

Get Healthy Rotherham. (2022, 05 10). *Get Healthy Rotherham*. Retrieved from Get Healthy Rotherham Well Being Walks: https://www.gethealthyrotherham.co.uk/News/249/get-healthy-rotherham-well-being-walks

Gostin, L., Boufford, J., & Martinez, R. (2004). The future of the public's health: vision, values, and strategies. *Health Affairs*, 23(4), 96-107.

Gray, M., & Barford, A. (2018). The depths of the cuts: the uneven geography of local goverment austerity . *Cambridge journal of regions, economy and society* , 11(3) 541-563.

Great Britain Parliament House of Commons Health Committee. (2004). *Great Britain Parliament House of ComObesity – Volume 1 – HCP 23-I, Third Report of session 2003–04. The report, together with formal minutes.* London: UK: TSO (The Stationery Office).

Greener, I. (2008). *Funding the NHS. In Healthcare in the UK.* London: Policy Press.

Greggs. (2020). *at a glance our history*. Retrieved from Greggs: https://corporate.greggs.co.uk/at-a-glance/our-history

Griffin, N., Phillips, S., Hillier-Brown, F., Wistow, J., Fairbrother, H., Holding, E., . . . Summberbell, C. (2021). A critique of the English national policy from a social determinants of health perspective using a realist and problem representation approach: the 'Childhood Obesity: a plan for action'. *BMC public health*, 21(1), 1-10.

Guilcher, S., Kaufman-Shriqui, V., Hwang, J., O'Campo, P., Matheson, F., Glazier, R., & Booth, G. (2017). The association between social cohesion in the neighborhood and body mass index (BMI): an examination of gendered differences among urban-dwelling Canadians. *Preentive medicine*, 99, 293-298.

Hamdy, O., Porramatikul, S., & Al-Ozairi, E. (2006). Metabolic obesity: the paradox between visceral and subcutaneous fat. *Current diabetes reviews*, 2(4), 367-373.

Han, J., Chu, X., Song, H., & Li, Y. ((2015)). Social capital, socioeconomic status and self-efficacy. *Applied Economics and Finance*, 2(1), 1-10.

Han, T. S., Van Leer, E. M., Seidell, J. C., & Lean, M. E. (1995). Waist circumference action levels in the identification of cardiovascular risk factors: prevalence study in a random sample. *Bmj*, 311(7017), 1401-1405. .

Han, T. S., Van Leer, E. M., Seidell, J. C., & Lean, M. J. (1995). Waist circumference action levels in the identification of cardiovascular risk factors: prevalence study in a random sample. *Bmj*, 311(7017), 1401-1405.

Hanifan, L. J. (1916). The rural school community center. *Annals of the American Academy of Political and Social Science*, 67:130–38.

Hankey, C. &. (2018). *Advanced Nutrition and Dietetics in Obesity*. West Sussex: John Wiley & Sons. .

Harpham, T., Grant, E., & Thomas, E. (2002). Measuring social capital within health surveys: key issues. *Health policy and planning*, 17(1), 106-111.

Harris, J. A., & Benedict, F. G. (1918). A biometric study of human basal metabolism. *Proceedings of the National Academy of Sciences*, 4(12), 370-373.

Hastings, A., Bailey, N., Bramley, G., & Gannon, M. (2017). Austerity urbanism in England: The 'regressive redistribution' of local goverment services and the impact on the poor and marginalised . *Enviroment and Planning A*, 49(9) 2007-2024.

Hay, B. (2022, July 26). *The Intermediary*. Retrieved from How much have detached semi detached and terraced house prices increased by?: https://theintermediary.co.uk/2022/07/how-much-have-detached-semi-detached-and-terraced-house-prices-increased-by/#:~:text=The%20UK%20average%20detached%20house,House%20price%20at%20%C2%A31%2C164%2C863

Hay, C. (2009). The winter of discontent thirty years on. *The Political Quarterly*, 80(4), 545-552. .

Haynes, W. (2013). Bonferroni correction. *Encyclopedia of systems biology*, 154-154.

Hazlehurst, J., Logue, J., Parretti, H., Abbott, S., Brown, A., Pournaras, D., & Tahrani, A. (2020). Developing integrated clinical pathways for the management of clinically severe adult obesity: a critique of NHS England policy. *Current obesity reports*, 9(4), 530-543.

Helms, E. R., Aragon, A. A., & Fitschen, P. J. (2014). Evidence-based recommendations for natural bodybuilding contest preparation: nutrition and supplementation. *Journal of the International Society of Sports Nutrition*, 11(1), 1-20.

Henderson, A. (2021, July 20). *Slimming World Syns: What Are They and What Do They Mean for Healthy Weight Management?* Retrieved from Womens Health: https://www.womenshealthmag.com/uk/food/weight-loss/a36004291/slimming-world-syns/

Herts CC Indices of Deprivation in Hertfordshire. (2021, June 19). *Indices of Deprivation in Hertfordshire*. Retrieved from Herts CC Indices of Deprivation in Hertfordshire: https://hertscc.maps.arcgis.com/apps/MapSeries/index.html?appid=faa9c3160cf8409ba082fd73a597df20

Herts Insight . (2021, July 12). *Herts Insight*. Retrieved from Deprivation and Poverty Profile for LSOA Welwyn Hatfield 007A: https://reports.instantatlas.com/view-report/a0bcf43e68524a11b96cc82611fbb445/E01023954

Heslehurst, N., Rankin, J., Wilkinson, J., & Summerbell, C. (2010). A nationally representative study of maternal obesity in England, UK: trends in incidence and demographic inequalities in 619 323 births, 1989–2007. *International journal of obesity*, 34(3), 420-428.

Heuer, C. (2010, March). "*Fattertainment*" – *Obesity in the Media*. Retrieved from Obesity Action: https://www.obesityaction.org/resources/fattertainment-obesity-in-the-media/

Heydari, S. T., & Zare, N. (2011). Diagnostic value of bioeletrical impedance analysis versus body mass index for detection of obesity amoung students. *Asian journal of Sports Medicine*, 2(2), 68.

Higgins, V., & Marshall, A. (2012, April 30). *Health Survey for England Time Series Dataset, 1991–2009*. Retrieved from UK Data Service (accessed September 24, 2017).: http://doi. org/10.5255/UKDA-SN-7025-1

Hilal , A., & Hilal, S. (2013). Using NVivo for data analysis in qualitative research. *International interdisciplinary journal of education*, 2(2), 181-186.

Hilton, S., Patterson, C., & Teyhan, A. (2012). Escalating coverage of obesity in UK newspapers: the evolution and framing of the "obesity epidemic" from 1996 to 2010. *Obesity, 20(8)*, 1688-1695.

Hobbs, B. (2016). *When Did Microwaves Become Popular in UK?* Retrieved from Best spy: https://www.bestspy.co.uk/microwaves-become-popular-uk/

Hoffer, E. C., Meador, C. K., & Simpson, D. C. (1969). Correlation of whole-body impedance with total body water volume. *Journal of applied physiology*, 27(4), 531-534.

Holtgrave, D., & Crosby, R. (2006). Is social capital a protective factor against obesity and diabetes? Findings from an exploratory study. *Annals of epidemiology*, 16(5), 406-408.

Homer, C., Tod, A., Thompson, A., Allmark, P., & Goyder, E. (2016). Expectations and patients' experiences of obesity prior to bariatric surgery: a qualitative study. *BMJ open*, 6(2), e009389.

Honjo, K. (2004). Social epidemiology: Definition, history, and research examples. *Environmental health and preventive medicine*, 9(5), 193.

Hooper, L., Anderson, A., Birch, J., Forster, A., Rosenberg, G., Bauld, L., & Vohra, J. (2018). Public awareness and healthcare professional advice for obesity as a

risk factor for cancer in the UK: a cross-sectional survey. *Journal of public health*, 40(4), 797-805.

House of Commons Health Committee. (2009). *Health inequalities: Third Report of Session 2008-09*. London: Third Report of Session 2008-09. Volume 1. Hc286-1.The Stationery Office.

HSCIC. (2016). Statistics on Obesity, Physical Activity and Diet. *Office of National Statistics* .

Ibrahim, M. M. (2010). Subcutaneous and visceral adipose tissue: structural and functional differences. *Obesity reviews*, 11(1), 11-18.

Iceland. (2019). *About Iceland*. Retrieved from Iceland: http://about.iceland.co.uk/

Iceland. (2020). *Iceland delivery*. Retrieved from Iceland: https://www.iceland.co.uk/free-delivery.html

Institute of Health Equity. (2014, Febuary 21). *Social Gradient*. Retrieved from Institute of Health Equity: https://www.instituteofhealthequity.org/in-the-news/articles-by-the-institute-team-/social-gradient

Institute of Health Equity. (2022, January 24). *About Professor Sir Michael Marmot*. Retrieved from Institute of Health Equity: https://www.instituteofhealthequity.org/about-us/about-professor-sir-michael-marmot

Jackson, A. S., & Pollock, M. L. (1978). Intertester reliability of selected skinfold and circumference measurements and percent fat estimates. *Research Quarterly. American Alliance for Health, Physical Education and Recreation*, 49(4), 546.

Jackson, A. S., & Pollock, M. L. (1985). Practical assessment of body composition. *Physician and Sportsmedicine*, 13(5), 76.

Jackson, S. E., Wardle, J., Johnson, F., Finer, N., & Beeken, R. J. (2013). The impact of a health professional recommendation on weight loss attempts in overweight and obese British adults: a cross-sectional analysis. *BMJ open*, 3(11), e003693.

Jackson, S., Holter, L., & Beeken, R. (2019). 'Just because I'm old it doesn't mean I have to be fat': a qualitative study exploring older adults' views and experiences of weight management. *BMJ open*, 9(2), e025680.

Jamie's Ministry of Food - Channel 4. (2008, 10 02). *Jamie vs Burger Mum*. Retrieved from Jamie's Ministry of Food - Channel 4: https://www.youtube.com/watch?v=JsOl64sQjd4

Jamie's Ministry of Food. (2008). *Jamie's Ministry of Food, Jamie Oliver, TV Show, Channel 4*. Retrieved from Jamie's Ministry of Food: https://www.jamiesministryoffood.com/

Jamie's Oliver's Ministry of Food. (2008). *Jamie's Ministry of Food, Jamie Oliver, TV Show, Channel 4.* Retrieved from Jamie's Ministry of Food: https://www.jamiesministryoffood.com/

Jennings, A., Hughes, C., Kumaravel, B., Bachmann, M., Steel, N., Capehorn, M., & Cheema, K. (2014). Evaluation of a multidisciplinary Tier 3 weight managment services for adults with morbid obesity and comorbidities, based in primary care. *Clinical obesity*, 4(5), 254-266.

