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Utilising a social-ecological approach to understand the barriers and facilitators of weight loss in behavioural weight management programmes

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Abstract

Background

Behavioural weight management programmes are efficacious in improving health and weight outcomes in adults living with obesity. Typically, a target of 5% weight loss is considered "successful" as this weight change has been associated with improvements in health. Despite the successes of these programmes, many participants fail to reach a 5% weight loss. Comparing barriers and facilitators during participation in programmes can highlight differences between those who are "successful" and "unsuccessful". Research which aims to understand why participants are "unsuccessful" often focuses on programme or intrapersonal factors and does not consider wider contextual and environmental influences on experiences and outcomes. Where there is data on wider contextual influences, the data is often collected at follow-up (potentially introducing hindsight bias) or fails to compare commonalities and differences between "successful" and "unsuccessful" participants. Gathering data on what factors (i.e. internal, and external to the programme) influence success during participation can provide suggestions on how programmes can be improved. Therefore, this research aimed to explore the barriers and facilitators of weight loss for participants in behavioural weight management programmes, and to compare commonalities and differences between "successful" and "unsuccessful" participants, using a social-ecological approach.

Methods

The study used a two-phase convergent parallel design mixed methods approach. This involved collecting qualitative and quantitative data concurrently, analysing them independently, and then merging them for interpretation. The first phase was a systematic review of the barriers and facilitators of weight loss and participation in behavioural weight management programmes. The review used a data-based convergent synthesis to combine qualitative and quantitative data for thematic analysis. Quality assessments were used to rank the trustworthiness of the themes identified in the data. The second phase involved a combination of surveys, interviews and personal network data collection with adults living with obesity participating in a 12-week online behavioural weight management

programme. The content of the surveys and interviews was informed by the wider literature and systematic review and asked participants the degree to which and how different aspects described in the social-ecological model impacted their weight loss. Questions included intrapersonal, interpersonal, programme, environment, and also COVID-19 topics. Surveys were administered at baseline (n= 129) and the end of the programme (n= 102). Survey data were analysed using a sequential modelling approach to build an explanatory model of "successful" weight loss (i.e. ≥5%). Semi-structured interviews (n=48) were conducted midway through the programme. Data were analysed using a thematic framework approach. The data were coded before participants were grouped as "successful" or "unsuccessful" at achieving a ≥5% weight loss. Following the coding and grouping of participants, the themes were compared to identify commonalities and differences in the barriers and facilitators experienced between groups. Personal network data were collected at each timepoint as part of the surveys or interviews. Personal networks required participants to nominate people they spend time with (i.e. an alter) and answer questions on their attributes and connections to other alters. The personal network data explored the structure of participant networks (e.g. number of alters, density) and characteristics of the alters (e.g. their weight status, whether they offered social support) in the participants' lives and whether they affected success.

Following individual analysis of each study, the results were combined into a conceptual map to reveal a comprehensive overview of influential factors of "successful" weight loss. Factors which were identified in each study were then extracted to highlight key contributors to success.

Results

The systematic review identified 48 studies, including qualitative, randomised controlled trials and quasi-experimental methodologies. In total 39 barriers and 40 facilitators were extracted. Due to the generally high quality of the included studies, most themes were ranked as having high trustworthiness. Important factors included intrapersonal thoughts, feelings, behaviours and health, interpersonal dynamics, the programme materials, setting, and being mindful of participants and the facilities in the wider environment.

The survey also identified a range of key influential factors across social-ecological domains. The explanatory model found lower baseline takeaway consumption, more dietary changes made at baseline and the end of the programme, lower levels of anxiety, and higher levels of social support from the household accounted for 29% of the variance in whether participants would successfully reach a 5% weight loss.

The thematic framework analysis of the interview data revealed commonalities and distinctions between "successful" and "unsuccessful" participants. Commonalities largely reiterated the themes in the systematic review. Factors only reported by "successful" participants included being motivated by stressors, sourcing pragmatic solutions to barriers, being proactive in learning about risks associated with excess bodyweight and being aware of negative media and public health messaging concerning obesity. Factors only reported by "unsuccessful" participants included having challenging work patterns, disliking their weight target, having difficulty in managing stressors and overcoming barriers, being resistant to social support, and experiencing negative social reactions to their weight managements attempts.

The personal network data collected as part of the surveys offered limited insights into the relationship between the network and weight loss due to issues with the data collection methods. The personal networks collected in the interviews did not find any significant relationships between "successful" weight loss and any of the tested variables.

The integration of the results from the systematic review, surveys, and interviews highlighted intrapersonal and interpersonal factors as important contributors to "successful" weight loss. These included the adoption of more behavioural changes, receiving higher levels of social support, having higher levels of motivation, self-efficacy, and control, and lower levels of anxiety and depression.

Conclusions

This research identified crucial barriers and facilitators for "successful" weight loss in adults living with obesity participating in behavioural weight management

programmes. The findings show there are a variety of influential factors across the social-ecological model, and the importance and effect of these vary between participants. Although it's not feasible to address all challenges, programmes can use these results to harness the best conditions for success within their control (e.g. adding in extra programme components, and considering how to address external challenges). Based on the findings from each study, suggestions for practice, policy and research are offered.

Table of Contents

List of Tables

List of Figures

List of Appendices

Publications and other outputs

The following is a list of publications, conference presentations and other engagement activities which have resulted from the research in this thesis.

Publications

Thomson M, Martin A, Logue J, Wells V, & Simpson SA (2020). Barriers and facilitators of successful weight loss during participation in behavioural weight management programmes: a protocol for a systematic review. *Syst Rev, 9(168), 1-8.* https://doi.org/10.1186/s13643-020-01427-1

Thomson M, Martin A, Long E, Logue J, & Simpson SA (2022). A qualitative exploration of weight management during COVID-19. *Clinical Obesity, 12*(3), e1512. **https://doi.org/10.1111/cob.12512**

Conference presentations

Thomson M, Martin A, Baxter AJ, Logue J & Simpson SA. Barriers and facilitators of weight loss in behavioural weight management programmes: A systematic review. University of Glasgow Postgraduate Researchers All Aboard Conference (online), 24th November 2022. I was awarded best presentation.

Thomson M, Martin A, Long E, Logue J & Simpson SA. The COVID-19 pandemic and its impact on participation in an online behavioural weight loss programme: A qualitative exploration. European Congress on Obesity (online), 12th May 2021. This abstract was selected by the European Association for the Study of Obesity for a press release: buff.ly/3y7tBwz

Thomson M, Martin A, Logue J, Baxter AJ & Simpson SA. Barriers and facilitators of successful weight loss during participation in behavioural weight management programmes: A systematic review. International Congress of Behavioral Medicine (online), 9th June 2021.

Thomson M, Long E. Logue J, Martin A & Simpson SA. Personal networks and weight loss outcomes during participation in a behavioural weight loss program. Networks 2021: A joint sunbelt and NetSci conference (online), 9th July 2021.

Thomson M, Martin A, Long E, Logue J & Simpson SA. A qualitative exploration of barriers and facilitators of weight loss during participation in an online behavioural weight loss programme (Poster), UK Congress on Obesity, 7th & 8th September 2022.

Additional engagement activities

Video for the impact in 60 seconds competition held by the University of Glasgow, September 2019. I was awarded second place. Video link: https://youtu.be/ULQPK11q0jw

Thomson M, Martin A, Long E, Logue J & Simpson SA. The COVID-19 pandemic and its impact on participation in an online behavioural weight loss programme: A qualitative exploration. (online), 28th April 2021. Invited presentation to the University of Liverpool's Appetite and obesity research group.

Thomson M, Martin A, Long E, Logue J & Simpson SA. Social interplay and weight management – how does who we interact with affect weight loss efforts. (online) 10th October 2022 Invited presentation to the Association for the Study of Obesity Scotland's Network Natter.

Thomson M, Martin A, Long E, Logue J & Simpson SA. Social and programme factors in weight loss. (online) 14th November 2022 Invited presentation to the NHS Greater Glasgow and Clyde weight management service.

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Author's Declaration

I declare that, except where explicit reference is made to the contribution of others, this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.

Printed Name: Meigan Eilise Thomson

Signature:

Abbreviations

Abbreviation	Full Name
UK	United Kingdom
Kg	Kilograms
USA	United States of America
SES	Socio-Economic Status
BMI	Body Mass Index
CVD	Cardiovascular Disease
NHS	National Health Service
PA	Physical Activity
BCT(s)	Behaviour Change Technique(s)
PMT	Protection Motivation Theory
SDT	Self-determination Theory
LoC	Locus of Control
1:1	One-to-One
GGC	Greater Glasgow and Clyde
RQ(s)	Research Question(s)
SQ(s)	research Sub-Question(s)
PICOS	Population, Interventions, Comparator, Outcome(s) of interest, and Study design
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RCT(s)	Randomised Controlled Trial(s)

PPI	Patient and Public Involvement
ASO	Association for the Study of Obesity
PIS	Participant Information Sheet
UofG	University of Glasgow
SPHSU	Social and Public Health Sciences Unit
MRC	Medical Research Council
WEL-SF	Weight Efficacy Lifestyle questionnaire – Short Form
GAD2	Generalised Anxiety Disorder (2-item) scale
PHQ2	Patient Health Questionnaire (2-item) scale
COREQ	Consolidated criteria for reporting qualitative research
IPA	Interpretative Phenomenological Analysis
HBM	Health Belief Model
SCT	Social Cognitive Theory

1 Introduction

1.1 Chapter outline

This chapter provides an overview of the impact of obesity on health, and the complex drivers of obesity and weight loss. The prevalence, causes, and impact on health and the economy are considered, as well as the benefits of weight loss to health and recommended approaches to support people to achieve a healthy weight will be discussed. Existing evidence of enablers and challenges related to behaviour change and weight loss within the context of behavioural weight management programmes are considered, providing a rationale for studying barriers and facilitators to weight loss faced by people in such programmes.

1.2 Obesity & health

1.2.1 Patterns of obesity

Obesity patterning is influenced by several factors including age, sex, deprivation, and education. As of 2016, approximately 1.9 billion adults worldwide were living with overweight, and of these, 650 million were living with obesity (1). It is anticipated that the global prevalence will continue to increase to 42-50% of adults living with obesity by 2030 (2). Within the United Kingdom (UK), 61-67% of adults are living with overweight and 25-30% are living with obesity (3–6). On average, it is estimated the average adult gains one kilogram (kg) of body weight per year (7). In the global adult population, the number of men living with obesity has risen by 28-36%, and the number of women has risen by 29-38% since the 1980s (8). Although overall prevalence is higher in men within the UK, obesity rates are increasing in women at a faster rate (9).

People who experience higher levels of deprivation in high-income European countries have a higher incidence of obesity than citizens who are least deprived (10). Similarly, in the United States (USA), counties with the highest poverty rates have a 145% increase in obesity rates compared to wealthier counties (11). As well as poverty playing a role in obesity prevalence in high-income countries, occupation is a key contributor. There is a higher prevalence of obesity in

routine and manual jobs, with workers in this group expected to see the largest increase in obesity rates by 2035 (12). Those who are less affluent are at a higher risk of obesity than those with a higher income (13,14). For example, Hayes and colleagues found that socio-economic status (SES) has become an increasingly important risk factor for obesity. Specifically, their results demonstrated that the recent birth cohort with low SES had a higher prevalence of obesity in middle age than previous birth cohorts with a low SES (i.e. the low SES 1940s cohort had an obesity prevalence of 25-35% whereas the low SES 1970s cohort had an obesity prevalence of 51%) (14).

Education has also been associated with obesity prevalence. In higher-income countries, those with lower levels of education were more likely to have obesity than those with higher levels of educational attainment (10,15,16). Education could play a role in the ability to understand, or problem solve how to maintain a healthy weight or link to economic inequality (17).

1.2.2 Impact on health

Obesity is defined as excess fat accretion which poses a threat to a person's health (18). Obesity is typically defined using the Body Mass Index (BMI). BMI shows a person's weight (in kg) divided by their height (in metres) squared (19,20). A person's BMI can indicate levels of body fat but does not consider the location of fat or muscle (21,22). Table 1-1 shows the BMI categories which range from underweight to obesity class 3 (21). These cut-offs are relevant for non-Asian populations only, Asian-Pacific cut-offs are included in brackets. Asian-Pacific populations have different BMI cut-offs due to health risks associated with adiposity emerging at lower BMI levels than the rest of the population (23). BMI as a measurement does have its limitations in accurately grouping individuals based on their percentage of body fat (22,24). The measurement does not differentiate between adipose tissue and muscle or consider overall body composition. Despite the fallibility of the BMI measurement, increasing BMI has been associated with obesity-related ill-health at a population level, due to the build-up of adiposity in the body (25,26). Increased waist circumference (>94cm in men and >80cm in women) is also associated with a higher risk of weight-related co-morbidities (27).

Table 1-1 Classification of body mass according to BMI (Asian-Pacific cut-offs included in brackets)

BMI Range (Kg/M^2)	Weight Classification
<18.5	Underweight
18.5-24.9 (18.5-22.9)	Normal
25-29.9 (23-24.9)	Overweight
30-34.9 (>25)	Class 1 Obesity (mild)
35-39.9	Class 2 Obesity (moderate)
40+	Class 3 Obesity (severe)

Adults living with obesity are at a higher risk of developing type 2 diabetes, certain cancers (e.g. endometrial, prostate, kidney, and colon), having an impaired immunological response and are more susceptible to cardiovascular diseases (CVD) such as heart attack, stroke, and vascular disease (1,28). Moreover, having a higher body weight can lead to mobility problems, either due to increased demand on joints, greater difficulty in movement related to body size or amputations due to related conditions (e.g. type 2 diabetes) (29).

Medical care and treatment can also be more complicated. Adults living with obesity are at an increased risk of complications, infections, and sepsis while in the hospital (30,31). Likewise, obesity has been associated with a range of psychological issues. There is an increased likelihood that individuals living with obesity experience problems with cognition and mood. With ascending BMI there is an increased susceptibility to psychiatric diagnoses such as depression, anxiety, dementia, and severe mental illness (32–36). These issues can result in a lower quality of life and the experience of stigma. Research has shown adults living with obesity perceive their functionality as worse, have more concerns about everyday tasks (e.g. rising from the sofa, walking in public) and

experience stigma about their weight from themselves and the public resulting in a lower quality of life (29,34,37).

The experience of stigma and weight bias has been shown to impact how people living with obesity interact with their social environment. They are less socially active than healthy-weight peers, engaging in less varied and less frequent social activities (10). Weight bias and stigma can affect how people living with obesity are perceived by their peers. Research has shown people living with obesity are perceived as less skilled, less compliant with advice and less attractive (38). These perceptions will likely impact how people with obesity interact with colleagues, friends, family, and professionals. Such weight bias has been associated with adults living with obesity reporting poorer body image, lower self-esteem, and less social engagement with others (39).

The impact on health is vast and cyclical. If living with obesity results in physical, psychological, and social ill-health which are concomitant with further ill-health, the person's wellbeing can worsen without the appropriate support and intervention.

1.2.3 Impact on the economy

The health risks associated with obesity have led to increased demands on the economy and health services. Between 2014-2015, the National Health Service (NHS) spent £6.1 billion on obesity and overweight-related ill-health in England alone (40). A review of the associated costs of obesity in Europe showed it accounted for approximately 4.7% of population healthcare costs (41). This is associated with the increase in comorbid health conditions (e.g. CVD, type 2 diabetes), prolonged hospital stays, increases in the duration of ill-health and health/recovery complications, and a resultant increase in demand for medical resources (medications, beds, equipment, staff) from the public (25).

Increasing BMI is also associated with costs outside of healthcare to both employers and the individuals themselves. As BMI increases, the number of sick days at work, short term-disability, and unemployment rates increase producing additional economic costs to employers, the individual and the taxpayer (10,25,42).

1.3 Origins of obesity

The drivers of obesity are complex. Obesity can simply be described as the result of an energy imbalance (energy input exceeding energy output) (43). The reason for this imbalance is a complex interaction between genes and the environment (44). The role of each varies between people (45). For example, some people have genes that make them more susceptible to fat accumulation (46). Although genetics accounts for approximately 47-80% of BMI-heritability, Albuquerque and colleagues pose this does not account for the rapid growth in obesity prevalence (47). This suggests a person's environment and how they interact with it may play a dominant role in weight acquisition. Similarly, how a person interacts with their environment and their weight-related behaviours can be influenced by biological factors such as metabolism, taste preferences, or how full they feel after eating (48,49).

A person's environment encompasses many variables including their upbringing (e.g. parent's behaviour, socialisation and activity as a child or earlier in their lives), their social environment (e.g. who they spend time with, who they admire or seek advice from), their physical environment (e.g. access to green space, proximity to healthy foods, availability of health resources, i.e. weight management classes) and their cultural environment (e.g. policy (i.e. sugar tax), norms around eating, activity, weight and special occasions). The environment a person experiences throughout their life will shape how they interact with diet and physical activity (PA), while their genes will determine how much diet/PA and health will influence their weight (44,50).

The multidimensional and interconnected causes of obesity are depicted and explored in The Foresight Report (51). Figure 1-1 shows the Foresight report diagram. This depiction shows how interconnected the causes of obesity are and shows how these factors can be grouped. Figure 1-2 shows a simplified version of this complex diagram. The diagram demonstrates a range of overarching and interconnecting themes which contribute to the development of obesity. For example, individual psychology includes self-efficacy, motivation, and mood while societal influences incorporate social norms, pressures to eat certain foods in certain environments, or with certain people (51).

Figure 1-1 The Foresight Report Factors Associated with the development of obesity
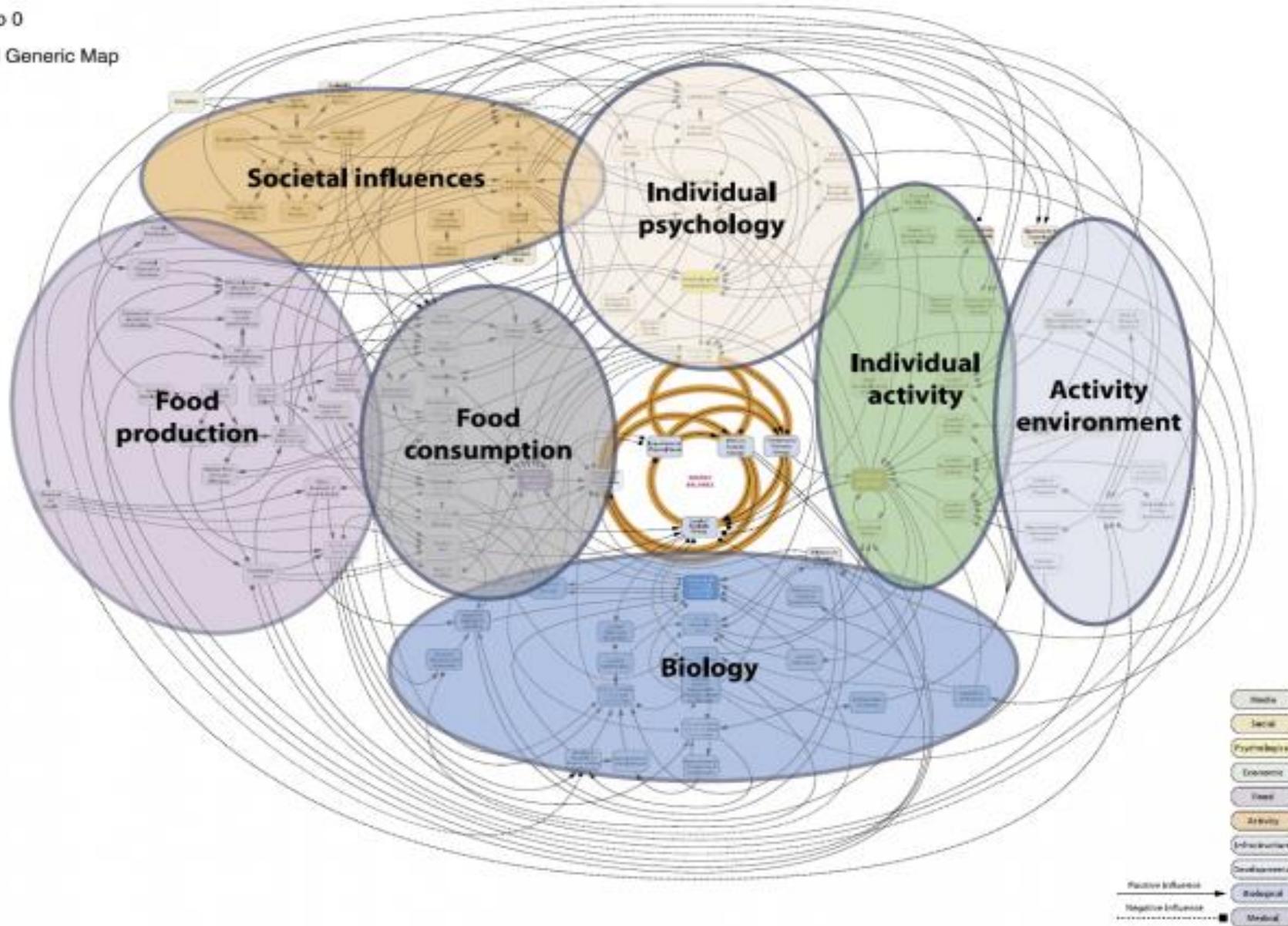
Figure 1-2 - The Foresight Report – Simplified version of factors associated with the development of obesity
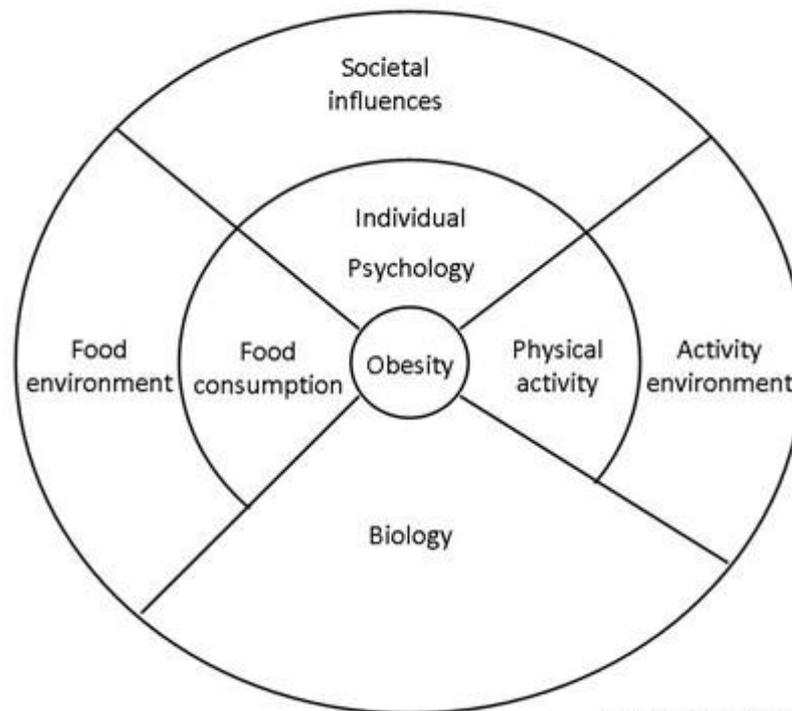
Source: Foresight systems map, 2007

The diagram shows the many factors which can contribute to obesity and illustrates that many factors are beyond the person's control (e.g. food production) (50). Imagining the individual in the centre of the diagram shows how the contributing factors could differ between individuals based on where they live (e.g. rural vs urban environments, proximity to exercise facilities), their income (e.g. affordability of fresh food), genetics (e.g. metabolism, inherited genes), health history (e.g. previous or current health conditions, understanding of healthy options), and life experiences (e.g. parental influences or exposure to advertising).