John Lewis. (2022, 12 12). *Tanita*. Retrieved from John Lewis: https://www.johnlewis.com/brand/tanita/_/N-1z140dp

Kaiser, H. (1974). An index of factorial simplicity. *psychometrika*, 39(1), 31-36.

Kawachi, I. (2008). The measurment of community social capital through surveys. In I. Kawachi, S. Subramanian, & D. Kim, *Social capital and health. In Social capital and health* (p. 57). New York, NY: Springer.

Kawachi, I., & Subramanian, S. (2018). Social epidemiology for the 21st century. *Social Science & Medicine*, 196, 240-245.

Kawachi, I., Kim, D., Coutts, A., & Subramanian, S. (2004). Commentary: Reconciling the three accounts of social capital. *International journal of epidemiology*, 33(4), 682-690.

Kelley, D. E., Bray, G. A., Pi-Sunyer, F. X., Klein, S., Hill, J., Miles, J., & Hollander, P. (2002). Clinical efficacy of orlistat therapy in overweight and obese patients with insulin-treated type 2 diabetes: a 1-year randomized controlled trial. *Diabetes care*, 25(6), 1033-1041.

KFC. (2019). *KFC Developments*. Retrieved from KFC: https://www.kfc.co.uk/development/developments-at-kfc

Khalil, S. F., Mohktar, M. S., & Ibrahim, F. (2014). The theory and fundamentals of bioimpedance analysis in clinical status monitoring and diagnosis of diseases. *Sensors*, 14(6) 10895-10928.

Kim, D., Subramanian, S., & Kawachi, I. (2008). *Social capital and physical health.* New York, NY: Springer.

Kim, D., Subramanian, S., Gortmaker, S., & Kawachi, I. (2006). US state-and county-level social capital in relation to obesity and physical inactivity: a multilevel, multivariable analysis. *Social science & medicine*, 63(4), 1045-1059.

Kissebah, A. H., Vydelingum, N., Murray, R., Evans, D. J., Kalkhoff, R. K., & Adams, P. W. (1982). Relation of body fat distribution to metabolic complications of obesity. *The Journal of Clinical Endocrinology & Metabolism*, 54(2), 254-260.

Klein, S. (2016). Textbook of Endocrinology (Thirteenth Edition). *Elsevier Health Sciences*.

Kobayashi, T., Suzuki, E., Oksanen, T., Kawachi, I., & Takao, S. (2014). The bright side and dark side of workplace social capital: opposing effects of gender on overweight among Japanese employees. *PLoS One*, (1), e88084.

Kuhn, T. S. (1970). *Criticism and the growth of knowledge: Volume 4: Proceedings of the International Colloquium in the Philosophy of Science*. London: Kuhn, T. S. (1970). Criticism and the growth of knowledge: Volume 4: Proceeding1965 (Vol. 4). Cambridge university press.

Kushner, R. F. (1992). Bioelectrical impedance analysis: a review of principles and applications. *Journal of the American college of nutrition*, 11(2), 199-209.

Kushner, R. F., & Schoeller, D. A. (1986). Estimation of total body water by bioelectrical impedance analysis. *The American journal of clinical nutrition*, 44(3), 417-424.

Lamnisos, D., Lambrianidou, G., & Middleton, N. (2019). Small-area socioeconomic deprivation indices in Cyprus: development and association with premature mortality. *BMC Public Health*, 1-11.

Lennon, J., & McCartney, P. (1966). Paperback Writer [Recorded by The Beatles]. London, EMI, England.

lidl. (2020). *lidl about us*. Retrieved from lidl: https://www.lidl.com/about-us

Lighter Life. (2016). *Lighter Life plans*. Retrieved from Lighter Life: https://www.lighterlife.com/

Lighter Life. (2018). *BMI Calculator*. Retrieved from Lighter Life: http://www.lighterlife.com/bmi-calculator/

LighterLife. (2016, September 10). *Credentials - NICE Approved* . Retrieved from LifterLife: https://www.lighterlife.com/credentials/

Lloret-Linares, C., Faucher, P., Coupaye, M., Alili, R., Green, A., Basdevant, A., & Poitou, C. (2013). Comparison of body composition, basal metabolic rate and

metabolic outcomes of adults with Prader Willi syndrome or lesional hypothalamic disease with primary obesity. *International journal of obesity*, 37(9), 1198-1203.

Local Goverment Association. (2010). *Marmot Review Report - Fair Society, Healthy Lives.* London: UCL.

Local Health Indicators: Public Health England (Rotherham). (2011). *Local Health Indicators: Public Health England.* . London: Public Health England.

LocalGP. (2016, 11 12). Discussion with Hertfordshire GP. (L. Blackwell, Interviewer)

Loopstra, R. (2020). Vulnerability to food insecurity since the COVID-19 lockdown. *The Food Foundation*.

Loury, G. (1992). The economics of discrimination: Getting to the core of the problem. *Harvard Journal for African American Public Policy*, 100.

Lovett, S. (2022, May 30). *Rising cost of food will push more families to food banks*. Retrieved from Independent: https://www.independent.co.uk/news/uk/home-news/cost-of-living-food-banks-uk-latest-b2090591.html

MacCallum, R., Widaman, K., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological methods*, 4(1), 84.

Mackenbach, J., Lakerveld, J., Van Lenthe, F., Kawachi, I., McKee, M., Rutter, H., & Brug, J. (2016). Neighbourhood social capital: measurement issues and associations with health outcomes. *Obesity reviews*, 17, 96-107.

Maddan, S., Walker, J. T., & Miller, J. M. (2008). Does size really matter?: A reexamination of sheldon's somatotypes and criminal behavior. *The Social Science Journal*, 45(2), 330-344.

Mail Online. (2021). *Britain's £15 BILLION takeaway binge: Deliveroo orders DOUBLE while JustEat sees 75% rise despite lockdown measures ending - as 38% of*

homes now get fast food delivered at least once a week. Retrieved from Mail Online: https://www.dailymail.co.uk/news/article-9882

Manca, A. R. (2014). Social Cohesion. In A. Michalos, *Encyclopedia of Quality of Life and Well-Being Research.* Dordrecht: Springer.

Mandela, N. (2001). "It always seems impossible until it's done.". *Speech*. South Africa.

Marmot Review report – 'Fair Society, Healthy Lives. (2010, Febuary 11). Retrieved from Local Goverment : https://www.local.gov.uk/marmot-review-report-fair-society-healthy-lives

Marmot, M. (2010). *Fair society, healthy lives: the Marmot review. 2010.* London.

Marmot, M. (2020). Health equity in England: the Marmot review 10 years on. *Bmj*, 368.

Marmot, M., Allen, J., Boyce, T., Goldblatt, P., & Marrison, J. (2020, February). *Marmot Review 10 Years On*. Retrieved from Institute of Health Equity: https://www.instituteofhealthequity.org/resources-reports/marmot-review-10-years-on#:~:text=%23Marmot2020%20confirms%20an%20increase%20in,the%20shorter%20the%20life%20expectancy.

Mattioli, A. V. (2020). Quarantine during COVID-19 outbreak: Changes in diet and physical activity increase the risk of cardiovascular disease. *Nutrition, Metabolism and Cardiovascular Diseases*, 30(9), 1.

May, J., Williams, A., Cloke, P., & Cherry, L. (2020). Still bleeding: The variegated geographies of austerity and food banking in reual England and Wales. *Journal of Rural Studies*, 79, 409-424.

Mayor of London. (2018). *Ban on junk food advertising on transport network*. Retrieved from London Gov: https://www.london.gov.uk/press-releases/mayoral/ban-on-junk-food-advertising-on-transport-network-0

McCrum, R. (2006). *Why I Love… Ready Steady Cook*. Retrieved from The Gradian: https://www.theguardian.com/media/2006/sep/10/lifeandhealth.broadcasting

McDonalds. (2019). *McDonalds Newsroom*. Retrieved from McDonalds: https://www.mcdonalds.com/gb/en-gb/newsroom/history.html

McDonalds. (2019). *McDonalds, History*. Retrieved from McDonalds: https://www.mcdonalds.com/gb/en-gb/newsroom/history.html (accessed 12th January 2019)

McIntyre, N., & Gayle, D. (2022, Febuary 26). *Poorest areas of England have less than third of garden space enjoyed by richest - Access to green space*. Retrieved from The Guardian: https://www.theguardian.com/inequality/2022/feb/26/poorest-areas-of-england-have-less-than-third-of-garden-space-enjoyed-by-richest

McRaw, M. P. (2010). Male and female differences in variability with estimating body fat composition using skinfold calipers. *Journal of Chiropractic Medicine*, 9(4), 157-161.

Measure Wellbeing. (2017, December 4). *World Health Organisation Five Well-Being Index (WHO-5)*. Retrieved from Measure Wellbeing: https://measure.whatworkswellbeing.org/measures-bank/who-5/

MedlinePlus. (2016, 01 15). *Orlistat*. Retrieved from National Institute for Health : https://medlineplus.gov/druginfo/meds/a601244.html

Megarry, T. (1995). *Society in Prehistory: The Origins of Human Culture.* New York: New York University Press.

Middleton, G., Henderson, H., & Evans, D. (2014). Implementing a community-based obesity prevention programme: experiences of stakeholders in the north east of England. *Health promotion international* , 29(2), 201-211.

Mills, C. (2021). *A review of evidence on socio-economic disadvantage and inequalities of outcome.* Wales: Llywodrath Cymru Welsh Government.

Mind. (2022, August 01). *Mind*. Retrieved from Self-esteem: https://www.mind.org.uk/information-support/types-of-mental-health-problems/self-esteem/about-self-esteem/#:~:text=Self%2Desteem%20is%20how%20we,value%20yourself%20as%20a%20person

Miners' Strike - National Coal Mining Museum for England. (2018). *The 1984/85 Miners Strike*. Retrieved from Miners' Strike - National Coal Mining Museum for England: https://www.ncm.org.uk/.../104/The_1984-5_Miners__Strike_Resource__hi_res_.pdf

Ministry of Housing Communities & Local Goverment. (2019, September 26). *The English Indices of Deprivation 2019 (IoD2019).* Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/835115/IoD2019_Statistical_Release.pdf

Mishra, P., Singh, U., Pandey, C., Mishra, P., & Pandey, G. (2019). Application of student's t-test, analysis of variance, and covariance. *Annals of cardiac anaesthesia*, 22(4), 407.

Misistry of Housing, Communities & Local Government. (2019, September 26). *English indices of deprivation - research using NHS Digital data: privacy notice*. Retrieved from GOV.UK: https://www.gov.uk/government/publications/english-indices-of-deprivation-privacy-notice/english-indices-of-deprivation-research-using-nhs-digital-data-privacy-notice

ML, K. (2011). *Personality and Sport § Sheldon's Constitutional Typology*". *Psychology in Physical Education and Sport.* Pinnacle Technology.

Mokdad, A. H. (2003). Mokdad, A. H., Ford,Prevalence of obesity, diabetes, and obesity-related health risk factors. *JJama*, 289(1), 76-79.

Moody A. Chapter 10: adult anthropHealth and Social Care Information Centre. (2016). *Anthropometric measures, overweight and obesity.* London UK: Health and Social Care Information Centre (HSCIC).

Moody, A. (2013). *Chapter 10: Adult anthropometric measures, overweight and obesity*. London: Health and Social Care Information Centre.

Moore, L. L., Bradlee, M. L., Singer, M. R., Splansky, G. L., Proctor, M. H., Ellison, R. C., & Kreger, B. E. (2004). BMI and waist circumference as predictors of a lifetime colon cancer risk in Framingham study adults. *International journal of obesity*, 28(4), 559-567.

Moore, S., Daniel, M., Paquet, C., Dubé, L., & Gauvin, L. (2009). Association of individual network social capital with abdominal adiposity, overweight and obesity. *Journal of Public Health*, 31(1), 175-183.

Morabia, A. (2004). *A history of epidemiologic methods and concepts.* Basel: Birkhäuser.

Morrisons. (2020). *Morrisons new look morrisons*. Retrieved from Morrisons: https://groceries.morrisons.com/content/new-look-morrisons-51556

Munguia-Izquierdo, D., Suarez-Arrones, L., Di Salvo, V., Paredes-Hernandez, V., Alcazar, J., Ara, I., & Mendez_Villanueva, A. (2018). Validation of field methods to assess body fat percentage in elite youth soccer players. *International journal of sports medicine*, 39(05) 349-354.

Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of management review*, 243.

Nantional Institute for Health Care Excellence. (2019, 04 15). *Obesity management in adults*. Retrieved from Pathways NICE: https://pathways.nice.org.uk/pathways/obesity/obesity-management-in-adults

National Institute for Health Care Excellence. (2014, 11 27). *Obesity: identification, assessment and management*. Retrieved from NICE: https://www.nice.org.uk/guidance/cg189

National Institute of Health. (2022, July 11). *socioeconomic status*. Retrieved from National Institute of Health - National Cancer Institute : https://www.cancer.gov/publications/dictionaries/cancer-terms/def/socioeconomic-status

National Instute of Health Care Excellence . (2013). BMI: Preventing ill health and premature death in black, asian and other minority ethnic groups. *Public health guidelines*, (PH46).

NHS. (2019, 05 16). *Fad Diets*. Retrieved from NHS.UK: https://www.nhs.uk/conditions/obesity/treatment/

NHS Better Health (Change4Life). (2022, 10 04). *Easy ways to eat well and move more*. Retrieved from NHS.UK: https://www.nhs.uk/healthier-families/

NHS Better Health. (22, 02 21). *Lose Weight*. Retrieved from NHS Better Health: https://www.nhs.uk/better-health/lose-weight/

NHS Data Model and Dictionary. (2022, July 26). *Lower Layer Super Output Area*. Retrieved from NHS Data Model and Dictionary: https://www.datadictionary.nhs.uk/nhs_business_definitions/lower_layer_super_output_area.html#:~:text=A%20Lower%20Layer%20Super%20Output,statistics%20in%20England%20and%20Wales.

NHS Data Model and Dictionary. (2022, July 26). *Middle Layer Super Output Areas (MSOA)*. Retrieved from NHS Data Model and Dictionary: https://www.datadictionary.nhs.uk/nhs_business_definitions/middle_layer_super_output_area.html

NHS Digital (HSE). (2019, December 15). *Health Survey for England*. Retrieved from NHS Digital: https://digital.nhs.uk/data-and-information/publications/statistical/health-survey-for-england/2019#resources

NHS Digital. (2019, May 17). *Health Survery for England*. Retrieved from NHS Digital: https://digital.nhs.uk/data-and-information/publications/statistical/health-survey-for-england

NHS Digital Health Survery for England. (2017). *Health Survery for England*. England: NHS Digital .

NHS Digital Health Survery for England. (2020). *Health Survery for England*. London: NHS Digital .

NHS England - Public Health England London. (2014). *Report of the working group into: Joined up Clinical Pathways for Obesity: Report of the Working Group*. London: NHS England Publications.

NHS England. (2014, 04 01). *Obesity Treatment*. Retrieved from NHS England: http://www.nhs.uk/Conditions/Obesity/Pages/Treatment.aspx

NHS England. (2019). *Definitions for health inequalities*. Retrieved from england.nhs.uk: http://www.england.nhs.uk/ltphimenu/definitions-for-health-inequalities/

NHS England. (2019). *What should my daily intake of calories be?* Retrieved from NHS: http://www.nhs.uk/common-health-questions/food-and-diet/what-should-my-daily-intake-of-calories-be/

NHS Rotherham framework. (2016). *Rotherham Healthy Weight Framework across all tiers for children (left) and adults (right) in Rotherham*. Rotherham, Yorkshire.: Rotherham NHS Trust.

NHS Rotherham Obesity Strategy (the Health Weight Framework) . (2016). *NHS Rotherham Obesity Strategy (the Health Weight Framework)* . Retrieved from NHS Rotherham Obesity Strategy: http://www.rotherhaminstituteforobesity.co.uk/NHS-Rotherham-Obesity-Strategy-(the-Health-Weight-Framework).html

NHS UK . (2022). *BMI BMI calculator | Check your BMI*. Retrieved from NHS UK: https://www.nhs.uk/live-well/healthy-weight/bmi-calculator/

NHS UK. (2016, July 12). *Weight Loss Surgery*. Retrieved from NHS UK: https://www.nhs.uk/conditions/weight-loss-surgery/who-can-have-it/

NHS UK. (2020). *Couch to 5K*. Retrieved from NHS UK : https://www.nhs.uk/live-well/exercise/running-and-aerobic-exercises/get-running-with-couch-to-5k/

NHS UK. (2022, 01 23). *BMI healthy weight calculator*. Retrieved from NHS.UK: https://www.nhs.uk/live-well/healthy-weight/bmi-calculator/#:~:text=You%27re%20at%20very%20high,34ins)%20or%20more%20for%20women

NHS UK. (2022). *lose weight*. Retrieved from NHS UK: https://www.nhs.uk/better-health/lose-weight/

NHS.UK. (2016). *Losing weight - 12 week plan.* Retrieved from NHS.UK: https://assets.nhs.uk/tools/download-panels/data/weight-loss/pdf/all-weeks.pdf

NHS.UK. (2020, 02 10). Retrieved from Get running with Couch to 5K: https://www.nhs.uk/live-well/exercise/running-and-aerobic-exercises/get-running-with-couch-to-5k/

NHS.UK. (2020, 04 14). *Weight Loss Surgery*. Retrieved from NHS Weight Loss Surgery: https://www.nhs.uk/conditions/weight-loss-surgery/

NHS.UK. (2020, 04 14). *Weight loss surgery types*. Retrieved from NHS Weight loss surgery: https://www.nhs.uk/conditions/weight-loss-surgery/types/

Nicki Ong. (2022, 01 15). *The 3 Body Types: Ectomorph, Mesomorph and Endomorph*. Retrieved from Nicki Ong: https://nickiong.com/blog/2016/01/18/the-3-body-types-ectomorph-mesomorph-and-endomorph/

Nobari, H., Oliveira, R., Clemente, F. M., Pérez-Gomez, J., Pardos-Mainer, E., & Ardigo, L. P. (2011). Nobari, H., Oliveira, R., Clemente, F. M., Pérez-Gómez, J.Somatotype, Accumulated Workload, and Fitness Parameters in Elite Youth Players: Associations with Playing Position. *Children*, 8(5), 375.

Norrington-Davies, T. (2005, November 24). "*Is the gastropub making a meal of it?*". Retrieved from The Daily Telegraph: https://www.telegraph.co.uk/foodanddrink/restaurants/3322965/Is-the-gastropub-making-a-meal-of-it.html

Northrup, D. (1997). The problem of the self-report in survey research. Institute for Social Research. *York University*.

Nuttall, F. Q. (2015). Body mass index: obesity, BMI, and health: a critical review. *Nutrition today*, 50(3), 117.

NVivo. (2020, March 24). *Qualitative data analysis softwear*. Retrieved from NVivo: https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/home

Ocado. (2019). *Ocado – Who We Are*. Retrieved from Ocado: http://www.ocadogroup.com/who-we-are/ocado-at-a-glance.aspx

Oddy, D. . (2016). *The Rise of Obesity in Europe: A Twentieth-Century Food History*. Surrey: Ashgate.

Office for National Statistics. (2019, October 15). *Postcode to Output Area to Lower Layer Super Output Area to Middle Layer Super Output Area to Local Authority*

District (August 2019) Lookup in the UK. Retrieved from Office for National Statistics: https://geoportal.statistics.gov.uk/datasets/06938ffe68de49de98709b0c2ea7c21a/about

Office of National Statistics . (2018, March 12). *ONS*. Retrieved from Unemployment Refereance Tables : https://webarchive.nationalarchives.gov.uk/ukgwa/20160107070948/http://www.ons.gov.uk/ons/publications/re-reference-tables.html#tab-all-tables

Office of National Statistics . (2023, January 17). *Labour market overview: UK*. Retrieved from Office of National Statistics : https://www.ons.gov.uk/employmentandlabourmarket/peoplenotinwork/unemployment/timeseries/mgsx/lms

Organisation, W. H. (2018, February 11). *Health inequities and their causes*. Retrieved from World Health Organisation: https://www.who.int/news-room/facts-in-pictures/detail/health-inequities-and-their-causes

Ostrom, E. (2000). Social capital: a fad or a fundamental concept. *Social capital: A multifaceted perspective*, 176.