Hruby and Hu (2015) demonstrate how factors outside an individual's control could contribute to the development of obesity (50). They link the reduction of exercise and increases in calorific intake to a range of societal and cultural changes over the past few decades. For example, increases in desk jobs and the use of transport are linked to decreases in PA, and the transition from home-cooked meals to highly processed and pre-made foods (i.e. microwave meals and takeaways) due to fewer households having "homemakers" (i.e. both adults are in work) are linked to increases in calorific intake (50,51).

1.4 Social-ecological model

The social-ecological model (SEM) is useful for conceptualising how multiple interacting factors both intrinsic and extrinsic to the individual can shape their behaviour (52,53). It recognises individuals are embedded within a larger system and different contexts will impact their behaviour and health outcomes (54–56). Within the context of health, the model has a multilevel structure incorporating intrapersonal, interpersonal, environmental, cultural, and policy-level factors (52,57). This approach can be used to understand what factors determine an individual's health behaviour but are not necessarily within their ability to control (e.g. facilities in their local area) (58). Such approaches to understanding health and behaviour are often recommended to guide public health interventions (59). Understanding the wider context influencing our behaviour (e.g. environment, policy) can help improve the effectiveness of health interventions by considering the wider barriers to behavioural change. Figure 3 below depicts how the different levels of the model nest within each other.

Figure 1-3 Social Ecological Model
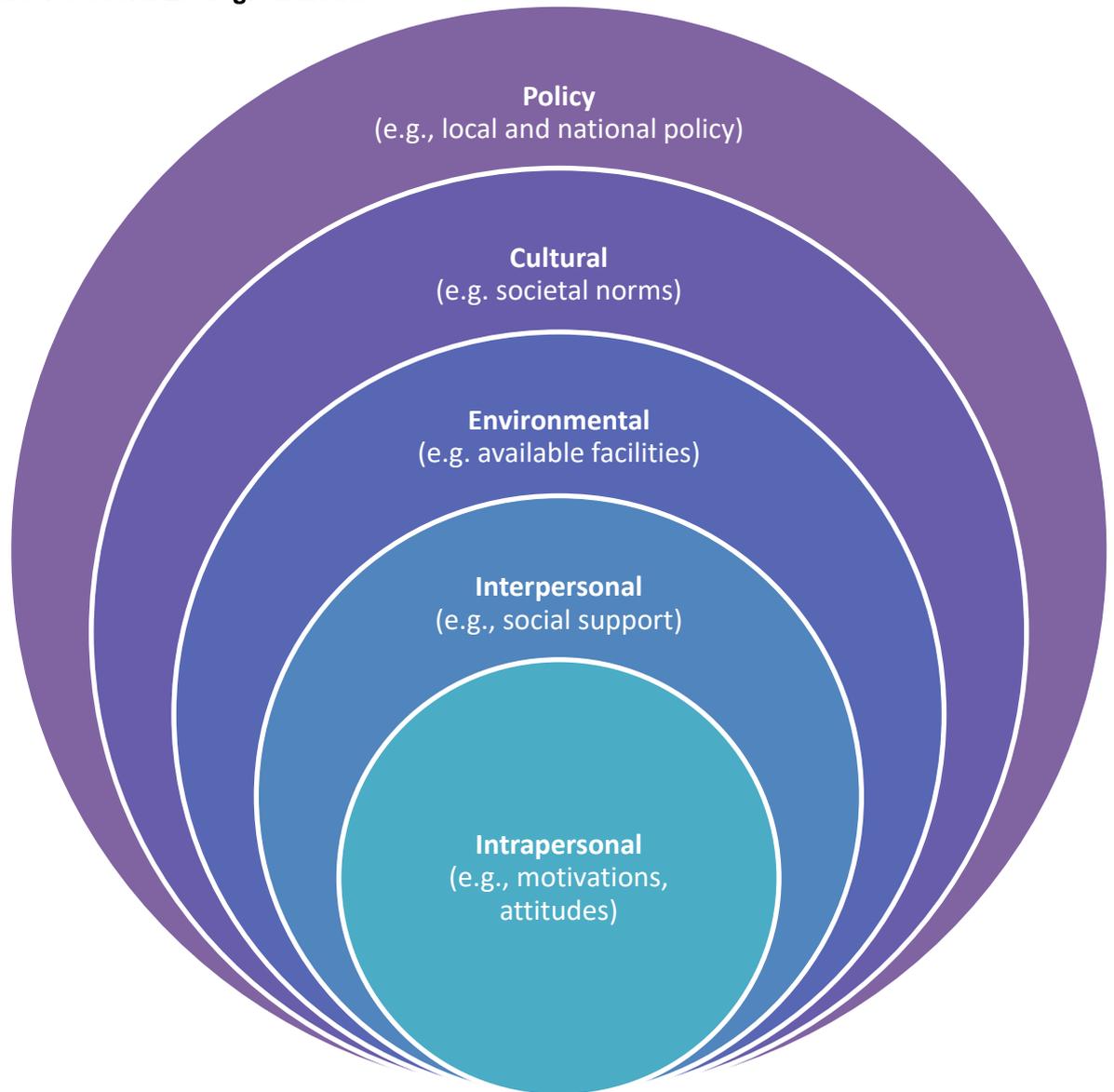
This model can be used to understand and explore the complex array of factors associated with weight gain, loss, and maintenance. As discussed in the Foresight report above, weight acquisition is a heterogeneous and complex interaction of genetics, environment, individual experience and psychology and socialisation, reflecting the multilevel structure of the SEM (51). Within the context of weight management, this approach is useful in thinking about how best to support people at risk of not achieving their weight loss goal and attaining a healthier lifestyle. How the constructs are experienced by the individual will likely influence their intentions, perceived ability, and execution of behavioural change (55). By assessing the factors from a multilevel point-of-view, we can identify interacting barriers and enablers as well as differences

between those who are successful and those who are "unsuccessful" in reaching their goals and use this information to adapt and improve interventions.

1.5 Benefits of weight loss

The risk to health and economic costs of obesity means we need effective interventions to support people living with obesity to successfully achieve and maintain a healthy weight and improve their health. Research has shown a small decrease in weight of 5-10% can have a range of health benefits (60–65). Some evidence suggests losing as little as 3% of initial body weight can improve obesity-related health conditions and future health (66,67). Weight loss has been associated with a reduction in the risk of CVD, type 2 diabetes and cancer, improvements in mobility, mood, immunological response, and chronic pain (60,68–71). Supporting individuals living with obesity to achieve maintained weight loss will improve health outcomes over their lifespan (by reducing the severity of current problems or preventing the development of new problems) and reduce societal costs associated with obesity-related ill-health.

1.6 Approaches to weight loss

Supporting individuals to lose weight and improve their health is challenging. There are a variety of approaches used to achieve weight loss. Selecting the appropriate approach can be tricky due to the multilevel influences on body weight. Methods include bariatric surgery, medication, meal replacement programmes and weight management programmes combining education, behaviour change, diet, and exercise (72,73). While surgical and medication approaches are effective in reducing body weight this is reserved for those with more severe obesity and given the current obesity levels developing effective approaches which can be cost-effectively delivered to more people is integral in impacting the obesity crisis. Some services/interventions are only available in some areas depending on the accessibility and resources of local healthcare providers or what is appropriate for the individual (i.e. considered and informed through current health and health history and the desired amount of weight loss).

Within the UK, the Obesity Care Pathway follows a largely tiered approach (74,75). Table 1-2 shows a brief overview of what each tier entails (76). The content and availability of resources do vary between localities. Tier 2 and Tier 3 are often delivered in the format of a behavioural weight management programme.

Table 1-2 Weight management tiers in the UK

Weight Management Tier	Definition
Tier 1	Universal services (e.g. health promotion through an advertisement)
Tier 2	Community Interventions (e.g. education programmes, diet, or exercise programmes)
Tier 3	Specialist weight management services (e.g. medication, community interventions with additional professional input to the patient such as meal plans made by a dietitian)
Tier 4	Bariatric surgery

1.7 Behavioural weight management programmes

Behavioural weight management programmes can be part of Tier 2 and Tier 3 services. These programmes aim to promote lifestyle change by supporting participants to engage in healthier behaviours. By improving diet and exercise behaviours, participants can improve their health and reduce their body weight. These programmes use a combination of dietary and exercise education, social support and behaviour change techniques (BCTs) and are typically delivered in a group or online format, with many programmes using a combination of both.

1.7.1 Behaviour Change Techniques

BCTs are strategies used to help someone change an undesirable behaviour or adopt a new desired behaviour, they are usually based on psychological theories and often have evidence supporting their use (58). These techniques are used in a variety of interventions and can vary in content. Arguably the benefits of using such techniques are that they can be used as a transferrable skill. An individual may be taught a range of techniques to manage their weight and use these skills to improve other health-related behaviours. Understanding what techniques are most useful in promoting different health behaviours can aid in developing effective interventions (77,78).

Examples of common BCTs used in weight management typically include (79–81):

- Goal setting - setting small, manageable, and achievable aims.

- Self-monitoring – keeping track of habits (i.e. the number of calories consumed, amount of energy expenditure or triggers for unhealthy behaviours) to enable the identification of habits, triggers, and log progress. This enables problems or areas which need more support to be identified.

- Problem-solving – identifying problem situations, moods and influences and creating a plan to deal with the problem.

- Social Support – sessions being led in a group format, peer support, online social networks, modelling.

- Health education – learning what healthy behaviours are, understanding the importance of diet and PA in health, health implications of excess body weight.

These are a few of the typical strategies used in behavioural weight management programmes, although specific techniques and combinations vary between programmes. The effectiveness of these techniques and combinations of these for weight loss is still being researched. For example, Dombrowski and

colleagues found self-monitoring, providing instructions and prompts on how to perform behaviours, and relapse prevention to be the most effective at producing "successful" weight loss (79). While a review by Hartmann-Boyce and colleagues found the most effective techniques for successful weight loss were self-monitoring, contact with a professional and the use of comparison between participants (80). Although there is some overlap between the effectiveness of different techniques in different studies, they do not always have consistent results, which may be a result of heterogeneity between programmes, participants, and context.

1.7.2 Successes of behavioural weight management programmes

Success rates in these programmes vary but generally 1/3 of participants achieve >5% weight loss, losing more weight than diet-only approaches (e.g. prescribed diets, calorie counting, food replacements) (65,82,83). A systematic review of types of weight loss intervention (and achieved weight loss), found at 6 months a combination of methods (e.g. education, BCTs and social support) was more effective than advice/education or exercise alone (63). Specifically, behavioural weight-management interventions have been shown to achieve approximately 2.5-5% greater weight loss than dietary education alone (84). When compared to education only, pharmaceutical treatments or counselling, structured behavioural weight-management interventions, such as Weight Watchers or Slimming World, are more efficacious in promoting lifestyle change and improving health outcomes and are more cost-effective due to the format (i.e. group or online sessions) and resources used (61,85–87). Randomised controlled trials have shown participation in programmes like these leading to weight loss can also reduce progression to type 2 diabetes in high-risk populations (68,88).

1.7.3 Problems with behavioural weight management programmes

Despite the success of behavioural weight management programmes, they still suffer from high attrition rates (i.e. drop-outs). Attrition rates vary widely between 10-80% (89). Participants in such programmes report difficulty in adhering to lifestyle changes for prolonged periods (84,90). This often results in participants leaving a programme early or not achieving their goal despite taking part. Dropping out of a behavioural weight management programme is

associated with poor weight loss outcomes and poor maintenance of any achieved weight loss afterwards compared to participants who completed the programme (91). However, of those who do complete these programmes, up to 50% still fail to achieve >5% weight loss (65,92). Little is known about what factors may act as a barrier to achieving a 5% weight loss while attending a programme. Gaining insight into why individuals leave or fail to lose weight despite staying in a programme could enable interventions to be adapted to improve retention and participant success rates. Being able to identify those at risk of dropping out or failing to lose weight early in the intervention would enable programmes to provide appropriate additional support to the individual (93).

Identifying the active elements in attrition and failure to achieve weight loss goals has proved difficult. Research to date has not identified consistent predictors of drop-out in these programmes which are likely to vary according to population, intervention methods and differences in definition (i.e. use of different time points or the number of attended sessions), context and measurement of attrition (91). The differences in the definition and measurement of attrition make it difficult to identify reasons or predictors consistently across studies.

Attrition and failure to lose weight from weight management programmes may be linked to a wide range of factors. This can be explored through the SEM to understand the complex multilevel influences which affect success and failure (54). Panter-Brick and colleagues used a social-ecological approach to understand how different factors could impact the behaviour change process from initiation to health improvement (55). Such an approach could be adapted to understand the factors impacting success/failure in the context of weight management.

However, one of the major problems in the weight loss literature is participants who drop out of programmes are rarely followed up (85,94). When reporting programme outcomes, many state success/failure rates with little investigation of factors during participation that could inhibit success. This leaves a knowledge gap relating to why people leave or do not attain goals during the programme.

1.8 Barriers & facilitators of weight loss

To understand what influences levels of success we need insight into the lived experience of participants in such programmes. Considering barriers and facilitators across different levels of the SEM can provide holistic insights into what affects weight loss outcomes. A study by Zheng and colleagues found participants who were good responders to a weight management programme (i.e. losing >15% of their initial body weight) perceived significantly fewer barriers to their weight loss during participation compared to the poor responders (i.e. those who lost <5%) (95). This suggests that from the onset of participation in a weight loss programme there may be differences in perceived obstacles to weight loss between those who are going to be "successful" and "unsuccessful". Most of the evidence on barriers and facilitators of weight loss is collected at baseline or follow-up. As discussed above, with the factors contributing to obesity and the SEM, weight management can be influenced by a range of factors involving aspects both within and outside of a person's control (51,52). Examples of these include intrapersonal factors such as readiness to change and motivation, interpersonal factors such as support and social norms, and environmental-level factors such as availability and proximity of resources (50,59). Additionally, the programme components (e.g. BCTs used) may interact with these factors to shape the participant's level of success (96,97). These different influencing factors will be considered below.

1.8.1 Intrapersonal factors

With the heterogeneity between participants, pinpointing a set of intrapersonal factors that may relate to success is difficult. A qualitative study by Rogerson and colleagues explored the thought processes and behaviours of participants, finding that "unsuccessful" participants differed in their thought processes from "successful" participants. "Unsuccessful" participants focused on their weight rather than a general lifestyle change and engaged in dichotomous thinking (i.e. where if they made one mistake in their diet or missed a class they would disengage, give up or engage in further unhealthy behaviours). While the "successful" participants engaged in mindful thinking processes (i.e. focusing on the moment and not allowing slip-ups to disrupt further behaviours and goals) and had higher levels of knowledge of healthy behaviours (98). Differences in

reaction to negative moods and events have also been observed when comparing "successful" and "unsuccessful" participants. Studies have found those with lower success rates are more likely to use food as a filler when they are bored or as an 'emotional crutch' when experiencing low mood or stress, resulting in overeating, and eating less healthy foods (90,99). These differences in thinking and reactions to slip-ups show clear individual-level differences. Commonly explored factors associated with levels of success include past experiences of weight loss, demographic factors and thought processes related to belief in being able to change and how to overcome adversity. These are discussed further below.

1.8.1.1 Weight loss & history

One of the strongest predictors of success is early weight loss (94,99–101). Gow and colleagues infer from their findings that early weight loss acts as a predictor of longer-term success as it identifies those who are most motivated and engaged in the intervention (99). Those experiencing early weight loss become more motivated due to feeling the initial reward of weight loss, enhancing their self-efficacy and belief that they are doing the components of the interventions properly. This was supported by Toth-Capelli and colleagues, who found people who adhere to and attend programmes in a dedicated way were more successful (102).

A participant's weight history also acts as a predictor of intervention outcomes. A person's weight history can provide information on the degree to which excess body weight is linked to genetics or biology (e.g. predisposed genes or pregnancy) or habits and socialisation (e.g. eating habits and health knowledge shaped through experiences) (103). The number of weight loss attempts appears to have a role in success (104). Intuitively, if someone has a greater number of weight loss attempts it can be inferred they have failed somewhat in the past. This is supported in the literature with repeat weight loss attempts being associated with lower weight loss, reduced rates of completion in these programmes and an increased risk of weight regain post-intervention (104,105). However, there is evidence that increased weight loss attempts can promote better weight loss. Fewer previous weight loss attempts have been linked to attrition in weight management programmes (101). It should also be noted that

increased weight loss attempts do not mean they were unsuccessful in the past. A participant may successfully lose weight but then regain weight due to a range of factors (e.g. their biological makeup, social pressures, stopping the diet or exercise components of the weight loss programme). Evidence suggests those who are in this group benefit from the experience of weight loss attempts as they are more likely to achieve "successful" weight loss earlier in a programme (106).

1.8.1.2 Demographic factors

As with the development of obesity, demographic factors play a role in successful weight loss. Socioeconomic factors are a common predictor with lower income and unemployment being attributed to poorer outcomes (101). This may be linked to accessibility issues in terms of affordability and proximity to healthier choices (i.e. space for exercise, and access to healthier food options). Being male and having an older age has also been attributed to higher success (93). There is little explanation as to why this may be linked to success. Potential factors could be differences in motivation, attitudes, and self-efficacy. Low educational attainment is often linked to the risk of attrition or failure to achieve weight loss goals (101,107,108). Most studies simply quantify low educational attainment as a factor impeding success rather than exploring the active inhibitors. It has been suggested that low educational attainment can inhibit weight loss in a range of ways, including comprehending what factors contribute to obesity and weight loss (i.e. understanding what a healthy diet is), a lack of problem-solving skills (i.e. being able to recognise a problem behaviour/choice and think of a healthy alternative), or other less obvious factors such as less social support (100).

1.8.1.3 Motivation

Behaviour change theories identify motivation (e.g. self-determination theory (109)) and readiness to change (e.g. transtheoretical model (110,111)) as key intrapersonal components to initiate behaviour change (55,58,110,112). Motivation is the cognitive process that accounts for an individual's intensity, direction, and persistence of efforts towards attaining a goal (113).