Oxford Reference . (2022, 20 02). *Body composition*. Retrieved from Oxford Refenence : https://www.oxfordreference.com/view/10.1093/oi/authority.20110803095515129

Oxford Reference. (2022, March 24). *Inequality (Social Inequality)*. Retrieved from Oxford Reference: https://www.oxfordreference.com/view/10.1093/acref/9780199533008.001.0001/acref-9780199533008-e-1106#:~:text=inequality%20(social%20inequality)&text=Unequal%20rewards%20or%20opportunities%20for,or%20groups%20within%20a%20society

Oxford Reference. (2022, January 5). *Social Capital*. Retrieved from Oxford Reference: https://www.oxfordreference.com/view/10.1093/oi/authority.20110803100514968

Pendlebury, j., Bushe, C., Wildgust, H., & Holt, R. (2007). Long-term maintenance of weight loss in patients with severe mental illness through a behavioural treatment programme in the UK. *Acta Psychiatrica Scandinavica*, 115(4), 286-294. .

Pendrous., R. (2017). *Fridges heralded the UKs chilled food chain. Food Manufacture*. Retrieved from www.foodmanufacture.co.uk: https://www.foodmanufacture.co.uk/Article/2017/08/25/Fridges-heralded-the-UK-s-chilled-food-chain

Pettinger., T. (2017). *UK Economy in the 1980s*. Retrieved from Economics help: https://www.economicshelp.org/blog/630/economics/economy-in-1980s/

Picot, J., Jones, J., Colquitt, J., Gospodarevskaya, E., Loveman, E., Baxter, L., & Clegg, A. (2009). The clinical effectiveness and cost-effectiveness of bariatric (weight loss) surgery for obesity: a systematic review and economic evaluation. *Health Technology Assesment*, Vol 13: No.41.

Pietrobelli, A., Formica, C., Wang, Z., & Heymsfield, S. (1996). Dual-energy X-ray absorptiometry body composition model: review of physical concepts. *American Journal of Physiology-Endocrinology And Metabolism*, 271(6), E9.

Pi-Sunyer, F. X. (2009). Weight Loss. *In Clinical Lipidology*, 240-252.

Pi-Sunyer, X. (2009). The medical risks of obesity. *Postgraduate medicine*, 121(6), 21-33.

Pizza Hut. (2019). *Pizza Hut, Our History*. Retrieved from Pizza Hut: https://www.pizzahut.co.uk/restaurants/about/our-history/

Pontzer, H. R. (2012). Hunter-gatherer energetics and human obesity. *PloS one*, 7(7), e40503.

Poortinga, W. (2006). Do health behaviors mediate the association between social capital and health? *Preventive medicine*, 43(6), 488-493.

Pound Land. (2020). *Poundland*. Retrieved from about us our history: https://www.poundland.co.uk/about-us/our-history/

Prentice, A. M., & Jebb, S. A. (1995). Obesity in Britain: gluttony or sloth? *BMJ*, 311(7002), 437-439.

Press Release: Department for Environment, Food & Rural Affairs. (2016). *The UK's food history revealed through five generations of data*. Retrieved from Department for Environment, Food & Rural Affairs: https://www.gov.uk/government/news/the-uks-food-history-revealed-through-five-generations

Pret. (2020). *Pret*. Retrieved from About pret: https://www.pret.co.uk/en-GB/about-pret

Prime Minister's Speech, P. M. (2020, 03 23). *Prime Minister's statement on coronavirus (COVID-19): 23 March 2020*. Retrieved from Gov.UK: https://www.gov.uk/government/speeches/pm-address-to-the-nation-on-coronavirus-23-march-2020

Private Health. (2022, March 16). *How much for weight loss surgery* . Retrieved from Private Health: https://www.privatehealth.co.uk/conditions-and-treatments/gastric-bypass/costs/

Public Health England. (2014). *Adult obesity and type 2 diabetes.* London: Public Health England.

Public Health England. (2017). *The costs of obesity.* Retrieved from Public Health England: https://www.gov.uk/government/publications/health-matters-

obesity-and-the-food-environment/health-matters-obesity-and-the-food-environment--2

Public Health England. (2019). *Government Dietary Recommendations.* Retrieved from Public Health England: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/618167/government_dietary_recommendations.pdf

Public Health Outcomes Framework. (2018). *Chapter 5: inequalities in health.* London: Public Health England.

Putnam, R. (1993). The prosperous community: Social capital and public life. *The american prospect (Vol. 4)*, 13.

Pyne, J., Rost, K., Farahati, F., Tripathi, S., Smith, J., Williams, D., & Coyne, J. (2005). One size fits some: the impact of patient treatment attitudes on the cost-effectiveness of a depression primary-care intervention. *Psychological Medicine*, 35(6), 839-854.

QTV, N. R. (2011). RIO - Rotherham Institute for Obesity [Recorded by RIO]. Rotherham, South Yorkshire, England .

Rajkumar, R. V. (2015). Endomorphy dominance among nonathlete population in all the ranges of body mass index. *International Journal of Physiother Research*, 3(3), 1068-74.

Ranadev, A. (2012). *How far did the lives of teenager change during the 1960s*. Retrieved from Prezi: https://prezi.com/nvxgtvyhld_k/how-far-did-the-lives-of-teenager-change-during-the-1960s/

Reale, S., Walker, L., & Capehorn, M. (2013). A retospective analysis of reported alcohol consumption and correlation to BMI in patients attending the Rotherham Institute for Obesity. *A retospective analysis of reported alcohol*

consumption and correlation to BMI in patients attending the Rotherham Institute for Obesity. Rotherham, South Yorkshire: RIO.

Richmond, T., Milliren, C., Walls, C., & Kawachi, I. (2014). School social capital and body mass index in the national longitudinal study of adolescent health. *Journal of School Health*, 84(12), 759-768.

RIO NHS. (2015, 07 23). *Home - Rotherham Institute for Obesity*. Retrieved from Rotherham Institute for Obesity - NHS: http://www.rionhs.co.uk

(2022). *Rising cost of living in the UK*. London: House of Commons Libary .

Robb, C. E.-A.-M. (2020). Associations of social isolation with anxiety and depression during the early COVID-19 pandemic: a survey of older adults in London UK. *Frontiers in Psychiatry*, 991.

Robinson, E., Boyland, E., Chisholm, A., Harrold, J., Maloney, N., Marty, L., . . . Hardman, C. (2021). Obesity, eating behavior and physical activity during COVID-19 lockdown: A study of UK adults. *Appetite*, 156, 104853.

Rodgers, J., Valuev, A., Hswen, Y., & Subramani, S. (2019). Social capital and physical health: An updated review of the literature for 2007–2018. *Social Science & Medicine*, 236, 112360.

Rodgers, J., Valuev, A., Hswen, Y., & Subramanian, S. (2019). Social capital and physical health: An updated review of the literature for 2007–2018. *Social Science & Medicine*, 236, 112360.

Roeckelein, J. E. (1998). Dictionary of theories, laws, and concepts in psychology. *Greenwood Publishing Group*, 427–8.

Roeckelein, J. E. (1998). *Dictionary of theories, laws, and concepts in psychology*. London: Greenwood Publishing Group. 427–8. .

Rotherham Advertiser. (2017, July 14). *Life-changing Rotherham Institute for Obesity closes its doors*. Retrieved from Rotherham Advertiser:

https://www.rotherhamadvertiser.co.uk/news/view,lifechanging-rotherham-institute-for-obesity-closes-its-doors_23186.htm#:~:text=RIO%20was%20forced%20to%20close,services%20there%20if%20they%20pay.

Rotherham Council . (2020). *Boston Castle Ward Profile 2019*. Retrieved from Rotherham.GOV: https://www.rotherham.gov.uk/downloads/file/615/boston-castle-ward-profile

Rotherham.GOV. (2021, November 11). *Rotherham.gov.uk*. Retrieved from Rotherham.gov.uk/data/: http://rotherham.gov.uk/data/

Rotherham.gov.uk. (2017). *Rotherham Local Super Output Areas in the top 20% of the most deprived areas in England.* Rotherham: Rotherham.GOV.

Rotherham.gov.uk. (2022, 06 01). *Rotherham Data Hub*. Retrieved from Rotherham.gov.uk: https://www.rotherham.gov.uk/data/people/population/2

Ryan, A. M. (2015). Poor awareness of risk factors for cancer in Irish adults: results of a large survey and review of the literature. *The oncologist*, 20(4), 372-378.

Sainsburys. (2020). *Sainsburys Delivery*. Retrieved from Sainsburys: https://www.sainsburys.co.uk/webapp/wcs/stores/servlet/gb/groceries/discoverhome/shopping-online/delivery?storeId=10151&langId=44&krypto=4h4lV4jdYAYYGehHW3%2BVGF0VPS84ed9poGzgt1wkFQvNCCcikO5RkXh2nrrauIQVOzGma6PFf3yPF5FohEnhpEqwsioJLOADlltoTql8jnedT%2F5AVB

Sajan, K. (2022, September 4). *Foodbank closes down in Basingstoke after failing to find rent costs*. Retrieved from Basingstoke Gazette: https://www.basingstokegazette.co.uk/news/20900148.foodbank-closes-basingstoke-failing-find-rent-costs/

Santayana, G. (1905). *The Life of Reason: The Phases of Human Progress.* Archibald Constable & Co Ltd.

Scheffler, R., Brown,, T., & Rice, J. (2007). The role of social capital in reducing non-specific psychological distress: The importance of controlling for omitted variable bias. *Social science & medicine*, 65(4), 842-854.

Schoonenboom, J., & Johnson, R. (2017). How to construct a mixed methods research design. *Kolner Zeitschrift fur Soziologie und Sozialpsychologie*, 69(2), 107.

Scott, C., Sutherland, J., & Taylor, A. (2018). Affordability of the UK's Eatwell Guide. *The Food Foundation*.

Senior, L., Carter, D., & Capehorn, M. (2012). Service Evaluation of the Rotherham Institute for Obesity (RIO) and comparison of the 2010 and 2011 data. *Service Evaluation of the Rotherham Institute for Obesity (RIO) and comparison of the 2010 and 2011 data*. Rotherham, South Yorkshire: RIO.

Sharman, K., & Nobles, J. D. (2015). Bridging the gap: SHINE–a Tier 3 service for severely obese children and young people. *British Journal of Obesity*, 1(4), 124-167.

Shaw, S. (2018, March 18). *A lot people going lose out anger frustration norfolk village cut bus route*. Retrieved from Fakenham Times: https://www.fakenhamtimes.co.uk/news/21824745.a-lot-people-going-lose-out---anger-frustration-norfolk-village-cut-bus-route/

Sheldon, W. H., Stevens, S. S., & Tucker, W. B. (1940). The varieties of the human physique. *n/a*.