Motivation can broadly be broken down into intrinsic and extrinsic categories (114). Intrinsic motivation is when someone does something because of their interest and enjoyment in the task itself (e.g. running outside because you enjoy fresh air and nature). Whereas extrinsic motivation is undertaking a behaviour because the outcome is desirable (e.g. changing your diet to lose weight). This type of motivation relies on the reward of praise, recognition, and positive feelings either later or from others. Additionally, motivation can be broken down into autonomous and controlled (115). Autonomous motivation is where a specific behaviour is initiated by the person because they want to do it (e.g. finishing a book because you enjoy it). Whereas controlled motivation is where external or internal pressures make the person feel like they must do it (e.g. completing a task because you have a deadline).

Motivation has been found to have a key role in the success of weight management programmes. Different types of motivations may be key for different exercise and dietary behaviours. Low motivation and trying to maintain motivation when participants dislike the activity has been reported as a barrier to engagement with exercise (116). Similarly, participants report being autonomously motivated as the key to success, but this is supported by some controlled and extrinsic motivational factors such as reporting back to the programme facilitator on diet and exercise participation (117). Research has shown motivations can vary among participants in weight management programmes, but they commonly include an incentive to improve health, appearance and/or self-esteem (117). Some evidence suggests health motivation for weight loss is linked to a higher likelihood of success than those who are focused on improving one's appearance (90,94). The reason why health rather than appearance is a greater motivator may be linked to aspects of protection motivation theory (PMT) (118).

Protection motivation theory states people engage in different health behaviours by evaluating the following factors: severity of the health issue (e.g. health consequences for obesity such as heart disease), the likelihood of it occurring to them, appraising your ability to cope with inaction and perceived ability to execute the behaviour (118). This is used to evaluate the costs and benefits of action/inaction. Those who already have health risks associated with obesity

may find in their appraisal that following a programme and losing weight will gain greater rewards than inaction. Those involved for appearance reasons may not feel there is as much risk or threat and are therefore less stimulated to maintain their motivation. For example, it has been suggested that health will be more motivational for those with a higher BMI because higher body weight is associated with having a more negative impact on quality of life (e.g. higher incidences of disability, social exclusion, and CVD disease) (119). Therefore, inaction has a larger cost to their wellbeing leading to more autonomous motivation to follow a programme and achieve their goals. Furthermore, a study using National Weight Control Registry data in the USA found medical triggers such as ill-health and disease diagnosis were associated with greater weight loss and less weight regain (120).

Self-determination theory (SDT) describes motivation on a continuum from non-regulation (e.g. apathy) to extrinsic motivation (i.e. influenced by external rewards of punishments) to intrinsic motivation (i.e. internally driven through interest, challenge, or enjoyment) (121). These are influenced by the basic psychological needs of relatedness (e.g. feeling part of a group or competition), competence (e.g. positive, or negative feedback), and autonomy (e.g. the degree of choice someone feels they have). It distinguishes between the content of goals (e.g. improved health, improved body image) and the different regulatory reasons (e.g. self-esteem, social pressures to look a certain way) (122). Studies have found more intrinsic goals (e.g. health) tend to be more connected to the satisfaction of basic psychological needs (e.g. enjoyment), while extrinsic goals (e.g. appearance) tend to be regulated by more controlled reasons (e.g. preparation for an event) (122,123). SDT poses that autonomous/intrinsic motivation leads to higher levels of success, which Teixeira and colleagues have suggested is missing in the formulation of behavioural weight management programmes (124). They suggest if participants feel both competent and autonomous about reaching their weight loss goal this will likely lead to longer-term success in weight management. Furthermore, they propose programmes incorporating ways to support participants to adopt new behaviours and skills they enjoy would facilitate this motivation and success.

Readiness to change describes a person's preparedness to make changes in their life to acquire a particular outcome (e.g. being ready to change one's diet to lose weight). Readiness to change is recognised as a key facilitator for motivation in behavioural weight management programmes (117). Similarly, a person's motivation can facilitate their readiness to change. People go through a decision process of balancing what they want to achieve with what they will have to change and use a cost-benefit analysis to decide whether the change is worth the desirable outcome (125). Trials and feedback from participants identify readiness to change to be a key facilitator to "successful" weight loss and adherence to these programmes (93,98,126). It is also recognised that a person's readiness to change is influenced by a range of internal and external factors. Such factors include motivations, mood, social and cultural attitudes towards diet and exercise and environmental accessibility to the resources needed for change (98).

Success in these programmes is related to the changes participants make. Research has shown participants who accept weight management as a lifestyle change and not just a temporary one experience greater success in their weight loss attempts (95,127). It is recommended when supporting participants in their readiness to change, desired changes should be linked to specific weight-loss behaviours (e.g. reduce calorie intake by X) rather than general goals (e.g. reduce calorie intake) (44). This approach creates small manageable goals and enables participants to go through the decisional process of whether they can make these changes. A participant's readiness to change should also guide the approach taken to their weight. Those who are ready to implement change should be given the tools to implement the changes. Whereas, for those who are not ready to change, approaches should be taken to prevent further weight gain and explore the barriers they are facing to facilitate future readiness to change (128,129).

1.8.1.4 Locus of Control

Locus of control (LoC) describes the extent to which people believe they have control over what happens to them (130). An external LoC is where someone believes what happens to them is due to things they cannot control and external factors (e.g. where they live, other people, bad luck). Whilst an internal LoC is

where someone attributes what happens to them to their actions and behaviours.

Locus of control is a commonly reported mediator in weight loss trials. Some studies have shown that "successful" weight loss is attributed to having an internal LoC (81,94,131). These participants attribute the cause and treatment of obesity to their eating and exercise habits rather than an external source such as a medical condition or social pressure. This translates into their coping strategies during weight loss attempts. "Successful" weight loss participants will acknowledge any relapse and use problem-solving skills to evaluate the situation and their behaviour to try and avoid it happening again (94,104,120). However, the type of LoC does not simply indicate whether a person will be "successful". There is some evidence that it guides the level and duration of treatment a person requires to be "successful". An external LoC has been associated with longer attendance and continuing in a programme (125). It has been argued this may be due to a stronger need for guidance and to feel part of a social group. Studies have found that those with an external LoC can achieve the same levels of success (132). It has been suggested that the strategies for weight loss may need to be adapted depending on levels of internal and external control, and those with a high external LoC regarding their weight and food require an additional component to facilitate the transition to a stronger internal LoC (131,133). One suggestion is adapting programmes to include a self-efficacy element for participants with an external LoC as this component fosters confidence in their ability to make behavioural changes and eventually assume responsibility for outcomes (131).

1.8.1.5 Self-efficacy

Self-efficacy is another intrapersonal element related to a person's ability to change or adopt a new behaviour. Self-efficacy is a personal expectation of being able to successfully execute a course of action, navigate and respond to related problems and achieve goals (134). A person forms self-efficacy expectations based on the likelihood of the desired outcome formed via personal experiences, social and environmental influences, and their belief that they can overcome any obstacles faced while pursuing the outcome (135). The level of self-efficacy a person has will influence the actions they engage in, the level of

effort they put into the new behaviour(s) and how they react to obstacles (136,137). People with high self-efficacy can be seen as having an internal LoC as they accept responsibility for their behaviour and outcomes, pursue their goals and navigate problems efficiently (134).

Having a high degree of self-efficacy has been linked to increased weight loss success and being less tempted by prohibited items while in a weight loss programme (135,138). Those with high self-efficacy are more likely to adopt further healthful behaviours even if they are not part of the programme, improving outcomes (139). Weight loss at a steady rate has been shown to enhance self-efficacy and self-esteem, ultimately leading to further positive lifestyle changes (140). This suggests that while self-efficacy may shape behaviour during the programme, outcomes and achievements may also shape one's self-efficacy.

The evidence as to whether self-efficacy is predictive of success in these programmes is variable. There is evidence that levels of self-efficacy differ between participants which may impact success, for example, individuals with higher body weight have lower eating self-efficacy (141). Meaning those with higher body weight are less confident in being able to make and implement changes to their eating habits. Typically, research suggests those with high self-efficacy will succeed as they have the self-belief to make suitable changes to their diet and exercise. High self-efficacy has been linked to participants making positive changes in their diet and exercise habits, success in the programme, better overall changes in lifestyle, and long-term weight loss maintenance. (104,142–144). However, there is some evidence that those with high self-efficacy do not differ in levels of success from those with low self-efficacy (145). Studies have also shown that high self-efficacy may inhibit success in numerous ways. Some may struggle to adjust to changes advised in a structured programme, make unrealistic goals, have unrealistic expectations of change, and make inaccurate judgements/reports on the degree to which they have followed instructions (89,146,147). Despite the mixed evidence, it is likely that self-efficacy does play a role in weight-related behavioural change and therefore success. However, further exploration is needed to understand how and the

degree to which self-efficacy interacts with other variables and influences success (148).

1.8.2 Interpersonal factors

Those we spend time with and look up to can influence our thoughts and actions. Bandura proposes new ideas, values, and practices diffuse within our societies through observing others' behaviour and modelling (149). This observation and modelling of behaviours generate the norms and expectations within groups and in wider communities and society (135). Arguably these norms and expectations could facilitate or act as a barrier to engagement with a weight loss programme and behavioural change towards diet, exercise, and other healthful lifestyle factors.

1.8.2.1 Social norms

Social norms can influence and inform the behaviours, opinions, and emotions we choose and understand as appropriate in different situations. Turner defined social norms as our "cognitive representations of what relevant others think, feel, or do in a given situation which people use to guide their thoughts and behaviours" (150). Social norms can be labelled as either descriptive or injunctive. Descriptive social norms relate directly to the prevalence or frequency of a given behaviour (e.g. how often people in the social group go out to a restaurant for dinner). Whilst injunctive social norms refer to expectations and the degree of approval or disapproval for behaviours (e.g. what others think of dieting or going to the gym).

Social norms drive our intentions, actions, and opinions. Our need to feel part of a group, fit in with society and not be judged or excluded from social groups facilitates our adherence to social norms (151,152). The stronger identity an individual shares with a group and the more unsure they are about the appropriate choice or behaviour, the more likely they are to be guided by the norms of the group (152). Following norms guides our behaviour and ensures our behaviour matches those of the relevant social group, creating a shared identity and feeling of belonging with the group. Social norms can, therefore, be real,

hypothetical (i.e. the imagined response/thoughts of your group) and adaptable (i.e. norms change between social groups) (151).

In the context of weight management programmes, social norms may facilitate or inhibit a range of different aspects. These may include engagement with the programme, changes to diet or PA, framing our knowledge on what foods are healthy or being able to adhere to the programme due to other social commitments (e.g. if a family group have a takeaway each week). There is evidence social norms can fundamentally influence how people perceive body weight and shape (153). Norms around attractive or desirable body weight may influence engagement with a programme and motivations to lose weight. Similarly, social norms in our peer group can influence the foods we select, our self-perception of weight and even whether we like or dislike the taste and textures of foods (152,154). Hence, it is likely peer groups have a significant influence when making changes to diet and PA levels. One study found close peer injunctive and descriptive social norms would influence a person's intention to exercise and ability to maintain a healthy diet, while less close peer injunctive norms would influence the intention to have a healthy diet (155). This suggests the social norms of those close to a person and in their wider social circles (e.g. colleagues, acquaintances, friends) may impact the choice to take part in a programme and the choices to follow aspects of the weight loss programme. There may also be wider consequences of social norms impacting how feasible changes seem, thus impacting an individual's self-efficacy.

1.8.2.2 Social support

Social support is a common facilitator or barrier to change. There are four key forms of social support (156):

1. Appraisal – where an individual provides information that the recipient can use for self-appraisal (e.g. a friend telling you the qualities you possess that can equip you to lose weight).

2. Emotional – listening to your problems and showing empathy/love/care (e.g. a friend listening to what you struggle with in your weight loss programme).

3. Instrumental – providing the resources or a service you need to reach goals/change (e.g. a friend going to a fitness class with you).

4. Informational – providing facts, guidance, or information (e.g. weight loss coach providing dietary advice).

The way and degree to which support is delivered can impact whether it facilitates weight loss. Karfopoulou and colleagues compared support between participants who maintained weight loss after a programme and those who regained weight (157). Although they found those who regained weight had more support, they did find a key difference in the forms of support each group received. Regainers received support in the form of verbal instructions (informational) and encouragement (emotional), while maintainers received compliments (emotional) and active participation (instrumental). This suggests while emotional support can work as both a barrier and facilitator, the other forms of support it is paired with may impact how it is received. Instrumental may be an important support factor related to success. During weight loss, there is also evidence that support from different groups/situations may facilitate changes in behaviour. Qualitative research has shown support from partners such as cooking healthy meals can facilitate weight loss (98). Wang and colleagues found those who lost weight had greater support for healthy eating habits from friends and co-workers, and greater support for PA from family (158). Those who gained weight experienced familial social undermining, where their family undertook behaviours that hindered the attainment of their goal (e.g. getting a takeaway). This study shows the importance of social support for behavioural change and success in these programmes.

The concept of negative support is commonly reported in qualitative studies. Participants report pressure from friends or family to engage in unhealthy eating behaviours and habits as a barrier to their success (90,98). Moreover, those who classify family or friends as a barrier to success report they have limited healthy choices due to peer/family food preferences and are embarrassed to disclose they are on diet (98). The impact of these negative social aspects on weight loss may operate as a barrier by impacting the individual's sense of control or self-efficacy.

1.8.2.3 Social networks

One way to explore and understand a person's social environment is through exploring their social or personal network and the relational ties between network members. Mapping a social network allows us to observe who in a network is connected and what attributes they have. This can be used to understand how network characteristics (e.g. who speaks to whom, health behaviours, demographic factors) may play a role in the behaviours of those in the network (159). A personal network focuses on the network from an individual's perspective. These networks will only include those people identified by the core individual as part of their network (160). Table 1-3 lists a glossary of some of the terminology used in social network research (160,161).

Table 1-3 Social network glossary

Term	Definition
The social or whole network	A map of the relational ties between all members of a single, bounded community (e.g. a social network could be used to map who speaks to who in a workplace)
Actors/Nodes	Network members who are distinct individuals or collective units (e.g. each employee at the workplace or each school in a district)
Personal network or egonet	A network focused on a single actor's perspective. (e.g. having one person nominate who they speak to in a workplace)
Ego	The focal actor in an egonet or personal network
Alter	The people the ego nominates in their network
Relational Ties	Link actors/nodes within a network.
Network Composition	Characteristics or attributes of the network members
Network Size	Number of people in a network
Network Structure	The way people in the network have relationships among themselves
Homophily	The degree to which actors in the network are similar (e.g. in terms of gender, sex, age, health behaviours, etc)

Social networks can be used to understand how ego and alter characteristics may shape behaviour, attitudes, and norms. A network shows which actors are connected. These "ties" can influence behaviour as they facilitate the flow of information between members (162). A person's understanding of a health risk, ability to identify the changes needed and ability to implement these changes are influenced by the norms, information, and experiences within their network (163). In addition to the diffusion of information, a person's network may reflect levels of social support and social involvement. Altogether, this may build a person's levels of self-efficacy, self-esteem, and influence the health behaviours they engage in (positive and negative) (164).

Research has shown that characteristics of an individual's social network can influence their weight and obesity-related risk behaviours (e.g. dietary choices, levels of physical or sedentary activity) (165,166). For example, a study of young adults living with a range of body weights (normal, overweight, obesity) found their network influenced the likelihood of them being overweight and weight loss intentions (165). Those with romantic partners, best friends, casual friends, or family living with overweight or obesity were more likely to be overweight themselves. Additionally, the study found if a person had alters in their network trying to lose weight or their network had social norms around weight loss then they would have a higher intention to lose weight than those without others in their network trying to lose weight. This suggests the development of obesity diffuses within friendship groups which may be linked to the sharing of information, modelling of behaviours or general changes in levels of support or norms towards healthy dietary and PA behaviours.

The idea that our social networks can strongly influence weight has implications for weight management programmes. It suggests the lived social experience (likely within and outside) of a programme can influence the degree of success a participant achieves. Providing a social group with similar goals and motivations may facilitate change. Exploring the role of personal networks of participants and social networks within programmes could deepen the understanding of how networks diffuse information, develop norms and support members.

1.8.3 Programme factors

Various aspects of the programme environment may also influence success. The programme includes programme-specific components (e.g. techniques used, theory) and multiple levels of the SEM (e.g. location, group, and coach dynamics). These aspects will also interact with factors external to the programme (e.g. intrapersonal variables such as motivation or self-efficacy).

1.8.3.1 Programme format

Weight management programmes differ in their format and how they are delivered to participants. Both aspects may interact with whether someone will be "successful". Programmes may be delivered in person, online or a mixture of both, and in 1:1 or group formats. Impact and participation in these formats will likely rely on participants' personal preferences and accessibility (e.g. participants in rural locations, or those with caring or work commitments, may be restricted in their choice).

Findings from the barriers and facilitators discussed above are often used to inform the format of programmes. Many programmes already utilise social support and encourage the development of a supportive network as part of the programme (94,167). This, as opposed to 1:1 support, has been suggested to be more efficacious for weight loss as participants are building connections and support with people with similar goals and motivations. This format also builds a degree of accountability in the group which could facilitate motivation (168). However, for some, this may have adverse effects with social comparison highlighting inadequacies and reducing self-efficacy (81). Programmes have also been adapted to incorporate online social elements. This is still in its infancy and the efficacy of such formats is still being explored, but when paired with other resources such as health coaches this could be a promising way to facilitate support (169).

A systematic review of effective programme factors found developing supportive relationships with peers, and an instructive coach-led goal-setting approach and components of the programme fostering self-regulation facilitate success (170). Similarly, how the participant perceives the support delivered is important. If

participants perceive the intervention as developing independence and enabling them to make their own choices and improving their problem-solving skills, they are more likely to be "successful" than those who see the intervention as invasive or controlling (171).

1.8.3.2 Behaviour Change Techniques

BCTs used in behavioural weight management programmes aim to help participants recognise barriers and adapt their behaviours or surroundings to manage their weight (58). The person's ability to recognise barriers, consider alternatives (i.e. food choices) and implement those alternatives will depend on a range of factors outside the programme but also on the BCTs taught and learned themselves. Those who do engage in BCTs, such as self-monitoring, have higher levels of success (120,172).

Certain BCTs may act as facilitators or barriers to weight loss in programmes. Systematic reviews have identified the following BCTs as facilitating successful outcomes in the context of health, weight loss and dietary/PA changes: instruction on how to perform a behaviour, behavioural practice/rehearsal, demonstration of behaviour, action planning, goal setting, feedback on the outcome of behaviour and adding objects to the environment (173,174). This implies showing a participant how to conduct a behaviour, supporting them to plan their actions, creating goals and providing feedback can teach participants about the appropriate behaviours and deal with any problems they are experiencing with the behaviour change. Restructuring a person's environment (e.g. by adding objects) may support behavioural change by making changes more convenient (e.g. having easy access to cooking utensils and healthy recipes), supporting habit formation (e.g. visible prompts for behaviours) or less cognitively intensive. For instance, by making it easier to remember and understand changes (e.g. using appropriately sized plates to help with portion control) (175). Cradock and colleagues' review also highlighted features of interventions such as supervised PA, group sessions, contact with experts and greater frequency and intensity of the intervention as facilitating change (174).

1.8.4 Environmental factors

The different environments participants find themselves in will have an impact on their success and experiences in a programme. Theoretically, most people will have a home, work, social, virtual, and specific environments (i.e. a club, group, or community that they are a part of) which will influence their actions in different ways either through social influences or characteristics of the environment. As social factors were discussed above, this section will focus on aspects of the physical and built environment of the home, work, community and online.

1.8.4.1 Home environment

The home environment shapes a lot of our choices around food selection and PA. As mentioned in the social section, who we live with can facilitate weight loss. For example, a study that put participants into teams and gave teams points based on their adherence to the programme and "successful" outcomes found teams who lived together had the greatest weight loss (176). Weight loss in one member of a household appears to have a ripple effect on other household members (177).

In addition to the household members, items within a household can impact weight loss. The presence of certain foods, exercise equipment or a garden can influence weight loss behaviours. Emery and colleagues compared the food environment in the homes of people living with or without obesity. They found people living with obesity had less healthy food in their homes, had a greater likelihood that unhealthy food would be visible throughout the home, and had more food storage capacity (141). Another systematic review found a key determinant of not maintaining weight loss after taking part in a programme was having unhealthy foods or "snacks" available in the home (178).

1.8.4.2 Work environment

For many, the work environment is where we spend a lot of our time and is influential on our ability to move around and what we can eat. Desk jobs and work hours restrict our ability to move and cooking facilities in the workplace or food vendors around the workplace may restrict our dietary choices (50).