Shuttleworth, K., & Nicholson, E. (2020, 08 18). *Devolution and the NHS*. Retrieved from Institute for Government: https://www.instituteforgovernment.org.uk/explainer/devolution-and-nhs#:~:text=In%20the%20UK%2C%20the%20National%20Health%20Service%

20%28NHS%29,the%20Northern%20Ireland%20assembly%20on%202%20December%201999.

Simkus, J. (2022, 01 26). *ANOVA (Analysis Of Variance): Definition, Types, and Examples*. Retrieved from Simply Psychology: https://www.simplypsychology.org/anova.html

Singh, R. G., Cervantes, A., Kim, J. U., Nguyen, N. N., DeSouza, S. V., Dokpuamg, D., & Petrov, M. S. (2019). Intrapancreatic fat deposition and visceral fat volume are associated with the presence of diabetes after acute pancreatitis. *American Journal of Physioology-Gastrointestinal and Liver Physiology*, 316(6).

Sky News. (2022, June 6). *Food banks 'running out' due to cost of living crisis*. Retrieved from Sky News: https://news.sky.com/video/cost-of-living-crisis-means-food-banks-are-running-out-12628981

Slimming World. (2018). *Health Tools.* Retrieved from Slimming World: http://www.slimmingworld.co.uk/losing-weight/bmi-calculator.aspx (accessed 2nd January 2016)

Slimming World. (2019). *Slimming World taste the freedom*. Retrieved from Slimming World: https://www.slimmingworld.co.uk/

Slimming World. (2021, 09 10). *Slimming World on Referral... a powerful practical partnership*. Retrieved from Slimming World: https://www.slimmingworld.co.uk/health/swor/what-is-swor.aspx

Smith, G. D. (1996). Smith. *Income inequality and mortality: why are they related?* .

Solar, O., & Irwin, A. (2007). A conceptual framework for action on the social determinants of health: discussion paper for the Commission on Social Determinants of Health. *Geneva: World Health Organization*.

Spreckley, M., Seidell, J., & Halberstadt, J. (2021). Perspectives into the experience of successful, substantial long-term weight-loss maintenance: a systematic

review. *International Journal of Qualitative Studies on Health and Well-being*, 16(1), 1862481.

SPSS. (2017). IBM.

Stanford, F., Tauqeer, Z., & Kyle, T. (2018). Media and its influence on obesity. *Current obesity reports*, 7(2), 186-192.

Steele, C., & Capehorn, M. (2016). Evaluation of the use of the Malory Band in patients attending the Rotherham Institute for Obesity (RIO). Rotherham, South Yorkshire: RIO.

Steele, C., Carter, D., Kaill, A., Senior, L., Monaghan, T., & Capehorn, M. (2015). Are supermarket "Low Fat Foods" in the UK better than their "regular fat" counterparts in terms of sugar and overall calorie content. Rotherham, South Yorkshire: RIO.

Steele, C., Senior, L., & Capehorn, M. (2014). Do patients attending the Rotherham Institute for Obesity gain weight over the Christmas period? Rotherham , South Yorkshire: RIO.

Stubbs, R. J. (1993). The effect of covert manipulation of dietary fat and energy density on ad-lib. food intake in humans. *In PROCEEDINGS-NUTRITION SOCIETY OF LONDON*, Vol. 52, No. 1, pp. 35A.

Tahrani, A., Boelaert, K., Barnes, R., Palin , S., Field, A., Redmayne, H., & Rahim, A. (2008). Body volume index: time to replace body mass index? *In Endocrine Abstracts (Vol 15) Bioscientifica*.

Tahrani, Parretti, O'Kane, Chowhan, Ratcliffe, & Le Brocq. (2020, 12). *Managing obesity in primary care*. Retrieved from Guidelines: https://www.guidelines.co.uk/algorithms/managing-obesity-in-primary-care/455702.article

Team, R. (2016). RIO Meeting. (C. f. Research, Interviewer)

Tes. (2022, 03 02). *PE Somatotypes*. Retrieved from TES.com: https://www.tes.com/teaching-resource/gcse-pe-somatotypes-charts-12586474

Tesco. (2020). *Tesco Groceries*. Retrieved from Tesco: https://www.tesco.com/groceries/

The Department of Health. (2011). *UK physical activity guidelines - Obesity and healthy eating*. Retrieved from Gov.uk: https://www.gov.uk/government/publications/uk-physical-activity-guidelines

The Department of Health. (2011). *UK physical activity guidelines - Obesity and healthy eating.* London: Government publications.

The Guardian. (2017, 05 25). *Yuppies east london property 1980s gentrification*. Retrieved from The Guardian: https://www.theguardian.com/uk-news/2017/may/25/yuppies-east-london-property-1980s-gentrification

The Health Foundation. (2022, January 18). *Social determinants of health*. Retrieved from The Health Foundation: https://www.health.org.uk/topics/social-determinants-of-health

The Health Protection (Coronavirus) Regulations 2020. (2020). *The Health Protection (Coronavirus) Regulations.* London: Legislation.gov.uk.

The Office of National Statistics. (2023, 01 05). *The National Statistics Socio-economic classification (NS-SEC)*. Retrieved from The Office of National Statistics : https://www.ons.gov.uk/methodology/classificationsandstandards/otherclassifications/thenationalstatisticssocioeconomicclassificationnssecrebasedonsoc2010

The Times. (2020). *Hunt for contacts of coronavirus-stricken pair in York*. Retrieved from The Times: https://www.thetimes.co.uk/article/hunt-for-contacts-of-coronavirus-stricken-pair-in-york-dh363qf8k

The World Health Organisation. (2019). *World Health Organisation - Obesity news and fact sheet*. Retrieved from World Health Organisation: www.who.int/news-room/fact-sheet/detail/obesity-and-overweight

Theis, D., & White, M. (2021). Is obesity policy in England fit for purpose? Analysis of government strategies and policies, 1992–2020. *The Milbank Quarterly*, 99(1), 126-170.

Thurston, R. W. (2013). *Coffee: A comprehensive guide to the bean, the beverage, and the industry*. London: Rowman & Littlefield Publishers.

TM Treasury. (2018). *Soft Drinks Industry Levy comes into effect*. Retrieved from GOV.UK: https://www.gov.uk/government/news/soft-drinks-industry-levy-comes-into-effect

Trowell, H. (1975). Obesity in the western world. *Plant foods for man*, 1(3-4), 157-168.

University College London. (2008, November 15). *Professor Marmot becomes UK Goverment advisor* . Retrieved from UCL.ac.uk: https://www.ucl.ac.uk/epidemiology-health-care/research/epidemiology-public-health/research/whitehallII

Uphoff, N. (2000). Understanding social capital: learning from the analysis and experience of participation. *Social capital: A multifaceted perspective*, 216 .

Veenstra, G., Luginaah, I., Wakefield, S., Birch, S., Eyles, J., & Elliott, S. (2005). Who you know, where you live: social capital, neighbourhood and health. *Social science & medicine*, 60(12), 2799-2818.

Velapati, S., Shah, M., Kuchkuntla, A., Abu-Dayyeh, B., Grothe, K., Hurt, R., & Mundi, M. (2018). Velapati, S. R., Shah, M., Kuchkuntla, A. R., Abu-Dayyeh, BWeight regain after bariatric surgery: prevalence, etiology, and treatment. *Current nutrition reports*, 7(4), 329-334.

Venkatapuram, S., Bell, R., & Marmot, M. (2010). The right to sutures: social epidemiology, human rights, and social justice. *Health and human rights*, 12(2), 3.

Vertinsky, P. (2007). Physique as destiny: William H. Sheldon, Barbara Honeyman Heath and the struggle for hegemony in the science of somatotyping. *Canadian bulletin of medical history*, 24(2), 291-316.

Villalonga-Olives, E., Wind, T., & Kawachi, I. (2018). Social capital interventions in public health: A systematic review. *Social Science & Medicine*, 212, 203-218.

Wacquant, L. (2005). Habitus. *International encyclopedia of economic sociology*, 316.

Walker, L., Kaill, A., & Capehorn, M. (2012). A quantitative analysis of the use of exercise theraphy at the Rotherham Institute for Obesity. *A quantitative analysis of the use of exercise theraphy at the Rotherham Institute for Obesity*. Rotherham, South Yorkshire: RIO.

Walker, L., Kaill, A., & Capehorn, M. (2013). Patient Retention in a Primary Care MDT initiated Physical Activity Programme. Rotherham, South Yorkshire: RIO.

Walker, L., Kaill, A., Churchward, D., & Capehorn, M. (2013). Observational improvments in Cardiovascular fitness with Primary Care initiated physical activity within Rotherham Institute for Obesity (RIO). *Observational improvments in Cardiovascular fitness with Primary Care initiated physical activity within Rotherham Institute for Obesity (RIO)*. Rotherham, South Yorkshire: RIO.

Walker, L., Reale, S., & Capehorn, M. (2014). The impact of a six week exercise programme on cardiovascular fitness in obese individuals attending the Rotherham Institute for Obesity. Rotherham, South Yorkshire: RIO.

Walker, L., Steele, C., Kaill, A., & Capehorn, M. (2013). Body composition changes in patients who failed to meet weight loss targets at the Rotherham Institute for Obesity. Rotherham , South Yorkshire: RIO.

Walter-Kroker, A., Kroker, A., Mattiucci-Guehlke, M., & Glaab, T. (2011). Walter-Kroker, A., Kroker, A., MA practical guide to bioelectrical impedance analysis using the example of chronic obstructive pulmonary disease. *Nutrition Journal*, 10(1), 1-8.

Wang, Y. C. (2011). Wang, Y. C., McPherson, K., Health and economic burden of the projected obesity trends in the USA and the UK. *The Lancet*, 378(9793), 815-825.

Wang, Y., Hunt, K., Nazareth, I., Freemantle, N., & Petersen, I. (2013). Do men consult less than women? An analysis of routinely collected UK general practice data. *BMJ open*, 3(8), e003320.

Watson, V., Dibben, C., Cox, M., Atherton, L., Sutton, M., & Ryan, M. (2019). Testing the Expert Based Weights Used in the UK's Index of Multiple Deprivation (IMD) Against Three Preference-Based Methods. *Social Indicators Research*, 144(3), 1055-1074.

Wei, L., Li, N., Wang, G., Feng, X., Lyu, Z., Li, X., & He, J. (2018). Waist circumference might be a predictor of primary liver cancer: a population-based cohort study. *Frontiers in oncology*, 8, 607.

Wei, M., Gaskill, S. P., Haffner, S. M., & Stern, M. P. (1997). Waist circumference as the best predictor of noninsulin dependent diabetes mellitus (NIDDM) compared to body mass index, waist/hip ratio and other anthropometric measurements in Mexican American - a 7-year prospective study. *Obesity research*, 5(1), 16-23.

Weight Watchers. (2016). *What's a Healthy Weight for you?* Retrieved from Weight Watchers: http://www.weightwatchers.co.uk/health/asm/?skipmap=1

Weisstein, E. (2004). Bonferroni correction. *https://mathworld. wolfram. com/*.

Wenger, A. (2004, 05 21). Press conference. (G. Shreeves, Interviewer)

Wharton, S., Lau, D. C., Vallis, M., Sharma, A. M., Biertho, L., Campbell-Scherer, D., & Wicklum, S. (2020). Wharton, S., Lau, D. C., Vallis, M., Sharma, A. M., Biertho, L., CObesity in adults: a clinical practice guideline. *Cmaj*, 192(31), E875-E891.

Whitehead, M. (1992). The concepts and principles of equity in health. *Int J Health Serv1992;(first published with the same title from: Copenhagen: World Health Organisation Regional Office for Europe*, 22:429–445. .

Whitehead, M., & Dahlgren, G. (1991). What can be done about inequalities in health? *The lancet*, 338(8774), 1059-1063.

Whitehead, M., & Dahlgren, G. (2006). Concepts and principles for tackling social inequities in health: Levelling up Part 1. *World Health Organization: Studies on social and economic determinants of population health*, 2, 460-474.

Widdop, P., King, N., Parnell, D., Cutts, D., & Millward, P. (2019). Austerity, policy and sport participation in England. *In Sport Policy in an Era of Austerity*, 63.

Wind, T., & Villalonga-Olives, E. (2019). Social capital interventions in public health: moving towards why social capital matters for health. *Epidemiol Community Health*, 73(9), 793-795.

World Health Organisation . (2022, January 11). *BMI Calculator*. Retrieved from bmi-calculator: https://www.bmi-calculator.net/

World Health Organisation. (1998). *Wellbeing Measures in Primary Health Care/The Depcare Project*. Copenhagen: WHO Regional Office for Europe. Retrieved from WHO. (1998). Wellbeing Measures in Primary Health Care/The Depcare Project. WHO Regional Office for Europe: Copenhagen

World Health Organisation. (2008, August 2008). *Closing the gap in a generation: health equity through action on the social determinants of health - Final report*

of the commission on social determinants of health. Retrieved from World Health Organisation: https://www.who.int/publications/i/item/WHO-IER-CSDH-08.1

World Health Organisation. (2022). *WHO/Europe | Nutrition - Body mass index - BMI* . Retrieved from WHO/Europe: https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/body-mass-index

World Health Organization. (2008). *Waist circumference and waist-hip ratio: report of a WHO expert consultation.* Geneva: WHO Libary Catalouguing-in-Publication Data.

World Health Organization. (2011). *Waist circumference and waist-hip ratio: report of a WHO expert consultation.* Geneva: World Health Organization.

World Health Organization. (2021). *The WHO STEPwise approach to surveillance.* Europe: (No. WHO/EURO: 2021-2446-42201-58182). World Health Organization. Regional Office for Europe.

World Health Organizational. (2005). *WHO STEPS Surveillance Manual - The Pan American Version of the WHO STEPwise approach to chronic disease risk factor surveillance.* Geneva: World Health Organization.

Wu, Y., Moore, S., & Dube, L. (2018). Social capital and obesity among adults: Longitudinal findings from the Montreal neighborhood networks and healthy aging panel. *Preventive Medicine*, 111, 366-370.

WW - Weight Watchers. (2019). *Weight Watchers*. Retrieved from Weight Watchers programme: https://www.weightwatchers.com/uk/

WW. (2018). *WW*. Retrieved from WW: https://www.weightwatchers.com/uk/

Xin, Y., & Ren, X. (2020). Social Capital as a Mediator through the Effect of Education on Depression and Obesity among the Elderly in China. *International Journal of Environmental Research and Public Health*, 17(11), 3977.

Xue, X., & Cheng, M. (2017). Social capital and health in China: exploring the mediating role of lifestyle. *BMC public health*, 17(1), 1-11.

Yanovski, S. Z., Hubbard, V. S., & Heymsfield, S. B. (1996). Bioelectrical impedance analysis in body composition measurement: National institutes of health technology assessment conference statement. *The American journal of clinical nutrition*, 64(3), 524S-532S.

Yoon, J., & Brown, T. (2011). Does the promotion of community social capital reduce obesity risk? *The Journal of Socio-Economics*, 40(3), 296-305.

11. Appendices

11.1. Study 1 and 2 ethics email trails (Health Survey and RIO data)

From: hsetecda, UH
Sent: 22 February 2018
To: Blackwell, Liam <l.blackwell2@herts.ac.uk>
Subject: RE: Ethics question

Dear Liam,

After considering the information you have provided, the ECDA Chairman does not think that you need to submit an application for ethics approval for what you are proposing to do.

I suggest you keep a copy of this email trail for your records.

Kind regards,
Leire.

Leire Caselles Vallejo
Academic Services Officer (Ethics)
Academic Services
University of Hertfordshire
Hatfield AL10 9AB
UK
Tel +44(0)1707 28**1254**

Ethics Approval StudyNet Site available here:
http://www.studynet2.herts.ac.uk/ptl/common/ethics.nsf/Homepage?ReadForm

ECDA email addresses:

Health, Science, Engineering and Technology – hsetecda@herts.ac.uk
Social Sciences, Arts & Humanities – ssahecda@herts.ac.uk

IMPORTANT NOTE: **Outdated ethics forms will no longer be accepted from 1 August 2017**

……

From: Blackwell, Liam
Sent: 21 February 2018 11:58
To: hsetecda, UH <hsetecda@herts.ac.uk>
Subject: RE: Ethics question

Dear Leire,

Thank you for is, look forward to hearing from you.

Best wishes

Liam

Department of Psychology & Sports Sciences
Centre for Health Services and Clinical Research

……

From: hsetecda, UH
Sent: 21 February 2018 11:20
To: Blackwell, Liam <l.blackwell2@herts.ac.uk>
Subject: RE: Ethics question

Dear Liam,

I am yet to hear from the ECDA Chairman. I will follow up today and let you know as soon as I hear back.

Kind regards,
Leire.

Leire Caselles Vallejo
Academic Services Officer (Ethics)
Academic Services
University of Hertfordshire
Hatfield AL10 9AB
UK
Tel +44(0)1707 28**1254**

……

From: Blackwell, Liam
Sent: 21 February 2018 11:11
To: hsetecda, UH <hsetecda@herts.ac.uk>
Subject: RE: Ethics question

Dear Leire,

Any luck with finding out the answer to the questions regarding the datasets?

Best wishes

Liam

Department of Psychology & Sports Sciences
Centre for Health Services and Clinical Research

……

From: Blackwell, Liam
Sent: 16 February 2018 14:03
To: hsetecda, UH <hsetecda@herts.ac.uk>
Subject: RE: Ethics question

Dear Leire,

I can confirm that I will not be adding any new data to both datasets and I was not part of the data collection process. The first dataset finished data collection in 2015, the second in 2009. Also, both datasets have been made available for analysis, one for service evaluation with the other in the public domain for research purposes.

Best wishes

Liam

Department of Psychology & Sports Sciences
Centre for Health Services and Clinical Research

……

From: hsetecda, UH
Sent: 16 February 2018 12:54
To: Blackwell, Liam <l.blackwell2@herts.ac.uk>
Subject: RE: Ethics question

Dear Liam,

Could you please confirm that you do not intend to do any further collection of data and that the consents included a clause about the re-use of data in subsequent studies?

Many thanks,
Leire.

Leire Caselles Vallejo
Academic Services Officer (Ethics)
Academic Services
University of Hertfordshire
Hatfield AL10 9AB
UK
Tel +44(0)1707 28**1254**

……

From: hsetecda, UH
Sent: 16 February 2018 11:00
To: Blackwell, Liam <l.blackwell2@herts.ac.uk>
Subject: RE: Ethics question

Thank you, Liam. I am seeking advice from the ECDA Chairman and will get back to you as soon as possible with a response.

Kind regards,
Leire.

Leire Caselles Vallejo
Academic Services Officer (Ethics)
Academic Services
University of Hertfordshire
Hatfield AL10 9AB
UK
Tel +44(0)1707 28**1254**

……

From: Blackwell, Liam
Sent: 16 February 2018 10:46

To: hsetecda, UH <hsetecda@herts.ac.uk>
Subject: RE: Ethics question

Dear Leire,

Thanks for your reply, I now have two data sets so I'll give you the information for both if that is ok.

Dataset 1:

This data is from a weight management centre and is not accessible in the public domain.
The data contains almost 8,000 referrals (collected over 9 years) with measurements (weight, height, who-5 score etc) from 6 sessions, it is not possible to identify any individuals.
The data was collected by as part of the programme with all attenders giving their informed consent (to the management centre) to join the programme and have the measurements recorded.

Dataset 2:

The dataset is from health questionnaires.
The data contains 200,000 answered questionnaires and is available in the public domain under licence. Again, none of the individuals can be identified.
The data has been collected and built my researchers over almost 20 years (1991-2009).

Best wishes

Liam

Department of Psychology & Sports Sciences
Centre for Health Services and Clinical Research

……

From: hsetecda, UH
Sent: 16 February 2018 10:25
To: Blackwell, Liam <l.blackwell2@herts.ac.uk>
Subject: RE: Ethics question

Dear Liam,

Thank you very much for your query. Could you please give us a bit more information about the dataset you have been given access to?

To determine if UH ethical approval is required, some of the questions to answer are:

Is the data already legitimately accessible in the public domain?
Is it possible to identify individual participants from the data? (even if no names or contact details are provided, individuals could be identified if the sample is small enough)
How was the primary data obtained and would the individuals have given consent for use of their data?

Once we have more information, we will be able to advise better.

Kind regards,
Leire.