Notably small changes (e.g. removal of vending machines, the addition of places to exercise) to the work environment can be as effective as weight management programmes (179). Small changes to the environment promoting weight loss suggest the key role a workplace can have in facilitating change and losing weight. It also highlights the influence of external factors on success which individuals may not be aware of or able to change in a way to facilitate their weight loss. There are numerous studies of weight-loss interventions within the workplace. For many, the workplace is one of the most difficult places to change due to being restricted to desks to complete work, where their work is situated (e.g. lack of access to green space) and work hours. Having weight management programmes in the workplace may facilitate changes to the physical and social environment and increases convenience and accessibility (180). Success has varied in such programmes and some studies have found they are no better than control groups (181,182).

1.8.4.3 Wider community

A person's community in this context is referring to where they spend their time outside the home and at work. This may be the area surrounding their home or work. The built environment in someone's community may also facilitate the degree of success in a programme. Levels of engagement with PA may be influenced by the presence of paths, parks, walking trails and fitness facilities (183). Similarly, the availability and visibility of calorie-dense and palatable convenience foods rather than fresh foods may act as a hindrance to success (184). Depending on where a person resides, they may also have restricted access to healthier options and rely on calorie-dense convenience foods.

Evidence suggests people living with obesity perceive their environments as restrictive. Boehmer and colleagues found that obesity was significantly associated with perceptions that there were no nearby non-residential destinations, fewer or damaged sidewalks, an unpleasant community, and a lack of interesting places to go (185). This potentially highlights a barrier to navigating their environment to facilitate change that people living with obesity face compared to people of a healthy weight.

1.8.4.4 Media and the online environment

Exposure to the media and online environments plays a role in weight loss. Media (e.g. newspapers, magazines, music, and television) and online environments (e.g. social media, forums, and chat rooms) transmit messages and share ideas about what is normal or acceptable behaviour. Arguably, such platforms can shape our perceptions of healthy body shapes, food, and PA behaviours and ultimately affect the aforementioned constructs of social norms, motivation and self-efficacy (135,149). With the growth in social media use over the past couple of decades, understanding how social media may impact a programme is of increasing interest. There is some evidence that social media use in these interventions can support dietary changes (186). Although not many programmes that incorporate a social media component (e.g. forums and groups on social media websites), have investigated the impact these have on weight loss (187). More research is needed to understand how social media use external to and as part of a programme impacts success.

1.9 Programme of doctoral research

1.9.1 Rationale

Obesity is increasing in prevalence and is associated with a range of health issues. A weight reduction of 5% has been shown to reduce and improve associated health issues (65). Behavioural weight management programmes can support weight loss in a cost-effective way for groups of participants. However, randomised trials of behavioural weight management programmes have shown that ~50% of those attending and completing such programmes do not achieve a 5% weight loss (65,92). Programmes also suffer from variable attrition rates likely due to problems with engaging and adopting the behaviour changes proposed (84,91).

Early in the programme is potentially a critical time for providing additional support as results in the first few weeks can predict later success. Despite this, most of the research discussed above is either at follow-up, focuses on specific variables, or does not explore the lived experience during participation, potentially missing key influencers. This emphasizes the gap in the current

research evidence that little is known about the experience of barriers and facilitators early and during programme participation that participants face and how this may be connected to later outcomes. Understanding the lived experience of participants will fill a knowledge gap and could inform the enhancement of programmes to support those at risk of not achieving their goals or dropping out, perhaps in ways research into outcomes or evaluating test scores cannot.

1.9.2 Aims

This doctoral research aimed to explore the lived experience of participants taking part in behavioural weight management programmes and identify the barriers and facilitators experienced by "successful" and "unsuccessful" participants. This project utilised a social-ecological approach aiming to explore the individual, social, environmental, and programme-level factors which determine success or failure (57,188). This provides insights into the different barriers and facilitators experienced in different aspects of a participant's life, and also allows comparisons to be made between "successful" and "unsuccessful" participants. This has the potential to inform the development of future interventions and research that can support those most at risk of failing to achieve a 5% weight loss (94).

To explore this, I conducted four studies:

1. A systematic review – to synthesise the existing evidence on barriers and facilitators of weight loss *during* participation in behavioural weight management programmes.

2. Two surveys with participants in an online behavioural weight management programme – one at the beginning of (i.e., 0-2 weeks in) and one at the end of (i.e., 12 weeks) the programme.

3. Semi-structured qualitative interviews with participants in an online behavioural weight management programme – *during* participation in the programme (4-8 weeks).

4. Personal network interviews & surveys – collected as part of the surveys and interviews.

1.9.3 COVID-19 impact on the thesis

COVID-19 led to significant changes to this project. The project initially involved interviewing National Health Service Greater Glasgow and Clyde (NHS GGC) patients taking part in a behavioural weight loss programme. These interviews were scheduled to begin in March 2020. With the risk to patients and rules around lockdown, these services were suspended indefinitely. The supervisory team and I considered how to amend the project to still address the research aims. My supervisor (JL) had a connection with the Second Nature programme who agreed to let me recruit participants from them. Second Nature is an online behavioural weight management programme that uses a mixture of education, BCTs, and social support.

This resulted in changes in how participants were recruited for the thesis studies. Originally, participants who had been referred to the face-to-face programme by the NHS GGC weight management team or their general practitioner would receive an invitation in the post to take part in another student's questionnaire and/or my interview study. Those who completed the other student's questionnaire were again invited to the interview study. With Second Nature, I recruited self-referred participants who started the programme between October 2020 and January 2021. Second Nature sent out invitation emails to people who signed up during this time for the interview and surveys, and participants who were interested contacted me directly via email.

In terms of thesis content, changes were made to mitigate the impact of COVID-19. Originally the project involved 4 personal network questions embedded in another student's questionnaire and 50 interviews with participants from a face-to-face behavioural weight loss programme. The format of the interviews was originally face-to-face or over the telephone. This changed to being over the telephone only. Due to this, the software we were originally going to use for the personal network data (network canvas) was dropped. This was largely due to network canvas being a very visual tool, so it was deemed inappropriate for a telephone call, and an excel spreadsheet was also quicker for data input to

avoid awkward pauses in the interview. The two surveys were added to the project largely as a safeguard in case I became ill or if interview interest was low. In the original plan if recruitment was poor there was an option to attend group sessions to recruit and encourage participation. The content of the interviews also changed to include COVID-19-related questions. With the overall changes, this meant project management, data collection, analysis and write-up increased.

The changes to the project meant March to June 2020 involved a new ethics application and survey development, causing delays to the systematic review. Ethics was approved in late September 2020 by the College of Social Sciences at the University of Glasgow and the interview and surveys commenced in mid-October 2020 – a seven-month delay to the project.

1.9.4 Research Questions

Each study in the project aims to compile and collect evidence on barriers and facilitators to weight loss in behavioural weight management programmes. The project aims to understand these factors through a socio-ecological lens and collect data reflecting the complex multi-level structure of human experience. Reflecting on the discussion above, the methods selected aimed to add to the understanding of how social-ecological constructs (i.e. intrapersonal, interpersonal, and environmental) and programme-related factors impact success. Table 1-4 below shows the purpose of each component of this project.

Table 1-4 Purpose of each study in this thesis

Research Study	Purpose
Systematic Review	To collate all the existing evidence on barriers and facilitators to weight loss in behavioural weight management programmes.
Surveys at baseline and end of a 12-week block	To collect evidence on what factors at baseline and end-of-programme relate to success.
Interviews	To explore the factors participants' report as impacting their weight loss early into a programme.
Personal network study	To analyse social network differences between those who are "successful" and "unsuccessful".

The project's overarching research question is: What are the differences in barriers and facilitators experienced between those who achieve a 5% weight loss and those who do not while taking part in a behavioural weight management programme?

Table 1-5 details the breakdown of the research questions (RQs) and sub-questions (SQs). These are mapped against which sub-study of the project they were explored in.

Table 1-5 Research questions & sub-questions

Research Questions	Research Sub-questions	Part of the project it's explored in
RQ1 What intrapersonal factors impact success while taking part in a behavioural weight loss programme?	SQ1.1 – What barriers and facilitators are identified by participants in affective domains? (i.e. emotional regulation, enjoyment). Do these differ between "successful" and "unsuccessful" participants?	Interviews
	SQ1.2 – Are there differences in mood scoring between those who are "successful" and "unsuccessful" during the programme? (i.e. anxiety and depression)	Surveys
	SQ1.3 – What barriers and facilitators are identified by participants in cognitive domains? (i.e. motivation, perceived control, self-efficacy). Do these differ between "successful" and "unsuccessful" participants?	Interviews
	SQ1.4 – Are there differences in cognitive scoring between those who are "successful" and "unsuccessful" during the programme? (i.e. self-efficacy, LoC, motivation)	Surveys
	SQ1.5 – What barriers and facilitators are identified by participants in behavioural domains? (i.e. differences in behavioural changes). Do these differ between "successful" and "unsuccessful" participants?	Surveys Interviews
	SQ1.6 – Are there differences in the amount or types of behavioural changes between "successful" and "unsuccessful" participants?	Surveys Interviews
RQ2 What interpersonal factors impact success while taking part in a behavioural weight loss programme?	SQ2.1 – What types of social support help weight loss? SQ2.2 – Do levels of social support differ between those who are "successful" and "unsuccessful"?	Surveys Interviews Personal networks
	SQ2.3 – Are there differences in how "successful" participants handle social situations?	Interviews
	SQ2.4 – How does social interaction and influence impact success?	Interviews
	SQ2.5 – Do characteristics of a participant's network impact success? (i.e. their bodyweight, whether they are also trying to lose weight)	Personal Networks
	SQ2.6 – Does a participant's network structure relate to success?	Personal networks

	SQ2.7 – Do "successful" participants change who they spend time with or avoid those who are a negative influence?	Interviews Personal networks
RQ3 What environmental factors impact success while taking part in a behavioural weight loss programme?	SQ3.1 - What barriers and facilitators are identified by participants in their environment?	Interviews
	SQ3.2 – Do "successful" participants have less temptation in their area? (i.e. access to takeaways, household having snacks)	Surveys Interview
	SQ3.3 - Do "successful" participants have more opportunities to engage in healthy behaviours (i.e. exercise, eat healthily) where they live?	Surveys Interview
RQ4 What programme factors impact success while taking part in a behavioural weight loss programme?	SQ4.1 – What barriers and facilitators are identified by participants when interacting with the programme?	Interviews
	SQ4.2 Do "successful" participants enjoy and interact with the programme more?	Surveys Interviews
RQ5 – What other factors or multi-level factors impact success while taking part in a behavioural weight loss programme?	SQ5.1– What barriers and facilitators are identified by participants which are not covered above? Do these differ between "successful" and "unsuccessful" participants?	Interviews
	SQ5.2 What impact has COVID-19 had on the participant's weight loss journeys?	Interviews Surveys

1.9.5 Thesis Chapters

Table 1-6 shows the structure and content of the thesis by chapter. This introductory chapter acts as the main introduction to the thesis with subsequent studies having succinct introductory content relevant to the purposes of the research.

Table 1-6 Content of thesis chapters

Chapter	Content
Introductory Chapter	Introducing the topic of obesity and the rationale/questions for the PhD. Acting as the main introduction of the thesis.
Systematic Review	Brief introduction. Explanation of methods and results.
Methods	Brief introduction and methods used for the studies with participants in the online behavioural weight management programme.
Survey Results	Results from surveys 1 and 2.
Interviews Results	Results from the interviews.
Personal Networks Results	Results from the personal networks collected in both surveys and the interviews.
Discussion & Conclusion	Pulling together all the information from the 4 studies to build a conceptual map of the factors impacting success. Discussion of findings, limitations, and future directions.

2 Phase 1: Systematic Review

2.1 Chapter outline

The following chapter is a systematic review examining barriers and facilitators to weight loss and participation in behavioural weight management programmes. The review follows the premise that participants in such programmes are embedded in a wider social-ecological context which may help or hinder their experience and outcomes. Therefore, the purpose of the review was to identify previous research which may provide insight into what social-ecological factors may facilitate or hinder success. The review was registered with PROSPERO (registration ID: CRD42019148158) and the protocol was published in BMC systematic reviews (189). In this chapter, I discuss the rationale, methods, and results of the systematic review.

2.2 Background

As explained in Chapter 1, obesity is associated with a higher morbidity rate and a reduction of healthy years across the lifespan (190). This is attributed to the range of physical and mental health issues caused by excess body fat, an unhealthy diet, and reduced PA. Such health issues include type 2 diabetes, cancer, cardiovascular disease, dementia, and depression (28,36). Moreover, there are financial implications of obesity including health care costs and work-related costs such as sick pay and unemployment due to associated health issues (41). Behavioural weight management programmes have shown promising results in supporting weight loss and improving health in participants while being cost and time effective to deliver (65). Despite the success of these programmes, many attendees do not achieve the desired weight loss either through attrition or not losing weight during participation (89,92).

2.2.1 Justification for this review

With the increasing prevalence of obesity in the general adult population and the associated impact on health and the economy, it is crucial to improve interventions to support "successful" weight loss and improved health outcomes. Research has shown that early or lack of success in a programme can be a

predictor of longer-term success and outcomes (93). Some evidence suggests this can be predictive from the first month in a programme (129,191). Jakicic and colleagues found implementing a stepped-care approach throughout a weight management programme increased success rates in the programme (192). They evaluated participants' weight loss at different points in a programme, and if a participant was not losing weight, they added additional support or components to the programme. This suggests understanding what is needed and adapting programmes during participation could support higher levels of success. Therefore, collating the existing evidence on what factors are acting as barriers or facilitators of success during programme participation would allow suggestions to be made on how to increase success levels in these programmes.

Systematic reviews have investigated different aspects of the programme and participant characteristics which may inform understanding about the factors that could be interacting with participation and success. Reviews looking at factors impacting success for the participant have revealed reasons for attrition and adherence to these programmes. These include demographic, behavioural, psychological, and situational factors, such as age, mood, perception of early success and compliance with the programme (63,89,93). These reviews also have some methodological shortcomings which may impact the robustness of their findings. These include limited use of databases (63), failing to consider qualitative data (63,89), lack of clarity around the screening and extraction process (193), screening and extraction being conducted by one researcher (63,89) (thus introducing selection bias), extracting data at follow-up rather than barriers/facilitators experienced during the programme, and focusing on factors related to either attrition or adherence (63,89,193). These shortcomings in reviews limit the rigour and generalisability of the findings. Failure to consider qualitative data results in the loss of participants' perspectives and explanatory insights into what is impacting their success.

While these reviews provide insight into what factors help or hinder success in these programmes, there is a gap in the evidence base about the barriers and facilitators identified ***during or shortly after*** participation in such programmes. The reviews included studies that had a longer-term follow-up which could potentially mean some relevant factors were not identified. Collecting evidence

during and/or shortly after programme completion may uncover factors that are missed due to their importance not being recognised or remembered at later data collection time points. To date, there are no systematic reviews synthesising both the quantitative and qualitative data to address this question. Uncovering the factors interacting with participation (not just those associated with adherence or attrition) will add to the evidence base and identify what factors within and outside of the programme need to be considered when trying to improve success rates and deliver these programmes.

Therefore, this review aimed to explore the evidence of what factors have been identified as helping (supporting weight loss) or hindering (blocking weight loss or high attrition) during participation. Due to the typical timings of data collection (i.e. at the end of a programme), data collected shortly after programme completion was also included. Since participation in these programmes is set within a wider context (i.e. the participant's social life, environment, and culture) which can influence success, the review focuses on barriers and facilitators identified within and outside of the programme. These factors were mapped using the social-ecological approach to understand the intrapersonal, interpersonal, programme, environmental and cultural factors associated with hindering or supporting participation and weight loss in these programmes.

2.3 Objectives

The objectives of this systematic review were to (see Table 1-5 for RQs):

- Extract the existing quantitative and qualitative evidence on barriers and facilitators to "successful" weight loss (≥5% baseline body weight) in behavioural weight management programmes during or shortly after participation.

- Synthesise the evidence using a social-ecological approach to explore the barriers and facilitators present at different levels of the model.

These objectives were addressed by:

a) Systematically searching and identifying studies and extracting any quantitative or qualitative data linked to weight loss success/failure. This could be in the form of study results, participant or facilitator feedback or process evaluations. Secondly, if studies reported data on reasons for attrition or adherence this was also extracted.

b) Using a data-based convergent synthesis to combine all data in a single thematic synthesis.

c) Using quality assessments to assess the trustworthiness of the themes. These scores allowed for themes to be organised by strength based on the studies rather than frequency.

2.4 Methods

2.4.1 Eligibility criteria

Studies were assessed and selected according to the following criteria: Population, Interventions, Comparator, Outcome(s) of interest, and Study design (PICOS). There were no restrictions on the dates of publication and studies had to be published in English. Eligible studies were limited to settings in Western high-and middle-income countries. This was identified using the guidance from the Organisation for Economic Co-operation and Development (OECD): http://www.oecd.org/dac/financing-sustainable-development/development-finance-standards/daclist.htm. Studies were limited to these settings as it was expected this would allow comparison between studies of barriers and facilitators faced by participants due to higher levels of homogeneity between geographical contexts.

2.4.1.1 Population

This review included studies with adults (18+ years) who were taking part in a behavioural weight management programme in the community or as an outpatient. Programmes that had been tailored to fit the needs of a specific population were excluded (i.e. tailored to a specific disease or health condition, such as diabetes, cancer, or arthritis). This is due to tailored programmes not being comparable to typical programmes and may identify factors that are less

relevant to the general population taking part in weight management programmes.

2.4.1.2 Intervention

This review included studies involving behavioural weight management programmes (i.e. offering education on diet and/or PA and using BCTs for weight loss) with the primary goal of weight loss. Weight management programmes included in the review could be of any duration or intensity. Studies were excluded if the primary goal was not weight loss, if the programme has been adapted for specific physical or psychological needs or is targeting multiple health behaviours at once (e.g. weight loss and alcohol use).

2.4.1.3 Comparator/Outcomes

The primary comparator and outcomes of the review were:

1) Any data on intrapersonal, interpersonal, programme, environmental, cultural or policy factors associated with "successful" or "unsuccessful" weight loss during the programme.

2) Measurement of weight change during programme participation. This could be in the form of BMI, waist-to-hip ratio, waist circumference, weight measurement (e.g. lbs or kg) at the start and end of the programme or change during the programme.

The secondary outcomes of the review were:

1) Any data reported on reasons linked to attrition (which would be labelled as barriers).

2) Any data reported on factors that facilitate or hinder adherence and compliance with the programme.

Studies had to have qualitative or quantitative data on barriers or facilitators of success in their programmes. Barriers were defined as any factor identified as inhibiting a participant's weight loss journey by making it more difficult to focus

on or undertake the programme fully or being linked to dropout. Facilitators were defined as factors that supported weight loss or were associated with success. Factors were extracted if they were modifiable (i.e. were not demographic factors such as age, sex, or race). Non-modifiable factors were not considered as these have been considered in previous reviews looking at predictors of success and do not focus on experience within a programme.

Quantitative data included study results where success rates (i.e. success or failure) were linked to certain study variables, survey measurements of factors linked to success (e.g. psychosocial variables), and programme evaluations/feedback and their relationship to success (i.e. participant feedback). While qualitative data included participant or facilitator interviews or focus groups inquiring about barriers or facilitators to weight loss or for feedback on programmes.

Outcomes had to be collected during the study or with a follow-up of up to 3 months. A 3-month cut-off was set for follow-up to identify factors associated with weight loss and the intervention rather than longer-term maintenance and to reduce the risk of factors being unreported due to recall or hindsight bias (194).

2.4.1.4 Study design

Experimental, quasi-experimental, observational, qualitative and mixed-methods studies were included. Case studies of individuals were excluded due to issues of generalising to the wider population. Any protocols or systematic reviews in the search results were screened for related data which could be included in the study (i.e. study result papers).

2.4.2 Search methods

The initial search strategy was developed using the above PICOS statement. To develop a thorough search strategy, keywords that were used in other systematic reviews and papers within the field of obesity and weight management were used to inform word choice and an information scientist was consulted. An initial test of the search strategy was conducted in MEDLINE to assess the number of results received and assess if the search was thorough

enough. A random selection of 50 results was screened against the eligibility criteria by me and a supervisor to ensure we received the desired study types and outcomes from our search terms. Following this test, five databases were searched (from inception onwards) using the filter 2 option (see appendix 1, lines 34-37): MEDLINE, Embase, Cochrane Library, PsycINFO and CINAHL. The structure and formatting of the searches were adapted to each database.

In addition to searching databases the following methods were employed to find more relevant studies for the review:

1) Screening of systematic review reference lists: Systematic reviews which emerged in the database searches were not included in the review but were used to source further relevant studies. Each systematic review was assessed for relevance to the objectives of this review using phase 1 of the Risk Of Bias in Systematic Reviews tool (http://www.bristol.ac.uk/population-health-sciences/projects/robis/). Systematic reviews considered relevant to this review had their reference lists downloaded to be included in screening for this review.