Leire Caselles Vallejo
Academic Services Officer (Ethics)
Academic Services
University of Hertfordshire
Hatfield AL10 9AB
UK
Tel +44(0)1707 28**1254**

Ethics Approval StudyNet Site available here:
http://www.studynet2.herts.ac.uk/ptl/common/ethics.nsf/Homepage?ReadForm

ECDA email addresses:

Health, Science, Engineering and Technology – hsetecda@herts.ac.uk
Social Sciences, Arts & Humanities – ssahecda@herts.ac.uk

IMPORTANT NOTE: **Outdated ethics forms will no longer be accepted from 1 August 2017**

……

From: Blackwell, Liam
Sent: 15 February 2018 09:45
To: hsetecda, UH <hsetecda@herts.ac.uk>
Subject: Ethics question

Dear Sir/Madam,

I have a couple of questions regarding ethics for retrospective data analysis.

I am a PhD student here at UH and I have been given access to a dataset that contains body measurements (height, weight, age, sex etc) with no personal identifiers. Do I need to complete an EC1A or another similar form before I can conduct analysis on this? If I do not need to complete an EC1A what form would I need to complete?

Hope this makes sense

Best wishes

Liam Blackwell
……

11.2. Study 3 UH Ethical approval

University of Hertfordshire UH

HEALTH SCIENCE ENGINEERING & TECHNOLOGY ECDA

ETHICS APPROVAL NOTIFICATION

TO: Liam Blackwell

CC: Dr Keith Sullivan

FROM: Dr Simon Trainis, Health, Sciences, Engineering & Technology ECDA Chair

DATE: 1st August 2017

Protocol number: LMS/PGR/UH/02925

Title of study: *A Psychological Approach to Obesity*

Your application for ethics approval has been accepted and approved by the ECDA for your School and includes work undertaken for this study by the named additional workers below:

This approval is valid:

From: 01/08/17

To: 16/07/18

Additional workers: no additional workers named

Please note:

Approval applies specifically to the research study/methodology and timings as detailed in your Form EC1. Should you amend any aspect of your research, or wish to apply for an extension to your study, you will need your supervisor's approval and must complete and submit form EC2. In cases where the amendments to the original study are deemed to be substantial, a new Form EC1 may need to be completed prior to the study being undertaken.

Should adverse circumstances arise during this study such as physical reaction/harm, mental/emotional harm, intrusion of privacy or breach of confidentiality this must be reported to the approving Committee immediately. Failure to report adverse circumstance/s would be considered misconduct.

Ensure you quote the UH protocol number and the name of the approving Committee on all paperwork, including recruitment advertisements/online requests, for this study.

Students must include this Approval Notification with their submission.

11.3. Study 1 Data

#BMI30 is a duplicate of BMI Grouped

 # BMIVaild30 is a duplicate of BMIVaild

 # BMIValid30 changed to group (re-coded)

1 -> BMI <30

2 -> BMI >30

 # BMI30 changed (re-coded)

1 -> underweight & healthy weight

2 -> overweight & obese

 # group LB recoded

 # all groups combined group organisation LB re-coded

-9, -8, -7, -6, -2, -1 -> system missing

1 -> Yes includes strongly agree & agree

2 -> No includes disagree & strongly agree

1 -> underweight, healthy weight & overweight

2 -> Obese

Select cases – use filter variable – output – filter out unselected cases (removes missing cases)

 # NextDoorLB is a duplicate of neigbrs

 # NextDoorLB changed (re-coded)

-9, -8, -7, -6, -2, -1 -> system missing

Same for all social capital measurements in HSE survey

1 -> Agree (Yes)

2 -> Disagree (No)

-9, -8, -7, -6, -2 and -1 -> system missing

1 -> Yes (can be trusted)

2 -> No (Can't be trusted)

-9, -8, -7, -6, -2 -1 -> system missing

Yes -> 1

No -> 2

 # HelpfulLB is a duplicate of helpful

 # HelpfulLB changed (re-coded)

-9, -8, -7, -6, -2, -1 -> system missing

Yes (helpful) -> 1

No (look out for themselves) -> 2

 # BMI20AboveLB is a duplicate of BMI Grouped

 # BMI20AboveLB changed (re-coded)

underweight, blank -> system missing

2, 3, 4 -> remain the same

New recode

Healthy weight -> 2, 3

Obese ->

11.4. Social capital analysis

A breakdown showing the risk ratios and significant broken down by England and Yorkshire and the Humber, for social capital measure, SES social class and levels of income.

Measure	England	Yorkshire & The Humber
Enjoy	**1.38(<.001)**	1.46 (.073)
Neighbours	**1.09 (.007)**	1.13 (.361)
Transport	**.89 (<.001)**	.80 (.116)
Leisure	**.93 (.021)**	.95 (669)
Helpful	**.91 (.003)**	1.02 (.892)
Trust	**.92 (.003)**	**.77 (.042)**
Group Orgs	1.00 (.860)	1.01 (.913)
Teens	.95 (.146)	1.13 (.435)
Vandals	1.02 (.570)	.93 (.649)
Shops	.99 (.832)	1.11 (.712)
Post Office	1.10 (.230)	.43 (.061)
Advantage	1.04 (.217)	1.08 (.593)
Income (1)	1.01 (.822)	1.26 (.199)
Income (2)	.94 (.149)	.96 (.806)
Income (3)	**.88 (.003)**	.83 (.295)
Income (4)	**.79 (<.001)**	1.18 (.410)
Social Class (1)	**2.02 (<.001)**	**2.00 (.030)**
Social Class (2)	**2.13 (<.001)**	**2.56 (.003)**
Social Class (3)	**2.24 (<.001)**	**2.28 (.011)**

11.5. RIO Agreement (Before service closure)

Clifton Medical Centre
The Health Village
Doncaster Gate
Rotherham
S65 1DA

Tel 01709 720193
Fax 01709 722406

® love it in RIO

www.RIONHS.co.uk

To whom it may concern

We hereby give permission for Liam Blackwell to conduct interviews with RIO patients on site as part of his research with University of Hertfordshire.

Yours Sincerely

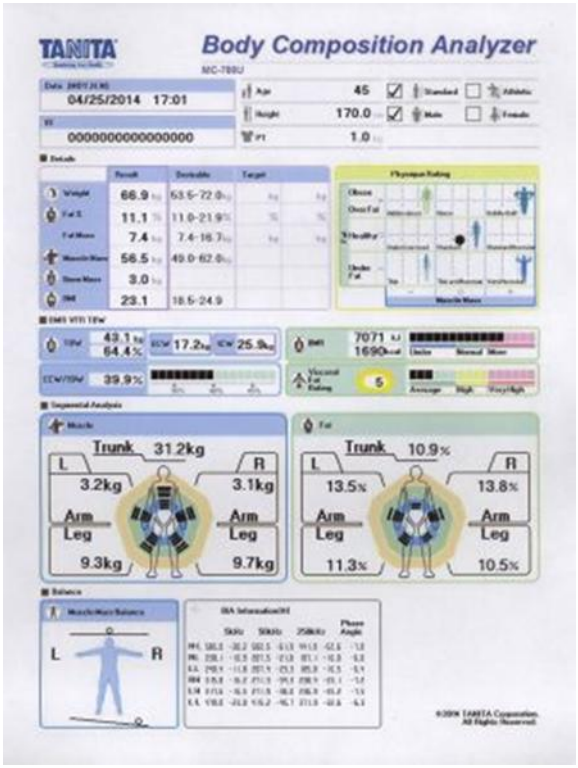
Dr Matthew S Capehorn
Medical Director, LighterLife
Clinical Manager, Rotherham Institute for Obesity (RIO)
Clifton Medical Centre, The Health Village, Doncaster Gate, Rotherham, S651DA
Work 08444773622 Mobile 07786931007

11.6. RIO Data dictionary

Variable Name	Variable Definition
ID	EMAS Number
Count	Referral appearance
Year	Year of referral
DOB	Date of Birth
AGE	Age
Sex	Gender
Ethnicity	Ethnicity
Employ	Employment
Needs	Any further needs
Pregnant	Pregnant
Source	Source of referral
DOM1	Date of the first measurement
WHO51	WHO5 at the first measurement
Height	Height
Weight1	Weight at the first measurement
BMI1	BMI at the first measurement
Waist1	Waist size t first measurement
DOM4	Date of measurement (week 4)
Weight4	Weight measurement (week 4)
BMI4	BMI weight measurement (week 4)
Waist4	Waist measurement (week 4)
CWaist4	Change in weight loss (week4)
WTLoss4	Weight Loss at 4 weeks
DOM8	Date of measurement (8 weeks)
BMI8	BMI of measurement (8 weeks)
CWaist8	Change in weight loss (8 weeks)
WTLoss8	Weight Loss (8 weeks)
DOM12	Date of measurement (12 weeks)
WHO512	WHO5 (12 weeks)
Weight12	Weight (12 weeks)
BMI12	BMI (week 12)
Waist12	Waist measurement (12 weeks)
CWaist12	Change in weight loss (12 weeks)
WTLoss12	Weight Loss (12 weeks)
DOM6	Date of measurement (6 months)
WHO56	WHO5 (6 months)
Weight6	Weight measurement (6 months)
BMI6	BMI measurement (6 months)
Waist6	Weight measurement (6 months)
CWaist6	Change in weight loss (6 months)
wtl	
Maintained	
Completed	Completed
Destination	Destination
Other	Other
medstart	Have the patient started medication?
Bariatric	Bariatric surgery
barwhen	Date of Bariatric surgery
timeobese	Time obese
Binge1	Binge eating baseline.
Binge6	Bring eating (6 months)

11.7. TANITA - Multi Frequency Segmental Body Composition Analyser

Alongside an example pf the TANITA sheet RIO printed a hard copy of and placed into patients' medical notes:



11.8. Study 3 information sheet

UNIVERSITY OF HERTFORDSHIRE

ETHICS COMMITTEE FOR STUDIES INVOLVING THE USE OF HUMAN PARTICIPANTS
('HEALTH & HUMAN SCIENCE ETHICS COMMITTEE')

PARTICIPANT INFORMATION SHEET

A Psychological Approach to Obesity

Introduction

You are being invited to take part in a research study. Before you decide whether to do so, it is important that you understand the research that is being done and what your involvement will include. Please take the time to read the following information carefully and do not hesitate to ask us anything that is not clear. Please take your time to decide whether you wish to take part. Thank you for reading this.

What is the purpose of this study?

Understanding people's experiences to help develop more effective services that can be delivered to people seeking to lose weight.

Do I have to take part?

It is completely up to you whether you decide to take part in this study. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. Agreeing to join the study does not mean that you must complete it. You are free to withdraw at any stage without giving a reason and at any point; you are free to ask to have your data withdrawn at any point as well

How long will my part in the study take?

The first thing to happen will be you will be asked to take part in a focus group or interview with the researcher. This will involve completing chatting about your experiences of using RIO and other weight lost programmes for no longer than 30 minutes.