2) Contacting experts in adult weight management research: Corresponding authors for protocol papers and conference abstracts were contacted to ask for full text/result publications to be added for consideration in the review. Experts were also identified through the screening process and the website search. A Twitter call was also made for relevant literature. A form was set up using google sheets which was shared via Twitter. This was shared via the networks of myself and the supervisory team. To gain traction and reach those working in the field, the following hashtags were used: #obesity #research #weightloss #weightintervention #systematicreview.

3) A search of the following public health and obesity websites:

   a. Public Health England(https://www.gov.uk/government/organisations/public-health-england).

b. The Scottish Public Health

Observatory(https://www.scotpho.org.uk/).

c. Association for the Study of Obesity (https://www.aso.org.uk/).

d. European Association of Obesity (https://easo.org/).

e. Centre for Disease Control and Prevention (https://www.cdc.gov/).

f. World Health Organization (https://www.who.int/).

The results from the searches were downloaded and stored in Endnote Version X9 (https://endnote.com/). Endnote was used to remove duplicates and the remaining studies were uploaded to Covidence (https://www.covidence.org/home) for screening and data extraction.

2.4.3 Data collection and analysis

2.4.3.1 Screening

The screening was performed in Covidence (https://www.covidence.org/). The first round involved title and abstract screening. I screened 100% of the papers and a random 58% (3028/5221) were screened independently by a fellow doctoral student. The full-text screening was conducted by me and a random 52% (149/286) were screened by the same doctoral student. Any disagreements were discussed and if an agreement could not be reached this was brought to the supervisory team to reach a consensus.

2.4.3.2 Data extraction

A data extraction spreadsheet was created in Microsoft Excel. This had columns to extract data on the study population, study characteristics, weight outcomes, barriers and facilitators, levels of adherence and attrition. Study characteristics included the format, duration of the programme and individual sessions and setting of the study. Data extraction was conducted by me and 10% (5/48) were checked by the same PhD student who completed the screening stages. Any discrepancies were noted on the shared excel file and discussed.

2.4.3.3 Quality Assessments

The Joanna Briggs critical appraisal tools were used to assess the quality of the included studies (195,196). The tools used were the:

- Checklist for qualitative research (see Appendix 2).

- Checklist for quasi-experimental studies (see Appendix 3).

- Checklist of randomised control trials (see Appendix 4).

I completed all the quality assessments, and all were checked by the supervisory team. Any discrepancies were discussed.

2.4.3.4 Data Synthesis

The data from the eligible studies were synthesised narratively. The synthesis combined both qualitative and quantitative data using a data-based convergent synthesis (197,198). This approach was selected as it allows quantitative and qualitative data to be analysed and synthesised together. This approach was required as there were high levels of heterogeneity between studies in how and what factors were identified as a barrier or a facilitator – this allowed the data to be collated and examined together.

Qualitative Data

Participant or facilitator feedback, interview, focus group, or open-ended survey response data related to what impacted experience in behavioural weight management programmes were extracted.

Quantitative Data

Quantitative data reported in the studies as acting as a barrier/facilitator or being attributed to success, failure, adherence, or attrition were extracted. Data sources included surveys and variables measured before and after the intervention as part of the study. The quantitative data was then converted into

a qualitative description to incorporate into the analysis of the results. This was conducted in one of two ways:

1) Any qualitative interpretation of the variable made by the authors in the results of the discussion sections of the paper was used.

2) If this was not explicitly available in the text, I wrote a short interpretation of the result which was discussed with the supervisory team.

Synthesis of qualitative and quantitative data

All included studies were imported into NVivo Version 12 for coding and analysis. Data were coded inductively using a thematic synthesis approach (199). As noted above, qualitative and quantitative data were coded concurrently with the quantitative data being transformed into a narrative. The data were grouped as either a barrier or facilitator of weight loss or participation in the programme. Codes were then grouped as being either an intrapersonal, interpersonal, environmental, programme or cultural level. Similar and common codes were then grouped to create themes. To categorise themes further, the intrapersonal, programme and environmental themes were put into sub-themes. This was partly to manage the data but mainly to improve the structure and clarity of the themes and ideas emerging.

Intrapersonal themes were grouped as either behavioural, cognitive, emotional, or health-related themes. Any theme related specifically to the programme was grouped under this category – this meant programme themes also included intrapersonal, interpersonal, and environmental themes. This was to enable programme-specific factors to be easily identified compared to external factors to the programme and vice versa. Programme themes were grouped as programme interactions, information and guidance, approach, materials, timing, or programme setting. Environmental themes were grouped as either local environment, or financial.

2.5 Results

2.5.1 Identified studies

The PRISMA flow diagram is shown in Figure 2-1(200). A total of 5895 studies were identified from the database searches and 324 from other sources. Once duplicates were removed, 5221 had their titles and abstracts screened. Following the preliminary screening, 260 were assessed fully and 48 were included for data extraction and analysis.

2.5.1.1 Study Characteristics

Of the 48 studies that met the eligibility criteria, 15 were solely qualitative (interviews or focus groups), 24 were RCTs, of which 6 included qualitative data, and 9 were quasi-experimental (single group and pre-test-post-test designs) of which 6 included qualitative data. 27 studies were conducted in the USA, 14 in the UK, 3 in Australia, and 1 each in Canada, Italy, New Zealand and Sweden. The study characteristics and outcomes can be seen in Tables 2-1 (qualitative studies), 2-2 (RCT studies) and 2-3 (mixed methods and quasi-experimental designs). Due to poor reporting of social-economic factors, these have been removed from the tables. For this, any income or employment status data had been extracted from the studies. Adherence rates have also not been reported since most studies either did not report these or reported them as completion of the programme (which is reflected in the attrition columns) rather than adherence to programme advice and behaviours.

Identification of studies

Identification

Records identified from:
Databases (n = 5895):
MEDLINE (n = 3530)
Embase (n =1643)
PsychINFO (n = 22)
CINAHL plus (n = 651)
Cochrane library (n = 49)
Systematic Reviews (n=308)
Contacting authors (n=16)
Twitter (n = 0)

Records removed *before screening*:
Duplicate records removed (n = 998)

Screening

Records screened
(n = 5221)

Records excluded
(n = 4935)

Reports sought for retrieval
(n = 286)

Reports not retrieved
No full text (n = 21)
No English text (n = 5)

Reports assessed for eligibility
(n = 260)

Reports excluded (212):
Wrong study design (n= 12)
Wrong intervention (n = 52)
Wrong setting (n = 9)
Wrong route of administration (n = 3)
Wrong population (n = 13)
Wrong outcomes (n = 117)
Wrong comparator (n = 6)

Included

Studies included in review
(n = 48)

Figure 2-1 Study selection for systematic review (PRISMA flow diagram)

Table 2-1 Main characteristics of qualitative studies included in the analyses

Author & Year	Country	Number of Participants		Age (mean, years)	Sex (%, female)	Programme Characteristics		Attrition rates		Weight loss outcomes
		Intervention	Control			Format of sessions	Length of intervention (months)	Intervention	Control	
Adolfsson et al. 2002 (201)	Sweden	15	n/a	50.9	80	In-person, group	12	0	n/a	Median 2% 5/15 lost 5% body weight
Ahern et al. 2013 (202)	UK	9	7	Intervention = 44 Control = 49	100	In-person, group	12	4	5	6 participants achieved a weight loss of >5% (3 from commercial, 3 from standard care)
Renouf et al. 2015(203) (POWeR primary care trial)	UK	11	7	Range: 31-71	55.56	Online, 1:1 support from professional	6	Not reported	Not reported	Not reported
Bradbury et al. 2015 (204) (POWeR community trial data)	UK	POWeR: 264 POWeR+= 247 Qual -19Wider RCT: POWEeR: 264 POWeR+coach = 247 Qual -19 POWeR+= 247 Qual -19	275	Range: 34-68 Median: 56	73.68	POWeR = Online only POWeR+ = Online plus 1:1 support either in-person or online.	2	POWeR = 224 POWer+ with coach+ = 194	113	-0.3 kg control, -2.01 kg power, -2.27 kg coach
Bunn et al. 2016 (205) (Football	UK	Interviews: 63 RCT: 374	Interviews: n/a	47.1	0	In-person, group, 6 email prompts	3	44	27	Intervention: amount lost At 12 weeks (mean & CI): -5.8kg (-6.33 to -5.27), Change in weight: -5.23% (-5.69 to -4.78)

Fans In Training)			RCT: 373							Control: -0.42kg (-0.76 to 0.09), change in weight: -0.37% (-0.67 to -0.07)
Fogel et al. 2009 (206)	USA	14	n/a	48.6	100	In-person, group	Ongoing	Not reported	n/a	Mean loss: 17.09 lbs
Holdsworth et al. 2017 (207) (Camwell RCT)	UK	18	n/a	18-<35: 5.5% 35-<50: 44.4% 50-<60: 22.2% >60: 27.8%	61.1	In-person, 1:1 support with professional	12	0	n/a	Loss of 5%: 4 (22.2%)
Ingels et al. 2018 (208) (PEIA weight management programme)	USA	21	n/a	50.72	86	In-person, 1:1 support with professional	24	6	n/a	Regain: 3 (50%) Mod Loss: 4 (50%) Large loss: 2 (29%)
Little et al. 2017 (209) (POWeR trial) (see Little et al. 2016 in Table 2-2 for full results)	UK	31 (14 remote support, 17 face-to-face support) 13 nurses	n/a	61	48.4	Control (Power+): online only Power+F: online + 1:1 behavioural counselling sessions. Power+R: online + phone or email contacts	12	(See Little et al. 2016, table 3)	(See Little et al. 2016, table 3)	5% weight loss: Control: 19% at 12m, Power+F: 28% at 12m Power+R: 32% at 12m

McMahon et al.2016 (210) (aspire trial)	UK	12	n/a	Range: 21-53	93	In-person, 1:1 support with professional & group	6.5	0	n/a	Range: 5.5-32.6%, mean: 18.8 kg
Piana et al. 2013 (211)	Italy	80	n/a	53.25 (+/-12.2)	62.5	In-person, group sessions	3	Not reported	Not reported	Mean (95% CI) - Weight (kg): -3.23 (-1.91/-4.55), Waist (cm): -6.8 (-4.4/-9.2)
Wright et al. 2015 (212)	UK	20	n/a	Range: 35-45 years	100	In-person, Group sessions & 1:1 with professional	12	2	n/a	>5% weight loss: 9 (45%), 0-5% weight loss: 6 (30%), Weight gain: 3 (15%), Dropped out: 2 (10%)

Table 2-2 Main characteristics of quantitative studies included in the analyses

Author & Year	Country	Number of Participants		Age (mean, years)	Sex (%, female)	Programme Characteristics		Attrition rates		Weight loss outcomes
		Intervention	Control			Format of sessions	Length of intervention (months)	Intervention	Control	
Gray et al. 2013 (213) (Football Fans In Training)	UK	51	52	47.1	0	In-person, group, 6 email prompts	12 (3 months of education/PA then 9 months of email prompts)	10	10	**Intervention:** 4.6% (2.8) loss at 12 weeks, 5.2% (4.2) at 6 months **Control:** 0.6% gain at 12 weeks
Chambliss et al.2011 (214)	USA	Basic: 45 Enhanced: 45	30	45	83	Online – computerised self-monitoring with basic or enhanced tailored feedback	3	Total: 23 Basic: 12 Enhanced: 11	2	Mean (SD): Weight kg Completers: Basic: -3.64 (3.42) Enhanced: -3.26 (3.10) Control: 0.32 (2.31)
Gabriele et al. 2010 (215)	USA	Total: 104 minimal support: 34 nondirected support: 35 directed support: 35	n/a	45.4	87	Online individual or group (e.g. forum/chat)	12	Total: 8 (3 min, 2 nondirect, 3 direct)	n/a	% weight loss. Female range: −11.73 to 3.51 mean:−2.97 SD:−3.82 Male range: −11.17 to

										1.03 Mean: −6.80 SD: 5.23.

Nondirect: Female range: −12.88 to 3.75 Mean: −2.94 SD: 3.96,

Male range: −19.03 to 0.00 Mean: 6.65 SD: 7.09

Direct: female range: −14.19 to 1.10 Mean: −5.25 SD: 3.98,

Male range: −12.20 to 2.12 Mean: −3.43 SD: 5.75

39.6% achieved 5% weight loss |
| **Hartman et al. 2016 (216)** | USA | 36 | 18 | 59.6 | 100 | Online and telephone calls | 6 | 3 | 2 | Intervention: 5.3% (42.4% vs 11.8% in controls lost |

										5% of baseline weight). Control: 1%
Nanchahal et al. 2012 (217) (Camwell RCT)	UK	191	190	48.76	72.18	1:1 sessions with professional	12	88	114	Mean & 95% CI. Weight (kg) 12 months: Control: -1.31 (-2.23 to -0.37) Intervention: -2.39 (-3.46 to -1.31)
Hunter et al. 2008 (218)	USA	224	222	67.9	50	1:1 online & access to exercise in the USAF facility	6	21%	14%	Intervention: weight: -1.3 (4.1) 5% or more weight loss: (22.6% of the group.) Control: weight: 0.6 (3.4)
Krukowski et al. 2008 (219)	USA	123	n/a	46.8	83	Online	6	21%	n/a	Mean weight loss (SD), percentage change: 6 months: 7.5kg (+/- 6.4); 8.5% 12 months:

Study	Country									
										6.6kg (+/-6.6), 7.5%
Kumanyika et al. 2009 (220)	USA	281 (intervention plus family support)	63 (intervention only)	46.5	89.8	In-person, group sessions, 1:1 support from professional	24	105	24	% with >5% weight loss: Control – 23.9 Intervention – 14.5
Lin et al. 2015 (221)	USA	63	61	50.7	84.6	Text messages	6	9	10	Intervention: -3.7 (-5.3 - -2.1), Control: -0.2 (-1.4-+1.0)
Little et al. 2016 (222) (POWeR trial)	UK	Total: 539 270 remote support 269 face-to-face support	279	53.71 (+/-13.14)	63.6	Power+: online only Power+F: online + 1:1 support from professional Power+R: online + 1:1 phone or email contacts	12	100	52	5% weight loss: Control: 19% at 12m, Power+F: 28% at 12m Power+R: 32% at 12m
Maddison et al. 2019 (223)	New Zealand	49	47	42.65 (+/-8.9)	0	In-person group	3	12	4	Intervention: -2.5kg mean
Morgan et al. 2009 (224) (SHED_IT RCT)	Australia	34	31	35.9 (+/-11.1)	0	Online	3	15% (Note -the paper doesn't specify whether this is	unclear	mean (95% CI). Weight (kg), Control: 6 months: −3.5 (−5.5, −1.4)

								intervention, control or overall)		Intervention: 6 months: −5.3 (−7.3, −3.3)
Nanchahal et al. 2009 (225)	UK	Lifestyle intervention: 30 Lifestyle + pedometer: 31	Usual care: 31 Usual care + pedometer: 31	47.2 (+/-11.6)	80.3	Online	12	8	12	Completers-only: % losing 5% or more of baseline weight. Lifestyle intervention: 34.0% (17/50) Control: 18.9% (10/53)
Patrick et al. 2011 (226)	USA	224	217	43.9 (+/-8)	0	In-person group & 1:1 support from professional	3	20	18	No significant group differences for BMI (p=0.053)
Shuger et al. 2011 (227)	USA	49 group weight loss 49 group weight loss + sensewear 49 sensewear alone	50	46.9 (+/-10.8)	81.7	In-person group sessions and 1:1 telephone calls with a professional	9	50	24	Weight change between baseline and month 9 Control - 0.9 kg (p=0.39) Group weight loss - -1.86kg (p= 0.23) Group weight

										loss + sensewear = -6.59 (p=<0.0001) Sensewear alone = -3.55 (p=0.003)
Tate et al. 2001 (228)	USA	46	45	40.9 (+/-10.6)	89	Online	6	10	10	Intervention: 4.1 (4.5) kg at 6 months, 45% lost >5%, waist reduction -6.4 cm (5.5) Control: 1.6 (3.3), 22% lost >5%, waist -3.1cm (4.4)
Webber et al. 2010 (229)	USA	40	40	48.7 (+/-10.6)	100	Online with two 1:1 in-person sessions with a professional and group sessions	4	6	4	Percentage loosing 5%: Control: 33%, Intervention: 41%
Webber et al. 2010 (230)	USA	33 enhanced support 33 minimal support	n/a	50.1 (+/-9.9)	100	Online	4	n/a – sub-study assessing completers		Mean loss of 4.5kg (4.6)
West et al. 2017 (231)	USA	199 behavioural treatment 199 behavioural	n/a	48.4 (+/-10.1)	89.7	Online	4.5	10%	n/a	6-month weight loss BT + MI : -5.1 kg

treatment + motivational interviewing										BT-only: -5.5kg. % achieving 5% weight loss at 6 months: BT+MI: 46.7% BT-only: 49.8%
Wylie-Rosett et al. 2001 (232)	USA	116 minimal support 236 intermediate 236 maximum	n/a	52.2 (+/- 82.31[1])	82.3	Minimal group: self-guided workbook Intermediate: workbook + online Maximum: workbook, online + 1:1 face-to-face or telephone professional	12	Total: 114 19 min support 53 intermediate 42 max	n/a	*% weight loss:* Min: 0.9% (0.54), Int: 2.2% (0.48), Max: 3.5% (0.49) Sig (p=.002) *>5% weight loss (%):* Min: 15, Int: 23, Max: 31, Sig (p=.012)

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[1] Please note this is a probable error with the figures contained in Table 1 of this paper

Table 2-3 Main characteristics of mixed-methods studies included in the analyses

Author & Year	Country	Number of Participants		Age (mean, years)	Sex (%, female)	Programme Characteristics		Attrition rates		Weight loss outcomes
		Intervention	Control			Format of sessions	Length of intervention (months)	Intervention	Control	
Abildso et al. 2010 (233)	USA	55 Interviews: 11	n/a	45.3	72.7	In-person, 1:1 with professional personal	3	15 Interviews: 4	n/a	Completers mean loss: 8.9 kg
Albarran et al. 2014 (234)	USA	111 (18 either interviewed or took part in the focus group)	112	Qual: 45 RCT: 44.6	100	In-person group and 1:1 with "promotora" (i.e. experienced peer) either at home or over the telephone	6	Not reported	Not reported	Baseline: Intervention: 173.65 lbs (29.72) Control: 176.45 lbs (35.3) End of 6 months: Intervention: 172.19 (31.63) lbs Control: 173.67 lbs (33.95),
Blunt et al. 2017 (235)	Canada	40 (15 took part in the focus group)	40	Range: 36-65	0	In-person, group	13 (3 months intensive, 10 months minimal support)	2	3	**12 weeks:** 30% lost 5% **12 months:** 17% lost 5%
Cifuentes et al. 2014 (236)	USA	Qual: 28 participant = 25 Group leaders = 3 Quant = 48	n/a	Qual = 55-86 (range) Quasi = 69.6	100	In-person, group	12 (optional to continue afterwards indefinitely)	21%	n/a	**All:** 12 weeks: -1.8% (2.9%), 24 weeks: -2.3% (4) 52 weeks: -3.5% (5.5). **Completers:** 12 weeks: -1.8% (2.9), 24 weeks: -2.3% (4.1),

										52 weeks: -3.5% (5.6)
Cleo et al. 2018 (237)	Australia	Qual: 7 RCT: TTT: 25 DSD: 25	25	Qual = 53 RCT = 50.5	Qual = 43 RCT = 81.3	Self-guided with 1:1 telephone support with a professional	3	6 (TTT: 4, DSD: 2)	3	TTT: -3.3kg DSD: -2.9kg Control: -0.4kg
Holtz et al. 2014 (238)	USA	26	n/a	37.4	33.4	Online	3	5	n/a	Sparkpeople: 4.43lb average loss (p=0.01), BodyMedia FIT: 2.65 lb (p=0.04), P90X: 2.47lb (p=0.17)
Zizzi et al. 2016 (239) **(PEIA weight management programme)**	USA	400 dropouts	n/a	48.6	Not reported	1:1 with professional	24	400	n/a	mean % body weight loss: 2.27 (4.9), 21% achieved 5% weight loss, 26.7% gained weight
Kim et al. 2008 (240)	USA	36 (12 facilitators also interviewed)	37	54.1	71.2	In-person Group meetings in a church setting	2	9	3	Mean changes & (standard error): Weight (lbs) Intervention: -3.6 (0.64) Control: -0.59 (0.59
McGirr et al. 2020 (241)	UK	51 (16 interviewed)	49 (21 interviewed)	32.5 (+/- 4.3)	100	Text messages	12	6	4	Full sample: intervention: mean loss: 1.6kg, control: mean gain: 0.17kg. Completers: weight change (kg) mean (SD): Intervention -1.75 (6.7), Control: 0.19 (7.5)
Merchant et al. 2017 (242)	USA	202 (38 interviews)	202	RCT: 22.7 (+/-3.8) Interviews:	RCT: 70.3 Interviews: 45	Online	24	40	23	Weight change (estimated marginal means)

				25 (+/- 4.46)						BMI – intervention: -0.3, Control -0.1
Seguin et al.2019 (243)	USA	15	n/a	52.2	100	In-person, group sessions	3	4	n/a	Weight change -1.5 kg
Stead et al. 2015 (244)	UK	Quant: 148 Qual: 24	n/a (only analysed data from the intervention arm)	63.73 (+/- 6.8)	25.7	1:1 counselling (optional family member or friend), telephone	12	Not reported	n/a	*Mean (SD) Weight loss (kg)* Super: −10.2 (4.3) Moderate: −3.8 (1.5) Low: 0.7 (2.4), *% body weight change*: Super: −11.5 (4.3) Moderate: −4.2 (1.4) Low: 0.8 (2.6),
Thabault et al. 2016 (245)	USA	36	n/a	66	61	Self-guided with up to 14 1:1 sessions	Up to 12 The data analysed is up to the 3-month point in the programme, if patients do not meet the weight goal by 6 months they are dropped out of the programme. If they are successful support can last up to 12 months.	0	n/a	The range of % body weight lost was −1.42% to 11.96%, with 39% of participants losing 5% or more of body weight in 12 weeks. **male:** 11.73 lbs, **female:** 10.16 lbs

Thiese et al. 2015 (246)	USA	13	n/a	Median: 50.7 (IQR: 21.2)	0	Self-guided, telephone contact with a professional	3	1	n/a	median: -5.1kg,
Um et al. 2015 (247)	Australia	34	n/a	50.7 (+/- 15.7)	71	1:1 with a professional	3	12	n/a	mean: 3.6% (2.5)
Walker et al. 2012 (248)	USA	34	37	24.6 (+/- 4.8)	100	In-person, group sessions	3.25			*% Weight change:* White: Intervention: -3.5 (7.9), Control: -1.3 (2.1) (non-sig), African-American: intervention: 1.5 (3.5), Control: -0.1 (3.3) (non-sig), Hispanic: intervention: -1.2 (2.6), Control: -0.2 (2.7) (non-sig)

2.5.1.2 Quality Assessments

Given the heterogeneity of studies and outcomes, quality assessments were used as a method to assess both study quality and the trustworthiness of each identified theme rather than merely reporting frequencies. The Joanna Briggs critical appraisal tools for qualitative, quasi-experimental, and randomised controlled trials were used. While scores are not typically given in these assessments, a score tallying all the areas where the items are present was calculated for use in analysing the trustworthiness of the themes for the results. Qualitative studies had the total number of items present (all the green boxes) added then if items 7 (i.e. is the influence of the researcher or the research, and vice-versa, addressed?) and 8 (i.e. are the participants, and their voices, adequately represented?) were not present this was subtracted. These items were specifically selected as it was important to ensure themes were representing the experience of those participating in the interview/focus group rather than the researcher's influence. Studies were then grouped as having a low, medium, or high degree of trustworthiness for the themes based on their scoring in the Joanna Brigg's critical appraisal tools (see Table 2-4). This enabled themes to be ranked as low, medium, or high strength. If themes were identified in more than one study with different scoring, the highest score was adopted. This was deemed appropriate as calculating frequency may wrongfully diminish the strength of a theme.

Table 2-4 Trustworthiness ranking based on quality assessment score

	Ranking		
	High	Medium	Low
Qualitative Appraisal Scoring	7-10	4-6	0-3
RCT Appraisal Scoring	9-13	5-8	0-4
Quasi-Experimental Appraisal Scoring	7-9	4-6	0-3

Tables 2-5, 2-6, and 2-7 show the overall quality of the studies was high. Only one of the qualitative studies reported all the aspects of the quality assessment tool (237). Most of the qualitative studies (Table 2-5) did not report their philosophical perspective (Q1), have a statement locating the researcher culturally (Q5) or discuss the influence of the researcher on the research (Q6). By not considering the role of the researcher during the preparation stages or in analysis, studies may have missed unintentional effects of the impact of the researcher on the content of the interview. The interviewer's previous experience will influence how the interviewer responds to participant experiences and in turn interact with how the participant responds to the researcher and further questioning. For randomised control trials (Table 2-6), only one study (which was a published detailed funder report) met all the quality assessment items of the tool. Most studies were either unclear or did not meet the blinding categories (Q4-6) with either the participants, those delivering treatment, or those assessing outcomes not being blind to treatment. Given the structure of many of the included studies, this appears to not have been applicable due to content, location, or transparency in the projects (i.e. location of intervention arms being different (e.g. online vs. in-person), content of intervention arms being different (i.e. additional support from staff), and use

of waitlist or active controls). The quasi-experimental studies (Table 2-7) were overall of high quality with the main criteria not present being the presence of a control group.

Table 2-5 Quality assessment results for qualitative studies included in the analyses

Study	1. Is there congruity between the stated philosophical perspective and the research methodology?	2. Is there congruity between the research methodology and the research questions or objectives?	3. Is there congruity between the research methodology and the methods used to collect data?	4. Is there congruity between the research methodology and the representation and analysis of data?	5. Is there congruity between the research methodology and the interpretation of results?	6. Is there a statement locating the researcher culturally or theoretically?	7. Is the influence of the researcher or the research, and vice-versa, addressed?	8. Are the participants, and their voices, adequately represented?	9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?	10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?	Quality Score (number of greens minus q7 & q8 if not present)
Abildso et al. (2010)	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	5
Adolfsson et al. (2002)	Unclear	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	6

Ahern et al. (2013)	Unclear	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	6
Albarran et al. (2014)	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Blunt et. (2017)	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	7
Bradbury et al. (2015)	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Unclear	Yes	6
Bunn et al. (2017)	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	7
Cifuentes et al. (2014)	No	Yes	Unclear	Unclear	No	No	No	Unclear	Yes	Yes	1
Cleo et al. (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10

Fogel et al. (2009)	Yes	Yes	Unclear	Yes	Yes	No	No	Yes	Yes	Yes	6
Gray et al. (2013)	Unclear	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	6
Holdsworth et al. (2017)	Unclear	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	6
Holtz et al. (2014)	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	5
Ingels et al. (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	9
Kim et al. (2008)	Unclear	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	6
Little et al. (2017)	Unclear	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	Yes	Yes	6

McGirr et al. (2020)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	9
McMahon et al. (2016)	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
Merchant et al. (2017)	Unclear	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	6
Piana et al. (2013)	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Unclear	4
Renouf et al. (2015)	Unclear	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	6
Stead et al. (2015)	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	6
Thabault et al. (2016)	Unclear	Yes	Yes	Unclear	Unclear	No	No	No	Yes	Unclear	1

Thiese et al. (2015)	Unclear	Yes	Yes	Unclear	Yes	No	No	No	Yes	Unclear	2
Um et al. (2015)	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	5
Wright et al. (2015)	Unclear	Yes	Yea	Yes	Yes	No	No	Yes	Yes	Yes	6
Zizzi et al. (2016)	No	Yes	Yes	Yes	Yes	No	No	No	Unclear	Yes	3

Table 2-6 Quality assessment results for RCTs included in the analyses

Study	1. Was true randomisation used for the assignment of participants to treatment?	2. Was allocation to treatment groups concealed?	3. Were treatment groups similar at baseline?	4. Were participants blind to treatment?	5. Were those delivering treatment blind to treatment assignment?	6. Were outcomes assessors blind to treatment assignment?	7. Were treatment groups treated identically other than the intervention of interest?	8. Was follow-up complete and if not, were differences between groups in terms of their follow-up adequately described and analysed?	9. Were participants analysed in groups to which they were randomised?	10. Were outcomes measured in the same way for treatment groups?	11. Were outcomes measured in a reliable way?	12. Was appropriate statistical analysis used?	13. Was the trial design appropriate, and any deviations from the standard RCT design (individual randomisation, parallel groups) accounted for in the conduct and analysis of the trial?	Quality Score (number of greens)
Blunt et al. (2017)	Yes	Yes	Yes	Yes	No	No	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	10

Chambliss et al. (2011)	Yes	Yes	Yes	Unclear	No	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Gabriele et al. (2010)	Yes	Yes	Yes	Yes	No	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11
Gray et al. (2013)	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Hartman et al. (2016)	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Holtz et al. (2014)	Yes	Unclear	N/A	N/A	N/A	Unclear	Yes	Unclear	Yes	Yes	Unclear	Unclear	Yes	5
Hunter et al. (2008)	Yes	Unclear	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9

Kumanyika et al. (2009)	Yes	Yes	Yes	No	No	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Lin et al. (2015)	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	12
Little et al. (2016 & 2017)	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Maddison et al. (2019)	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
McGirr et al. (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	13
Morgan et al. (2009)	Yes	Yes	Yes	Unclear	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11

Nanchalal et al. (2009)	Yes	Yes	Yes	Unclear	No	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Nanchalal et al. (2012)	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11
Patrick et al. (2011)	Yes	Yes	Yes	No	No	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Shuger et al. (2011)	No	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Stead et al. (2015)	No	Yes	Yes	Unclear	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11
Tate et al. (2001)	Unclear	Unclear	Yes	Unclear	No	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Walker et al. (2012)	Unclear	Unclear	No	Unclear	No	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7

Webber et al. (2010)	Unclear	Unclear	Yes	Yes	No	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9
West et al. (2017)	Unclear	Unclear	Yes	Unclear	No	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Wylie-Rosett et al. (2001)	Yes	Yes	Yes	Unclear	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11

Table 2-7 Quality assessments for quasi-experimental studies included in the analyses

Study	1. Is it clear in the study what is the "cause" and what is the "effect" (i.e. there is no confusion about which variable comes first)?	2. Were the participants included in any other comparisons?	3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	4. Was there a control group?	5. Were there multiple measurements of the outcome both pre and post-intervention/exposure?	6. Was follow-up complete and if not, were differences between groups in terms of their follow-up adequately described and analysed?	7. Were the outcomes of participants included in any comparisons measured in the same way?	8. Were outcomes measured in a reliable way?	9. Was appropriate statistical analysis used?	Quality Score (number of greens)
Abildso et al. (2010)	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	8
Kim et al. (2008)	Yes	No	N/A	Yes	Yes	Yes	Yes	Yes	Yes	7
Krukowski et al. (2008)	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	8

Seguin et al. (2019)	Yes	N/A	N/A	No	Yes	N/A	N/A	Yes	Yes	4
Thabault et al. (2016)	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	8
Thiese et al. (2015)	Yes	N/A	N/A	No	Yes	N/A	Yes	Yes	Unclear	4
Um et al. (2015)	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	8
Webber et al. (2010)	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	8
Zizzi et al. (2016)	Yes	Unclear	Unclear	No	N/A	Yes	Yes	Yes	Yes	5

2.6 Social-ecological barriers & facilitators

To address the purpose of this review (i.e. to identify barriers and facilitators to weight loss during participation), themes were grouped as a barrier or facilitator and then assigned to a level of the SEM.

Of the 48 studies, 47 identified facilitators and 43 identified barriers to weight loss either through quantitative results or qualitative exploration. Tables 2-8 and 2-9 show all the barriers and facilitators which were generated from the included studies, each categorised against aspects of the SEM (i.e. intrapersonal, interpersonal, environment, cultural, and political factors), programme-related factors, and by the trustworthiness ranking they received based on their quality assessment scores (see section 1.4.3).

Additional contextual factors acting as barriers to participation in the programme were reported. These included family or work commitments, life events (e.g. weddings), vacations, and situational circumstances (e.g. relocating, house maintenance/emergency) (207,216,221,223,224,239).

Table 2-8 Social ecological barriers to weight loss grouped by trustworthiness ranking.

Trustworthiness Ranking	Social-ecological construct					
	Intrapersonal	Interpersonal	Programme	Environment	Cultural	Political
High	Unsustainable	Lack of support	Not fitting in	Deprivation	Norms	
	Deviance from programme		Comparisons	Weather	Events	
	Low motivation		Lack of informational support			
	Programme not meeting expectations		Information overload			
	External Locus of Control		Negative leader attributes			
	Readiness to change		Finding the materials a chore			
	Reduced sense of accountability		Lack of material support			
	Emotional regulation		Duration			
	Negative emotions		Scheduling issues			
	Health restricting ability to participate		Unsuitable environment			
	Lack of visible results		Travel			
Medium	Transforming information into behaviour	Impracticality	Dependency on others	Lack of suitable facilities		Fear of deportation
	Recognising the problem	Stigma	Repetition of past advice	Disengaging from environment		
	Negative impact on health		Changes to staff during the programme			
Low			Lack of consideration of what led to weight issues	Income limitations		

Table 2-9 Social ecological facilitators of weight loss grouped by trustworthiness ranking.

Trustworthiness Ranking	Social-ecological construct			
	Intrapersonal	Interpersonal	Programme	Environment
High	Prompts	Influence	Membership	Nature of employment
	Adoption of specific behaviours	Social support	Pressure	
	Routine	Comparison	Tailored	
	Engagement		Novel & Relevant	
	Motivation		Challenges	
	Readiness to change		Structured	
	Internal locus of control		Positive leader attributes	
	Reshaping		Credibility	
	Accountability		Mindful of culture	
	Self-efficacy		Tools	
	Knowledge acquisition		Prompts	
	Positive emotions		Easy to follow	
	Emotional regulation		Fit into life	
	Other benefits		Regularity	
	Visible results		Atmosphere	
	Prioritising health			
	Lifestyle change			
Medium		Becoming a role model	Suitable environment	Affordability
Low				Adapting to environment

2.6.1 Intrapersonal factors

Intrapersonal themes related to thoughts, emotions, or behaviours from or by the individual that would facilitate weight loss. To group themes, they were categorised as either emotional (e.g. feelings), cognitive (e.g. thoughts), behavioural (e.g. behavioural changes or supportive behaviours) or health (e.g. health-related factors). There were 14 barriers and 17 facilitators identified in the review.

2.6.1.1 Behavioural factors

Behavioural themes were related to the factors supporting or hindering behavioural changes. There were three barriers and four facilitators identified.

<u>Barriers</u>

Of the three behavioural barriers, two had a high and one had a medium trustworthiness rating. The high trustworthiness themes were *unsustainable,* and *deviance from the programme*. The medium trustworthiness theme was *transforming information into behaviour*.

1. Unsustainable was used to describe behaviours that were difficult for participants to adopt and maintain. In the studies which had this theme, sustainability was focused on the diet (201,203,233,238,243,244). Dietary changes (e.g. reducing fat content) and portion control were identified as challenging to sustain throughout programmes:

> *"…majority of participants followed the recommended meal plan and Plate model during the first half of the programme. They also replaced high-fat products with leaner varieties. During the second half of the programme, the participants found it harder to follow the newly acquired routines of meal plan and Plate model."* (201)

2. Deviance from the programme guidance and structure acted as a barrier to weight loss (201,209,211,222,242,244). This was where participants did not follow the tasks involved in the programme (e.g. self-monitoring, dietary

guidance) or did not attend sessions. The example quoted below shows a participant deviating from the programme's nutritional advice due to a lack of visible results:

> *"I want to lose weight so now I do it my own way… I know it isn't good not to eat, but it is the only thing showing a result on the scale"* (201)

*3. **Transforming information into behaviour*** was used to describe instances where participants reported a lack of change due to not knowing how to change behaviours (238). This evidence showed that while participants generally knew what had to change to lose weight there was a gap in being able to transform this knowledge into action. This is shown in the quoted section from Holtz et al. below:

> *"…there seemed to be a lack of awareness about how to use the information to make healthy behavior changes. One participant stated he became more aware of his sleep, but he did not state how he planned to use that information. It was motivating to see his activity level, but he still did not necessarily change his behavior..."* (238)

Facilitators

All four intrapersonal facilitators ranked as having high trustworthiness. These themes were *prompts, adoption of specific behaviours, routine,* and *engagement.*

1. ***Prompts*** related to the incorporation or use of objects to initiate the desired health behaviour (201,207,209,225,238,242,246,248). This was related to both dietary and PA behaviours. For example, in Adolfsson et al's study, one participant ate the same food last for dinner to signal the end of eating (201). This was to prompt her to stop eating and give her body a signal for the meal to be over. Use of step counting was used to prompt more walking if steps had not been reached and starting and ending the day using a food journal was used to prompt goal-setting behaviours.

2. ***Adoption of specific behaviours*** related to actions participants took to facilitate change (201,203,209,210,214,216,217,221,222,224,225,228–230,232–234,238,239,242–244,248). These included increasing setting goals, increasing PA, meal planning, dietary changes, joining an additional weight loss or fitness class and replacing habits with healthier ones (e.g. changing a behavioural stress response). Success was associated with making specific (e.g. meal planning) and extensive (i.e. multiple) changes to behaviour. Although there was also evidence that making small incremental changes such as changing from sugary to sugar-free drinks and increasing step count by a small amount would support a longer-term steadier weight loss (237). The most cited behavioural action was self-monitoring of diet and/or PA. This seemed to enable participants to reflect on their decisions which can be observed in the quote below:

> *"I was actually able to evaluate what it is that I'm putting into my body and start making the more health-conscience choices that I need to make.".* (238)

3. ***Routine***. Establishing a routine for meals and physical exercise was associated with success (205,222,234,241,244). This was reported to support new healthy habits becoming automatic and part of participants' lives rather than a chore or obstacle. The quote below from Bunn et al. reflects how multiple themes in this review interacted to change a participant's routine. The participant adopted new behaviours towards alcohol consumption influenced by knowledge acquired through the programme and then saw visible results of weight reduction strengthening their routines and behavioural changes:

> *"I don't drink pints anymore, for a start, and that kind of came out, partly came out when we were talking about calories and making you think aboot it. And I'mno' daft. I knew there must be mair [more] calories in a pint, but I just couldnae stomach the idea of having a bottle of beer while everybody's getting a pint. And I thought, 'Right, I'll try this with the bottles of beer'. And then, once I seen the weight coming off, and that, [...] So, I went on to the bottles of beer. That changed everything for me, because the pints – you're obviously drinking mair alcohol, for a start, so I'm puggled [tired] come six o'clock when I come hame [home] from the fitba. I only, noo [now], have a few bottles of beer. I've actually started taking the car, coz I've got to the point where I realise I'mno' even needing a bottle of beer. I'll maybe have one bottle of beer* (205)

4. *Engagement* with the programme sessions and content (205,210,217,218,221,224,226,228,230–232,242). Participants who attended more sessions and adhered more to the programme advice and followed the content lost more weight in the studies. Engagement also included participants actively seeking guidance from the programme when further support was needed.

2.6.1.2 Cognitive factors

Cognitive themes were factors related to thinking processes such as understanding, planning and attitudes. Six barriers and eight facilitators were identified.

<u>Barriers</u>

Of the six barriers identified, five ranked as high and one had medium trustworthiness ratings. The high trustworthiness themes were low *motivation*, the *programme not meeting expectations, external locus of control, readiness to change*. and a *reduced sense of accountability*. The remaining theme was *recognising the problem.*

1. *Low motivation* describes where motivation was cited in the studies as being low or absent (208,211,238,239,244,248).

> *"It is more mental than physical, because if your heads not in it, then your not gonna make that commitment, your not gonna feel like doing things."* (208)

2. *Programme not meeting expectations* seemed to be linked to disengagement with the programme (204,218,235). Expectations around levels of support or guidance from the programme were cited. Instances, where participants had a negative experience with the programme either through content or with staff, were also grouped under expectations. This can be noted from Hunter et al's interpretation:

> *"Some individuals indicated that they chose a web-based program because they were looking for an easier way to manage their weight and were disappointed that it still required considerable behavioral change* (218).

3. *External locus of control* described evidence related to the presence or absence of external factors being blamed for lack of success and how participants reacted to external barriers (203,204,233,244,247). Less "successful" participants would have negative reactions and perceive barriers as more difficult to overcome. This was noted by Abildso et al. reporting reasons for dropout:

> *"…individuals who dropped out or lost less than 4.5kg indicated that they just gave up or resisted the suggested changes (cognitive rigidity) and attributed failure to external factors such as the need for more education, poor interaction with staff, or the difficulty of changing multiple behaviors"* (233)

4. *Readiness to change* was related to participants not being ready to or resisting changes to their dietary, PA, or health behaviours to lose weight (203,210,211,218,233,244). This included being ready to address old habits and make changes in their lives. Participants seemed to mainly describe this as being

within the right frame of mind to begin the programme and start making changes to their lives:

> *"When this came around last year and one of the girls at work joined it and she said, "Are you coming?" and I just weren't in right frame of mind, I knew you know. But this year I just thought right yeah, something clicked and I thought right I'm going to do it and that's how I ended up here really"* (210)

This theme also included participants being vague about the changes they needed to make and how they would implement them or overcome potential barriers.

5. ***Reduced sense of accountability***. Having a reduced sense of accountability to the programme also acted as a barrier (204,207,209,217,233,238,241). This included not having a place to report reasons for absence or deviating from the programme.