What are the possible disadvantages, risks or side effects of taking part?

You will be asked to give some of your time to this study.

What are the possible benefits of taking part?

You can be part of helping to develop the patient experiences at RIO and across the weight loss programmes. Currently the research is this area is very limited, this study could help lead to further research to produce effective interventions for patients.

How will my taking part in this study be kept confidential?

Each participant involved in this study, will not be able to be identified. Instead a random code will be given to your data. No identifiable patient data will be collected, thus complete anonymity will be guaranteed.

All data will be anonymised, paper copies kept in a locked draw in a locked filing cabinet. In addition, all digital files will be securely stored and password protected. Data may be used for publication purposes and that in that event only anonymised data will be published and for a PhD project.

What will happen to the results of the research study?

The data will be used to understand and in turn develop the service delivered to patients. This analysis will enable a process of evaluation to be started that will lead to exploration of how participant's and the care provided, can better be improved.

The data collected will also be used as part of a postgraduate research project report.

Who has reviewed this study?

This research has been reviewed by ECDA Ethics Committee (Protocol number: LMS/PGR/UH/02925)

Who can I contact if I have any questions?

If you would like further information or would like to discuss any details personally, please get in touch with me, in writing or by email:

Liam Blackwell l.blackwell2@herts.ac.uk

Although we hope it is not the case, if you have any complaints or concerns about any aspect of the way you have been approached or treated during this study, please write to the University Secretary and Registrar.

Thank you very much for reading this information and considering taking part in this study.

11.9. Study 3 consent form

UNIVERSITY OF HERTFORDSHIRE
ETHICS COMMITTEE FOR STUDIES INVOLVING THE USE OF HUMAN PARTICIPANTS
(ECDA ETHICS COMMITTEE')

CONSENT FORM FOR STUDIES INVOLVING HUMAN PARTICIPANTS

Understanding people's experiences to help develop service

I hereby freely agree to take part in the study

Print name: .....

	Please tick
I confirm that I have been given a Participant Information	☐
I confirm that I have been given details of my involvement in the study	☐
I confirm that I have been assured that I may withdraw from the study at any time without having to give a reason	☐
I confirm giving my consent to participate in this study, I understand that voice recording will take place and I have been informed of how/whether this recording will be transmitted/displayed	☐

Signature of participant.....Date.....

BELOW TO BE COMPLETED BY THE RESEARCH TEAM

Signature of investigator..... Date.....
Mr Liam Blackwell

11.10. Study 3 Debrief sheet.

Debrief Form

A Psychological Approach to Obesity

Firstly, thank you for giving up your time to take part in the study!

Research aims:

The aim of this study is to better understand the underlying reasons that result in people becoming overweight and obese. The interviews and focus groups allow the research and service users to discuss how you became overweight, what worked when trying to lose weight, how has the weight loss programme helped, what didn't and the advice you would give to someone starting out.

By identifying these causes which lead you to become overweight, what has/hasn't worked and the advice you would give will be put towards the enhancement of health services. After all you are the experts and are in the best place to inform the health professions and policy makers on what will help when developing a more effective intervention for others.

Your interview/focus group discussion will be transferred in to written format with your transcript, with the digital recording deleted. Your transcript will be given a code that will keep your words anonymous without any identification.

If you would like to be kept up to date with potential presentations and publications that are the result of this study, you can email the researcher Liam Blackwell directly at l.blackwell2@herts.ac.uk or the researchers supervisor Dr Keith Sullivan at k.sullivan3@herts.ac.uk

Further support if required:

Beat - support for anyone affected by an eating disorder.

Phone (18+): 0808 8010 677

(under 25): 0808 8010 711

The National Centre for Eating Disorders - provides advice and information on compulsive eating and weight problems.

Phone: 0845 838 2040

Samaritans available 24 hours a day for anyone struggling to cope and provide a safe place to talk where calls are completely confidential.

Phone: 116 123

Email: jo@samaritans.org

ME Association - provides information, support and practical advice for people who are affected by ME/CFS), their families and carers.

Phone: 0844 576 5326 (Mon-Fri 10am-12; 2-4pm; 7-9pm)

Thanks again for taking part!

11.11. Study 3 Focus group schedule

Each participant was given all relevant information, consent (signed with wet ink) and debrief sheet.

Session	Participants	Completed
1	5	5
2	5	5
3	5	4
4	5	5
5	5	5

11.12. RIO poster presentation for UH conference

Taking the Weight off!

Evaluating a Tier Three Weight Loss Centre (RIO) between 2009-2015
Based on Weight Measurements and Wellbeing Scores

Blackwell, L., Boyden, C., Orr, L., Cotena, E., Carter, D., Senior, L., Wellsted, D., Capehorn, M, & Sullivan, K.
University of Hertfordshire, Centre for Health and Clinical Research. Rotherham Institute for Obesity, Rotherham CCG

- Introduction -

In the UK, over a quarter of all adults (26%) in England are obese (BMI ≥30) Latest estimates suggest over £10 billion, about 10% of the UK National Health Service budget is spent on obesity related disorders (NIHR, 2016).

The World Health Organisation (WHO) define obesity as abnormal or excessive accumulation of fat that has an effect on an individual's health. The world health organisation considers Obesity as such a big issue that they formally recognised obesity as a global epidemic in 1997 (Caballero, 2007).

The National Director of Health and Wellbeing for Public Health England, Professor Kevin Fenton; suggested that Obesity will overwhelm the NHS within the next 10-20 years if not tackled now (Fenton, 2016).

In the UK, NHS health care professionals are normally the first to offer help and advice to patients with weight issues. The general NHS advice on the treatment of obesity includes four main suggestions (NHS England, 2014). These are diet, exercise, anti-obesity medication (Orlistat) and in more extreme cases bariatric surgery.

The NHS has an obesity care pathway for England, shown blow. However, specific weight loss centres that focus on weight management are extremely limited. RIO is one of a hand full of these tier 3 services across the UK. The red box below shows where RIO fits within the NHS pathway. RIO offer a multi discipline approach tackling obesity, using several different methods (Obesity pathway below, Barth, 2015).

RIO consists of eleven dedicate members of staff, who play a role in the help and support of patients attempting to lose weight. These health professionals include a GP, exercise therapists, talking therapists, obesity specialist nurses and health care assistances who play a key role in educating, encouraging and supporting patients weight loss.

- Aim -

To evaluate the effectiveness of RIO between 2009-2015, using RIO patients Weight Measurement and Wellbeing Scores

- Results -

Analysis will test the differences between measurements to compare the two groups on, weight loss, change in waist circumference and change in WHO-5 scores.

Patients lost weight and reduced their waist circumference with RIO shown in Table 1.

Table 1. *Body measurements for RIO patient's percentage weight loss and percentage reduction in waist circumference by group.*

Group 1	Mean				
	Median				
Group 2	Mean				
	Median				
Overall Group 1 vs Group 2					
Group 1	Mean				
	Median				
Group 2	Mean				
	Median				

Median percentage change week 1-12, 1-6, 1-12, 1-6 months are the same across group categories Mann-Whitney U Test 2016

During their time with RIO patient's mean wellbeing score increased at each point of measurement for both Group 1 and Group 2.

Figure 1. *Patients WHO-5 mean change in wellbeing scores at points of measurement during their time with RIO.*

- Methods -

The development of Rotherham Institute for Obesity (RIO) came in 2009. RIO are a multi discipline tier three weight management service which has recorded patient body and wellbeing measurements.

Between development in 2009 and the first part of 2015, RIO has recorded 7,353 adult patient referrals. Of these 4,680 patients were referred once, with the remaining 2,673 patients reappeared at RIO for further treatment and interventions.

Patients were split in to two groups, first referrals were placed in to Group 1, with patients with multiple referrals placed in to Group 2.

Group 1: 4,680 Patients **Group 2: 2,673** Patients

Analysis of this data will test the percentage of weight loss and waist circumference in patients at RIO. Further analysis to calculate patients WHO5 scores will be undertaken before analysing the percentage change of patient scores.

- **Patients Weight Loss**
- **Change in Patients Waist Circumference**
- **Change in WHO-5 Wellbeing scores**

The analysis will be undertaken using parametric tests of the mean scores. However, as RIO works with patients who are at the higher end of overweight, this potentially skews the data. During the analysis, the distribution will be tested further and non-parametric tests of the medians carried out.

- Conclusions -

The results have shown that RIO is a successful weight loss service:

- ✓ **Patients lost weight with RIO**
- ✓ **Patients reduced their waist circumference with RIO**
- ✓ **Patients WHO-5 Wellbeing scores increased during their time with RIO**

Patients in both Group 1 and Group 2 lost weight with RIO at a similar rate. This shows that weight loss can be successfully achieved for both single and multiple referrals at RIO.

Success was also seen in the reduced patient's waist circumference size; Group 1 and Group 2 both showed a reduction in size. Patients achieved a bigger reduction during their first referral at RIO, with this reduction occurring at a smaller rate for patients that return for multiple referrals.

The WHO-5 scores for patients have been calculated using the formula set by the WHO. This showed that patients wellbeing scores increased during their time with RIO.

These findings show that the methods RIO use work, allowing patients to both lose weight and improve their wellbeing whilst at RIO.

- ✓ **This has shown that the methods used at RIO are working!**
- ✓ **Patients to lose weight and improve their wellbeing during their time with RIO.**

References

Caballero, B. (2007). The global epidemic of obesity: an overview. *Epidemiologic reviews*, *29*(1), 1-5.

Barth, J. H., & Cade, J. (2015). How should we deliver obesity services? *British Journal of Obesity*, *1*(4), 151-157.

Fenton, K. (2016) NIHR Research Workshop: Prevention and treatment of obesity: Getting the Score /the 'trend' for research, Emirates Stadium, January 20th, NIHR.

NHS England (2014) Obesity. http://www.hscic.gov.uk/catalogue/PUB16988/obes-phys-acti-diet-eng-2016-rep.pdf

NHS England (2014) Weight loss surgery. http://www.hscic.gov.uk/catalogue/PUB16988/obes-phys-acti-diet-eng-2016-rep.pdf

NHS England (2014) Type 2 Diabetes – Cases. http://www.hscic.gov.uk/catalogue/PUB16988/obes-phys-acti-diet-eng-2016-rep.pdf

World Health Organisation (2014) Obesity and overweight. http://www.who.int/mediacentre/factsheets/fs311/en/

"It always seems impossible until it's done" (Mandela, 2001)