6. *Recognising the problem* covered participants' perceptions of obesity as a health issue and their own beliefs about the extent of their weight issue. This acted as a barrier to participation and weight loss for participants who did not think obesity was a threat to their health or did not accept the extent of their weight and therefore the risk to their health (202,211).

> *"Despite having a body mass index of greater than 30 kg/m^2, none considered themselves to be obese, instead describing themselves as overweight or too fat. Participants did not think their weight was a problem, although they perceived obesity as a medical issue associated health implications"* (202)

Facilitators

All eight facilitators ranked as high trustworthiness. These were *motivation, readiness to change, internal locus of control, reshaping, accountability, self-efficacy, knowledge acquisition* and *lifestyle change*.

1. ***Motivation*** was identified as a factor contributing to success (202,203,205,209–212,218,219,235,237,241–243). This could be fostered by the individual's needs or desires, interpersonal relationships, staff, and seeing results. Specifically, autonomous motivation (i.e. self-generated by someone's desires and goals rather than from external factors) was a predictor of weight loss (204,228–230,244).

2. ***Readiness to change*** referred to participants as being ready to make lifestyle and behavioural changes in their lives (209,210,234,245). This referred to the readiness of the participant to make specific changes and linked to the themes of *reshaping* their attitudes to barriers, *motivation,* and *self-efficacy.* Programmes identified readiness to change by assessing whether participants had a clear and specific plan for the changes they were aiming to make. Readiness to change could be from the onset of the programme or developed through programme content (e.g. raising awareness of health risks):

> *"Many women had been unaware they had a health problem until they enrolled in the programme and realized they had high cholesterol and/or were overweight by 'x' amount of pounds at the time of the programme's first health assessment. Such discoveries made the class content very 'real' and motivated them to implement lifestyle changes. These health assessments enabled them to track their progress and identify the other lifestyle changes that were needed. To emphasize this, one woman proudly took her health record out of her wallet and showed the interviewer how her cholesterol had fallen significantly between the first two assessments. In her case, realizing that her cholesterol was above normal levels but decreased as a result of her efforts not only motivated her to initiate changes, but also to continue eating less fat and doing more walking."* (234)

3. ***Internal locus of control.*** Participants having an internal LoC (i.e. believing their weight loss was within their control rather than external factors) was linked to success (202,233,238,244). Participants who acknowledged their results could be guided by the programme but were also linked to their independent actions were amongst the most "successful". Attitudes reported to be linked to

weight loss success were not going to let themselves fail; it was down to their discipline, or it was their responsibility to improve their health:

> *"Once you are into it it's your own discipline, it doesn't matter what they say to you because in the end it's up to you, they can encourage you and everything else but they can't make you do anything … it's up to yourself, totally up to yourself"* (244)

*4. **Reshaping*** of thoughts and attitudes towards diet, PA and health acted as facilitators (205,208–210,221,233,239,243,244). Seeing a reduction in perceived barriers throughout the programme, reducing negativity towards PA, changing views on healthful behaviours (e.g. food is fuel for the body rather than an emotional crutch), changing attitude from "I must do" to "I must try", challenging stereotypes and norms around diet and PA, and seeing mistakes as a blip in their weight loss journey rather than the end.

> *"They talk to you about portion control, which is something I never had before. When we did the session on portion control and we actually did a takeaway and converted it and you saw what you could really have, and you know in your head what you used to have…it really made me think differently"* (210)

*5. **Accountability*** to the programme, others (e.g. to maintain health for children), and themselves (202–204,206,207,224,225,233–235,237,238,242–246)**.** Participants who thought they were accountable for their actions and felt monitored felt there was less time for slip-ups. This could often result in feelings of guilt if participants did not adhere to or follow the programme which was associated with higher success. Some participants fostered their accountability by making their goals publicly visible either via online groups, family, or the programme.

"Participants in both groups described how having measurement visits scheduled every 6 months at which they knew they would meet staff in person, take surveys about their diet and exercise, and weigh in was helpful in keeping them on track. Some described how using the surveys as a self-monitoring tool motivated them to want to change their habits. Others noted that knowing that they had a visit coming up made them feel accountable to lose weight: A little bit ashamed if you haven't completed as much or achieved as much as you were hoping for with weight loss" (242)

6. *Self-efficacy.* Having higher levels of self-belief and confidence in one's abilities was associated with success (201,203,211,221,222,233,239,244,248). Some participants nurtured this by recalling previous instances where they successfully changed a health behaviour (e.g. smoking cessation) (244). The importance of self-efficacy was shown in Walker et al's study comparing ethnic-specific weight management programmes which found higher self-efficacy was correlated with a higher percentage of weight loss in African American women (248). Similarly, Little et al. (2016) reported:

"Participants in the intervention groups also felt more enabled to manage their weight problem than did those in the control group" (222)

7. *Knowledge acquisition.* Those who gained, accepted, and utilised new knowledge around healthful behaviours were more "successful" (210–212,214,222,225,234,238,239,244,246–248) l. In terms of knowledge acquisition, increased content awareness (e.g. calorie content, macronutrient content) and portion awareness seemed to facilitate participants being focused on health as seen in the quote below.

"It's a way to get useful information on cholesterol, lowering your cholesterol, lowering your fat, [it has] information on different topics." (238)

8. ***Lifestyle change***. Participants who held the view that the programmes were for a long-term lifestyle change rather than just weight loss were more "successful" (207,236,242,244,247).

2.6.1.3 Emotional factors

Emotional themes concerned feelings and reactions which acted to hinder or support weight loss and participation in the programme. Two barriers and two facilitators were identified.

<u>**Barriers**</u>

Both barriers identified had a high trustworthiness ranking. These were *emotional regulation* and *negative emotions*.

*1. **Emotional regulation*** was used to capture evidence related to how participants handled emotions and this blocking success (201,208,211,234,239,241,242,244,248). Participants reacting badly to setbacks was a barrier. Setbacks included not following the programme guidance (e.g. eating something, not in the diet plan) or gaining weight. Emotional eating was commonly cited as the negative reactive behaviour to negative experiences and emotions. This was where participants sought food as a source of comfort or relaxation. Another aspect was emotions blocking action, where participants did not follow healthful behaviours due to negative moods.

> *"'if you're down or, you know, you're having a tough go it's hard to focus on yourself and make as healthy choices and be healthier' (P10, large success)"* (208)

*2. **Negative emotions*** reported as acting as a barrier to success in the studies were: stress, lack of enjoyment (i.e. in PA, programme tasks), shame (i.e. of weight status), stress/anxiety, depression, and grief (201,208,209,211,215,222,234,235,239,241,242,244,248). This could also relate to negative emotions around attaining their goals in the programme. For example, fear of failure in the programme or in attaining their weight goal was

reported as a barrier. Piana et al. reported fear of failure, inconsistency in behaviours and low motivation as barriers to change in their study (211).

Facilitators

Both facilitators were rated as having high trustworthiness. These were *positive emotions* and *emotional regulation*.

1. **Positive emotions.** Having positive feelings about the programme, guidance, new behaviours or diet, or their progress was associated with success (205,208,210,211,235,239,248). Particularly in the case of PA, if a participant's views shifted from negative to positive or they appreciated the rewards after exercise:

> *"The last subtheme within the attitude change was appreciate exercise, which included liking exercise and realizing positives of exercising (e.g. "the program made me realize how good I feel when I do work out")"* (239)

2. **Emotional regulation** as a facilitator related to participants having positive reactions to setbacks, stressors, and maintaining good mental health (208,233,234,248). This included not letting it ruin their morale and seeing it as a single moment rather than allowing it to set the precedent for their next behaviours.

2.6.1.4 Health-related factors

Health-related factors were themes where physical health status or ability acted as a barrier or facilitator to weight loss and/or participation in the programme. Three barriers and three facilitators were identified.

Barriers

Three health themes acted as a barrier to success. Two had a high trustworthiness rating: *health restricting ability to participate* and *lack of*

visible results. One had a medium trustworthiness rating: *negative impact on health.*

1. *Health restricting ability to participate* was where aspects of the programme were inaccessible to participants due to health conditions, illness, injury, or physical ability (209,217,223–225,228,235,237,239,243,244). This also included when participants dropped out of the programme due to health issues developing/worsening during participation.

> *"'Len', aged 64, described how a stroke, back problems and a history of work-related injuries had left him tremendously frustrated at his inability to be as active as he once was; he felt that these physical problems had been an important barrier to success."* (244)

2. *Lack of visible results* in health or weight improvements (201,239,244,248).

> *"…a wee bit soul destroying after about 3 weeks and you've only lost a pound or something"* (244).

3. *Negative impact on health* due to programme guidance or weight loss behaviours making participants feel unwell, in pain or affecting their physical ability (238).

Facilitators

All three health themes facilitating success were rated as high trustworthiness. The themes were *other benefits, visible results,* and *prioritising health.*

1. *Other benefits* describe improvements in health that participants did not expect (208,211,234,237,239,241). This included seeing and feeling improvement in stamina, sleep, pain, depression, general mood, self-esteem, confidence, and medication dependency. Reducing the risk of developing future ailments was also considered a benefit by participants.

2. *Visible results* in weight and physical appearance and functioning (210,220,237,239,241,243,244,247).

> *"I'm using weights. Now my body feels strong. When I went to*
> *Walmart I couldn't lift the 50-pound bags, and now I can lift them up;*
> *I don't have to ask for help"* (243)

*3. **Prioritising health*** describes health being a priority or a participant's main motivation for their weight loss journey (209,211,212,223,234‑236,240,244). Participants who were newly diagnosed with a health condition (e.g. type 2 diabetes) or felt their diet was harmful to health and wanted to improve their health were more "successful".

2.6.2 Interpersonal factors

Interpersonal themes related to social interactions acted as a barrier or facilitator to weight loss. These relate to interactions which occurred both within and externally to the programme. There were three barriers and four facilitators identified in the review.

<u>**Barriers**</u>

Of the three identified barriers, one ranked as high and two ranked as medium trustworthiness. The high trustworthiness theme was a *lack of support*. The medium themes were *impracticality* and *stigma*.

*1. **Lack of support***. Support could be lacking or absent from the household, friends, family, or the programme itself (201,202,204,207,209,239,242,243,248). Lack of support was the second-highest trustworthiness theme overall in the interpersonal category. In most studies the type of support (e.g. emotional, instrumental) which was absent was unspecified. Although the types of support were unspecified this does indicate that a general feeling of being unsupported in the weight loss journey can affect outcomes. Where studies did specify the types of support this was usually instrumental and emotional support. Within the household, not having support from the household in the meal preparation and dietary changes acted as a barrier to change. Low emotional support was defined as a lack of compassion, encouragement, care, or concern for their weight loss.

> *"I guess no one reached out to me, I didn't reach out to them… It should happen though… I mean, we have the space, we have the group, we have the page, everybody is there"* (242)

2. *Impracticality* referred to the programme guidance/behaviours being difficult to incorporate into social situations outside of the programme setting (201,243). This specifically related to the practicality of meal preparation and having to cook different meals for different members of the family:

> *"But my challenge was that they learned so that I didn't have to be struggling; having to cook one food for me and another thing for them"* (243)

3. *Stigma* included the participant experiencing or perceiving social stigma about their weight status (211). This was stigma towards the participant's weight and negative social interactions (i.e. negative comments about their weight to the participants) from friends and family.

Facilitators

Of the four facilitators, three ranked as high and one as medium trustworthiness. The high trustworthiness themes were *influence, social support,* and *comparison*. The medium theme was *becoming a role model*.

1. *Influence*. Other people's behaviour and engagement acted to influence participants and support their interactions with the programme (220,242). Participants reported being influenced by peers' dietary and PA behaviours and their successes.

2. *Social support* referred to the presence of support from others who assisted in weight loss (204-211,214-220,225,232,234-236,241-243,245-248). Three types of support were identified: *instrumental, emotional,* and *informational*. Instrumental was a type of support that others physically provide to assist weight loss. This included the presence of behavioural prompts provided by the programme, a personal trainer showing capabilities and offering tutoring to reach potential, working out with friends, family members taking part in the

programme, and households accepting and adopting new recipes and exercise regimes. Emotional support is defined as support in the form of encouragement, empathy, and being a confidant. Having support from friends, family and the programme with the emotional issues encountered during weight loss whether weight loss specific or external worries and problems was important. Within the programme, this took the form of staff being supportive and congratulating members no matter what their weight loss and having an open discussion of obstacles and successes experienced with other members. As can be noted in the quotes in Ingels et al's study below, emotional support appeared to be important across weight loss outcomes:

> *"'my husband and I try to stay accountable for each other. So if I get in one of those moods it's like "why are you really feeling like this?" And you know, then we start talking about it' (P18, moderate success), or 'if I felt like I was becoming discouraged then I would talk to (someone)' (P19, regain), while another participant explained how their trainer would 'still talk to me and work with me when I was emotionally distraught over this plateau' (P2, large success)."* (208)

Informational support was support in the form of advice, guidance, or useful information for a participant. Within the programme, this included going over food logs and offering advice on how to improve diet, sharing knowledge, demonstrating how to use study tools, and having the opportunity to ask questions. While leaders of programmes followed the content of the programme if they were able to be reactive to participants' experiences and use this as an example of imparting knowledge in a way related to the example this facilitated understanding. For example, discussing current health behaviours and explaining why the calorie content was unhealthy or misleading. This also expanded to learning from peers within and outside of the programme and improving understanding of these topics through discussion.

> *"what I liked is that you learn lots of things from other people, and they help you and understand"* (243)

3. *Comparison.* Comparing oneself to others in their community or within the programme fostered motivation and participation (202,212). Seeing poor health outcomes associated with weight in family, friends, and the community facilitated change as participants did not want to share those outcomes. Within the programme, feeling like the group and having shared problems and experiences, or meeting previously "successful" participants acted as a facilitator.

4. *Becoming a role model* relates to the participant seeing themselves as responsible for showing others how to lead a healthier lifestyle (206,211,212,243). This is often related to setting a good example for children by incorporating a healthy lifestyle into family life. It also included the parent managing their weight and health so they could be involved in their children's lives.

> *"So it's knowing how to manage that transition, to manage to get her [teenage daughter] to eat healthily but not make a big deal about it and I spoke to [dietitian's name] about it and she was quite helpful really in giving me some guidance on that"*(212)

For some participants, this went beyond being a role model for the family and involved being a role model for their wider community. This fused with the idea of challenging stereotypes associated with their sexuality and making it normal or acceptable to be health or weight conscious.

> *''We are helping our community get healthier because there are a lot of us who are not.''* (206)

2.6.3 Programme factors

Programme themes included barriers and facilitators which were solely related to the programme environment. These were grouped separately from other themes to differentiate programme-specific themes from other social-ecological constructs. Themes were divided into the following categories: *programme interactions* (i.e. interactions with the coach or group members), *information and guidance* (i.e. how education is delivered), *approach* (i.e. the ethos of the

programme), *materials* (i.e. resources used)*, timing* (i.e. of the programme and sessions), and *programme setting* (i.e. where the programme took place). There were 15 barriers and 16 facilitators identified in the review.

2.6.3.1 Programme interactions

Programme interactions related to social interactions exclusive to the programme. This could either be within the group (online or in-person) or with the leader/facilitator of the group. Three barriers and two facilitators were identified.

Barriers

Of the three barriers, two ranked as high trustworthiness and one as medium. The high trustworthiness themes were *not fitting in* and *comparisons*. The medium trustworthiness themes were *dependency on others*.

1. Not fitting in. Participants reported that they did not fit in with the group either through not feeling a sense of membership (i.e. commonality with fellow participants), or camaraderie (i.e. feeling a sense of friendship or having fun/jokes with other participants) (235,241,242). This led to participants not engaging with the group:

> *"I look at 90% of stuff and don't comment on it… Unless I really, you know, am moved to comment. And sometimes I'll even write a comment on people's stuff and then delete it. Just like, "Oh my God, I don't want to be part of that conversation." (242)*

2. Comparisons. Participants who compared themselves to other participants who were having better results described this as disheartening. (220,235,242). This also included feeling judged or compared to others by fellow participants or staff (237).

> *"Some of it was we wanted to improve our self-image and we didn't like being compared to the model on the front of the magazine concept, and yet we had two [models] in the class." (235)*

3. *Dependency on others*. Participants who had a higher dependency on programme staff had lower success rates (203,204). This was in terms of requiring more support, and guidance or lacking independence from the programme itself. This is linked to motivation, accountability, and change:

> *"I knew I had to go and see somebody every fortnight I made more effort but you think to yourself oh I don't have to see her for another six weeks, and you let it go."* (203)

Facilitators

Both identified facilitators ranked as having high trustworthiness. The themes were *membership* and *pressure*.

1. *Membership*. Feeling part of the group in which, the sessions took place. This included having similar interests, a sense of camaraderie and being amongst "people like me" (202,205,206,210,234,235,238,240,241,243,247). Participants reported doing things together and making friends facilitated participation and behaviour change.

> *"…men articulated being with other men whom they saw as being sufficiently 'like them'; men with similar (enough) bodies and of a similar (enough) age, facing similar weight loss challenges, who were also football fans (and usually supporters of the same club)"* (205)

2. *Pressure*. Feeling a sense of social pressure to do well in the programme from other group members facilitated change (i.e. friendly competition) (201,233,237).

> *"it was easier to lose weight when we met every week… there was a positive pressure from the group"* (201)

2.6.3.2 Information and guidance

Guidance referred to how information and advice were delivered to participants. There were four barriers and two facilitators identified.

Barriers

Of the four barriers identified, two had high, one was medium, and one had a low trustworthiness ranking. The high trustworthiness themes were lack of *informational support and information overload*. The medium trustworthiness theme was the *repetition of past advice*. The low trustworthiness theme was a *lack of consideration for what led to weight issues*.

*1. **Lack of informational support*** referred to a lack of guidance and education within programmes (201,209,217,229,235,238,239,243,245,246). This included receiving a lack of feedback on participant progress. Studies reported a lack of guidance on how to use feedback from the programmes to inform behaviours and the steps needed to change behaviours. Additionally, studies reported a lack of guidance on how to use study tools and materials (e.g. pedometers), what constitutes an appropriate diet and advice on suitable exercise for the participant.

*2. **Information overload*** refers to participants finding the amount of information delivered by the programme overwhelming (214,236,240,241). Studies reported participants who did not attain their goals found the programmes supplied too much information in a short space of time, had too much information on materials and had too many materials. This could trigger disengagement or self-sabotaging behaviours:

> *"For me the frequency of messages. I felt more pressure to lose weight and as an emotional eater, this did not help. The messages with a question got my attention more – a lot of the others weren't fully read as I was too busy."* (241)

*3. **Repetition of past advice***. Programmes repeating past advice and not introducing novel guidance/content was a barrier to success (207).

> *"Those leaflets, I don't know, it's like we're stupid…a lot of people know everything about weight loss yet we can't maintain it."*(207)

4. Lack of consideration of what led to weight issues. One study identified this theme, participants reported feeling the programme did not consider factors that led to their weight issues and thus it failed to consider what they needed to learn and change (236).

> *"I didn't get this size overnight. We haven't talked about the motivational part, that mental part to remind us that this is a process not an easy quick fix."* (236)

Facilitators

Both facilitators ranked as high trustworthiness. These themes were *tailored* and, *novel and relevant*.

1. Tailored feedback and advice to the participant's weight loss journey facilitated change (204,209,214,215,217–219,221,225,227,233,235,236,242,244,245,248). There was evidence that setting programmes as a suitable intensity for participants facilitated change (215,226). Participants with fewer skills were suited better to a less intense programme than participants who already had baseline knowledge and skills in weight management. Receiving personal attention which could address their educational needs helped participants to focus on their own goals and progress allowing them to create plans of how to overcome barriers. Personalised feedback identified issues tailored to participants which might not have been identified in a wider group. It also allowed for additional support to be provided or sought if required. Participants described using this to inform them of their progress, make decisions on the next steps or targets in their journey, and feel their efforts were being recognised. Programmes that could offer real-time feedback (e.g. pedometers) found this fostered motivation to reach goals.

2. Novel and relevant related to the information being new, interesting, and relatable to the participant (205,211,212,219,225,228,234,235,238,240,241,244,246). This included the delivery being engaging for participants. Programmes that taught participants new information about diet, exercise and health entertainingly and interactively were reported as facilitators. Participants reported having information that

raised awareness of diet, exercise, and readiness to change, seemed relevant, and was shared through examples or stories. Furthermore, if content challenged participants' current knowledge this was found to be more engaging. Content and guidance which challenged participants' beliefs and attitudes towards diet, exercise, and health facilitated change (210,239,248). This was related to how weight links to health and diet primarily. If participants felt that they now had the "correct" information acted as a facilitator.

> *"One of the things (name provider) said to us at the beginning was," Yes, eat five a day but only two portions of fruit simply because it's full of sugar" and I'm thinking back to the big bowl of pineapple and tangerine and apple and whatever, grapes and all chucked into it and I'd sit there and actually I'd eaten 8 or 900 calories in just fruit and it was just such an eye opener"* (210)

2.6.3.3 Approach

Approach referred to ethos and delivery of the programme itself and from staff. There were two barriers and five facilitators identified.

<u>**Barriers**</u>

Both barriers identified are related to the staff leading or facilitating the programme. One ranked as high and the second as medium trustworthiness. The high-ranking theme was *negative leader attributes,* and the medium theme was *changes to staff during the programme*.

1. *Negative leader attributes relating to how they behaved and delivered the programme could act as a barrier*(203,234). Leader attributes included being perceived as unenthusiastic, lacking empathy, not taking part in activities, or as overbearing.

2. *Changes in staff during the programme*. One study reported this as a barrier as they felt the progress, they had made with the staff member was lost and they had to start over, suggesting consistency in staff could be important (207).

<u>**Facilitators**</u>

All five facilitators ranked as having high trustworthiness. The themes were challenges, *structured, positive leader attributes, credibility,* and *mindful of culture*.

1. Challenges were when programmes incorporated challenges and competitions into their structure (210,219). This was dominant in male-only programmes where PA challenges were set such as 5-a-side football games. Having these challenges set and acknowledging when participants achieved this facilitated change.

2. Structured. Programmes that offered a clear structure and routine for participants rather than minimal sessions or participant-led content had higher success (206,215,225,238). Where programmes found a balance between having a clear structure and approach while listening to the personal issues of participants. Additionally, if the programme focused holistically on the participant's lifestyle rather than just focusing on their diet this was a facilitator.

3. Positive leader attributes described positive characteristics of the staff delivering the programme (202,203,206,207,210,211,217,234,235,241,246,247). This included being supportive, approachable, non-critical, helpful, and normalising their issues.

4. Credibility referred to how credible the information and staff on the programme were to participants (203,212,219,248). Where participants found the approach and guidance credible, they were more likely to follow advice.

5. Mindful of culture. Programmes and participants reported content and delivery which was mindful of their culture supported weight loss and improved engagement (206,223,234,235,240,246). This was reported from a range of studies that incorporated cultural aspects into programmes. This included groups that had a shared culture based on gender, interests, ethnicity, job role, faith, and sexuality. Programmes were mindful of culture by delivering materials using their language and terminology (e.g. use of Spanish words, use of slang), using

meaningful materials from their culture to teach about diet and exercise (e.g. using bible verses and stories for each lesson) and considering common food items used in their cultures for creating dietary advice. Participants also reported that being in these groups facilitated a sense of being part of a wider community, feeling comfortable in the group, and feeling accepted, which facilitated attendance.

> *"I have gained a greater sense of myself, and being with other lesbians-that certainly is more affirming of who I am. And too, there is a greater acceptance, so there is a lot less punishment in coming to this group with all of us because we just have this greater sense of acceptance of who we are as women already."*(206)

> *"Since the program was based on the Word, it helped—it was more powerful. The people of God see the necessity of doing better to work for the Lord...faith that God would help them and that the body is as important as the soul to God. Desire to improve health, feeling better, and the program's faith orientation were reasons that WORD Leaders believed their group members made positive changes in health."* (240)

2.6.3.4 Materials

The materials category incorporated themes that covered how the programme equipment supported weight loss. Two barriers and three facilitators were identified.

Barriers

Both barriers had a high trustworthiness rating. The themes were finding the materials and tools a chore, and lack of material support.

1. Finding the materials and tools a chore. Finding the materials to be a chore or burdensome related to the nature and time needed for activities that the programme asked of participants (207,209,213,217,218,234–236,238). Often this

was related to goal-setting or self-monitoring. Wearable materials (e.g. a pedometer) participants found a chore due to forgetting to put them on.

> *"Cooking meals and trying to input exactly what I cooked or what I prepared was a downer… If I could not find what I cooked and how to input, it told me to enter the nutritional information that's on the package, but that would've been a whole lot of inputting or figuring out time, so I didn't do that."* (238)

Tools being difficult to use or inaccurate acted as a barrier (239,241,242). This could be the material guidance being unclear or the software producing inaccurate step or calorie counting. Difficulty in use included unfamiliarity with online tools, outdated technology, or wearables falling off.

2. Lack of material support was not having effective materials to complete the tasks required of the programme such as an online or mobile application for monitoring (247).

Facilitators

All facilitators were ranked as having high trustworthiness. These were *tools, prompts* and *easy to follow*.

1. Tools that were given to participants to facilitate the weight loss journey (207,216,217,227,232,244,246,248). Programmes giving participants food and exercise logs or wearables to track PA found engagement with these tools significantly correlated with reductions in weight and waist circumference. If online or paper materials were visually appealing this also facilitated use.

2. Prompts. Using prompts to initiate desired behaviours facilitated change (207,209,219,225,238,241,246). This could either be through the programme's guidance (e.g. wearing pedometers) or how participants used the tools they were given. For example, one participant put the food chart on their fridge so they could see the advice when they were selecting meals. Prompts were beneficial as they reminded participants to do tasks that were part of the programme and increased consistency in behaviours.

3. Easy to follow referred to the programme guidance and materials being straightforward and clear to participants (209,210,241). This included the language being easy to understand and the guidance being realistic to incorporate into the participant's life.

2.6.3.5 Timing

Timing related to the timing of the programme sessions and how the programme fitted into participants' lives. Two barriers and two facilitators were identified.

Barriers

Both barriers were high trustworthiness themes, these were *duration* and *scheduling issues.*

1. Duration related to the sessions and the length of the programme (204,207,229,235,241,243,245,246). This included the sessions and programme length and frequency not being enough, or the frequency of the programme changing. Studies reported that insufficient time inhibited the amount of material covered, and the capacity to answer participant questions and participants felt this gave them less support while in the programme.

> *"I wish it was longer, not only number of weeks but I wish it was a 2-hour program instead of an hour and a half because sometimes they had a lot more questions than we anticipated"* (235)

2. Scheduling issues were associated with difficulties in accessing sessions and/or support from the programme (201,202,204,211,216,217,232,239–241,245,248). This included being unable to schedule appointments for support within the programme (i.e. due to limited availability) or appointments being too brief to offer the support participants needed, ultimately leaving participants to form their own support. This also related to participants finding it difficult to fit the programme into their schedules or around caring commitments, and programmes lacking the flexibility to fit into different lifestyles.

<u>**Facilitators**</u>

Both facilitators were high trustworthiness themes. The themes were *fit into life* and *regularity*.

*1. **Fit into life*** referred to how well programme sessions and materials could be incorporated into a participant's life (202,204,237,238,241,242,244,245,247). If programmes had flexibility in the sessions participants could attend (e.g. multiple choices of sessions), were online or at the participant's home so the participant could engage around their schedule. If materials were easy to use and could be used at the participant's leisure (e.g. a pedometer which could be clipped on or use of applications/online websites which they could access anytime).

> *"You couldn't get face-to-face support to the same per cent that you get the text support…like, I've done Slimming World [Alfreton, UK] and that sort of weekly weigh-in is good, you know, seeing someone face to face for advice and support but in terms…that's the beauty of this, the likes of Slimming World, you don't get to make your consistent text messages and that is a big support 'cause it just a constant reminder, you know, when you're having your breakfast or when you're going to work or in the middle of the day."* (241)

This also included the time of year a study or weight management programme occurred. One study found that timing the weight management programme in the winter fitted in better with seasonal workers' routines (243).

*2. **Regularity*** referred to the frequency and effects of regular sessions (202,206,207,225,241,243,245). Studies showed a higher frequency of contact and monitoring (e.g. programme health measures or review/feedback of diaries) fostered a sense of accountability and motivation.

2.6.3.6 Programme setting

Programme setting referred to themes related to where the programme was delivered. Two barriers and two facilitators were identified.

Barriers

Both barriers identified were high trustworthiness. These were *unsuitable environment* and *travel*.

1. Unsuitable environment. The environment in which the programme took place was unsuitable for activities (235). In the study which cited this, having concrete floors was described as a barrier to exercise activities in the programme.

> *"One coach expressed concern about participants exercising on the concrete surface of the arena as this can exacerbate previous injuries, "…I didn't feel like I was giving them the exercises that they needed and again that was because we didn't take into account the environment that we'd be doing those exercises in." (235)*

2. Travel encapsulated difficulty travelling or inability to engage with the programme site due to road conditions, distance, and accessibility to transport (224,228,229,235,237,239,248).

<u>Facilitators</u>

Of the two facilitators identified, one ranked as high and one ranked as medium trustworthiness. The high trustworthiness theme was the *atmosphere*. The medium trustworthiness theme was the *suitable environment*.

1. Atmosphere of the physical environment where programme sessions were held (202,206,234). Sessions held in a location with a relaxed atmosphere and a "cosy" layout made participants feel more comfortable attending programmes.

> *"'I felt immediately comfortable, you know, right away. The meeting area had couches, chairs, and coffee tables.'' (206).*

Participants also reported if there was an informal atmosphere and general ethos of acceptance and community amongst the group it facilitated participation.

> *"Several commented specifically on the positive, encouraging, and supportive approach of the commercial program generally and of the group leader in particular" (202).*

2. Suitable environment. Programme location and supporting facilities being easily accessible and convenient to participants acted as a facilitator (207,241,247). The physical location of the programme was identified by two studies as having particular importance. Holdsworth et al. reported participants liked the healthcare environment for the programme (207). While participants from Gray's study, who were undertaking a weight management programme through their love of football, reported the sessions taking place within their football club facilitated change due to associations with their favourite team (213).

2.6.4 Environmental factors

Environmental themes related to factors in the participant's environment both internal and external to the programme acted as a barrier or facilitator to

weight loss. Five barriers and three facilitators were identified. Themes were categorised as local environment, and financial.

2.6.4.1 Local environment

Local environment referred to themes that impacted weight loss where the participant spent time or lived externally to the programme. Four barriers and two facilitators were identified.

<u>**Barriers**</u>

Two barriers had a high and two were medium trustworthiness. The high trustworthiness was *deprivation* and *weather*. The medium was a *lack of suitable facilities* and *disengaging from environment*.

1. Deprivation and low levels of employment in areas were associated with a higher likelihood of disengaging from the programme (217,228,243).

2. Weather included bad conditions which discouraged attendance or travel to the programme (213,235,243).

3. Lack of suitable facilities related to the local environment not having appropriate facilities for PA (239,244).

4. Disengaging from environment involved not going to certain places (e.g. a beach or a pool) due to their weight, and rather than finding ways to still engage with their environment, finding their weight as a barrier to engaging with their surroundings. (209)

<u>**Facilitators**</u>

Of the 2 facilitators identified, one was ranked as high and one was ranked as low in trustworthiness. The high trustworthiness theme was the *nature of employment,* and the low trustworthiness theme was *adapting to environment*.

1. Nature of employment related to an individual's employment role or contracted hours facilitating success. This was identified in two studies. One

study found participants who were in a non-academic role were more "successful" and compliant than academic staff (224). The second study found for seasonal workers if they took part in the programme during times of unemployment/out of season were more likely to be compliant with the programme (243).

2. **Adapting to environment.** This theme was constructed from one study with truck drivers who found making adaptations to how participants used their environment facilitated success (e.g. learning to do exercises in a small space and using a portable stove).

2.6.4.2 Financial

Financial themes related to economic factors impacting weight loss. One barrier and one facilitator were identified.

<u>Barrier</u>

The single barrier had a low trustworthiness ranking and was *income limitations*.

1. Income limitations. The costs of the programme (i.e. including travelling to and following dietary changes) or insurance not covering the full programme acted as barriers (236,239).

<u>Facilitator</u>

Mirroring the financial barrier was *affordability* which had a medium trustworthiness rating.

1. Affordability of the dietary changes being suggested by the programme and adopted by participants was noted as a facilitator in one study (244).

2.6.5 Cultural factors

Cultural themes are related to thoughts and social behaviours indicative of the participant's background or community which goes beyond their social network. This could be linked to race, ethnicity, religion, sex, sexuality, or any other

community a participant could feel a part of. Two barriers were identified in the review.

Barriers

Both barriers had a ranking of high trustworthiness. The barriers were *norms* and *events.*

1. Norms related to how participants felt they were expected to behave in their community. These included in-person and virtual norms. In the included studies this seemed to affect men more – men felt an online format and discussions on diet, weight loss and exercise were for women (205,238). Further, with virtual programmes, the anxiety around the norms of how to socialise on such platforms (e.g. language to use, general etiquette, and knowing when to post) prevented participants from engaging in these programmes.

2. Events that participants attended rather than attending the programme. Blunt et al. (2017) specified this as a sporting event (e.g. Superbowl) (235).

2.6.6 Political barriers

In this review, one political theme was identified which related to legislation. This was *fear of deportation* and ranked as a medium trustworthiness theme. This was within a rural Latina population in the USA and was reported as a barrier to the recruitment and retention of participants for the study (243).

2.7 Conclusions

This review collates the evidence of barriers and facilitators of weight loss during participation in behavioural weight management programmes within high-income Western countries. The themes identified in the review were mapped against the SEM to understand the participants' experience within and external to the programme. In doing so, it unveiled intrapersonal, interpersonal, programme, environment, cultural, and political barriers, and facilitators that future programmes should consider. This review was novel as it combined both qualitative and quantitative data, allowing for richer insights into potential barriers and facilitators of weight loss success.

A range of factors impacted success across domains of the SEM. On an intrapersonal level, these included the presence/absence of participant motivation, LoC, readiness to change and knowledge. Interpersonal factors included the presence/absence of support, comparisons with others and influence. Programme factors included the presence/absence of suitable materials (physical and educational), the ability to fit sessions into an individual's life, having a holistic approach, providing tailored feedback and the positive or negative approach of the leader. Additionally, when programmes incorporate aspects of a participant's culture (e.g. including interests like football or traditional foods) being mindful of culture was found to be a key facilitator. Environmental themes included the ability or inability to use their environment to facilitate change and income inequalities. Cultural factors included norms around behaviours and events inhibiting attendance and engagement. Finally, the solitary political theme was fear of deportation which reflects that programmes should be aware of wider societal influences that may impact participation and attendance.

3 Phase 2: Methods

3.1 Chapter outline

This chapter provides an outline and detailed discussion of the methods used in the second phase of this thesis to collect information on barriers and facilitators to weight loss from participants in an online behavioural weight management programme. In phase 1, the systematic review identified a wide array of influencing factors but much of this was collected post-intervention and focused on programme-specific and intrapersonal factors. Considering this, a mixed-methods approach was used to investigate how identified barriers and facilitators differ between those who are "successful" or "unsuccessful" (i.e. >5% weight loss or <5% weight loss) *during* participation in a behavioural weight management programme. In this chapter, I begin with a discussion of the rationale for the methodological approaches, followed by an explanation of the study procedures. In each section, the method is introduced (with a brief outline of literature to justify the methods), and the details of the unique research materials and procedures are provided, along with plans for data processing and analysis. Finally, the chapter concludes with ethical considerations for this research.

3.2 Methodological approach

The second phase of this thesis used a mixed methods pragmatic and phenomenological approach to explore what/how constructs of the SEM affected success (249,250). A phenomenological approach emphasises the subjective experiences of the individual and how they interpret the world and their context (249). A pragmatic approach acknowledges an individual's perceptions, beliefs, and attitudes are shaped by their unique reality and can differ between people (250,251). This accepts that perceived obstacles may differ in degree and scale between participants based on their situation, beliefs, and environment. These approaches seemed appropriate to gain insight into the lived experiences and perceptions of barriers and facilitators of weight loss *during* participation in an online behavioural weight management programme and how this could differ amongst participants.

Mixed methods research uses different methods of data collection and analysis (i.e. qualitative, and quantitative) and combines these results at an appropriate stage to address the research questions. This enables research to capture a holistic view of the mechanisms involved (252,253). In this phase, a combination of quantitative surveys, qualitative interviews, and personal network data was collected to enhance understanding of barriers and facilitators during participation.

Qualitative and quantitative methods have their different strengths and weaknesses, using them together allows for a fuller exploration of the research questions (see section 1.9.4) (249,254). Quantitative methods aim to address research questions using numerical data to interpret participants' beliefs and understanding of the world. In the context of this research, this involved questions and validated scales which have been informed by the research literature (255). The strengths of quantitative methods include findings are generalisable, have high reliability, and are replicable (256,257). Weaknesses of quantitative methods include limited depth and insight into the context of the topic/research, and they do not address the "how" and "why" questions.

Contrary to this, qualitative methods aim to address research questions by collecting subjective insights, descriptions, and details into how and why factors have an impact. Participants in qualitative research can share more in-depth discussions of their experiences, thoughts, and behaviours (249). Strengths of qualitative methods include that they provide rich insights; complement quantitative data; have a degree of flexibility where participants can add or raise points they think have been missed and provide insights into complex issues (257). Weaknesses include that the results are usually not generalisable due to smaller sample sizes, and they do not produce objective results.

Although these methods have their distinct strengths and weaknesses, combining them allowed for a fuller exploration of what factors impacted success and how/why (258). The quantitative data highlighted the key active ingredients to facilitate or hinder "successful" weight loss which could have been challenging to identify in the qualitative data. While the complementary qualitative data enabled exploration into why these factors are important for success and how

they unfold differently between participants. The qualitative insights also enabled novel factors not included in the surveys to be identified.

3.2.1 Application of a mixed methods approach

A convergent-parallel design for mixing methods was applied to merge the results (258,259). This approach to mixing methods involved collecting complementary quantitative and qualitative data concurrently to address the same research questions (259). In this phase, data were collected at three stages (beginning, middle, and end of the programme). Data were analysed independently and then the results were combined afterwards for interpretation. This enabled significant factors associated with success to be identified in the quantitative data and for an understanding of how these factors interact in real-life to be sought from the qualitative data. The interviews also enabled novel factors (i.e. those not in the survey) to be identified.

Following data analysis, I created a conceptual map of all the factors impacting success which were identified from the studies (i.e. systematic review, surveys, interview, and personal network data) to build a comprehensive overview of what factors influence whether a participant will be successful or not across the SEM (see section 7.3, figure 7-5). The systematic review data was included as it provided insights into factors impacting success across different programme formats (e.g. in-person), outside of COVID-19 restrictions, and with different participant groups (e.g. socio-economic backgrounds, race, gender), which may not have been found in phase 2. After all the factors were built into the conceptual map, I identified which factors were associated with success in all the studies (see section 7.3, figure 7-6). This facilitated a more detailed understanding of the key contributors to success in these programmes with participants' qualitative experiences providing insights and depth into how they interacted with their weight management.

3.3 Patient and Public Involvement

Patient and public involvement (PPI) involves actively working with patients or members of the public to carry out different aspects of the research process (260). This can include planning and designing the research study, managing the

data, and collecting/carrying out research tasks. Such involvement has been shown to effectively enhance the quality and appropriateness of research design and questions (261). This study, therefore, sought advice and guidance from people living with obesity ahead of ethics submission and design of the interview and survey questions. People living with obesity were put in contact with the researcher through the Association for the Study of Obesity (ASO) Scotland network. This involved email exchanges and telephone conversations where the researcher discussed ideas for the content of both the interview and the survey with three different representatives. They provided feedback on whether questions were accessible (i.e. used language participants would relate to), holistic (i.e. covered a breadth of areas that could be impacting their weight loss and programme experience), and appropriate (i.e. using person-first and non-stigmatising language). Questions which were identified or unclear were discussed and where feasible updated. They also provided interesting considerations for interview questions particularly relating to interpersonal relationships and how participant weight history could impact behaviours in the present. In response to this discussion, questions on interpersonal influence (i.e. including reaction to different people) and weight history were added to the interview schedule.

3.4 Study procedures

This phase used surveys, semi-structured qualitative interviews, and personal network data to explore barriers and facilitators faced by adults taking part in an online behavioural weight management programme.

Study data were collected at three-time points. Surveys were administered within the first two weeks (T1) of programme commencement and at programme completion (12 weeks from baseline) (T3). Interviews (T2) were completed midway through the programme (5-7 weeks). Personal network data were collected at all three-time points (T1 and T3 which were collected as part of the survey and at T2 as part of the interview).

3.4.1 Setting

Adults (BMI≥25kg/m^2, 18+ years) were recruited from the Second Nature programme across the UK. Second Nature was selected as a suitable programme to recruit from as it is an online programme that participants could continue using during the COVID-19 pandemic and it is endorsed by NHS England (https://www.nhs.uk/better-health/lose-weight/). The programme uses education, social support, and BCTs to facilitate healthy weight loss. As part of the programme, participants are allocated to a virtual group where they engage with a health coach and can communicate with other programme participants in their group.

Second Nature is a commercial programme and did not have any influence over the design or conduct of the research. Second Nature's role was to forward study information emails to people who registered to begin the programme between October 2020 and January 2021.

3.5 Recruitment

Participants were deemed eligible for the study if they were adults (18+ years) beginning or in the first two weeks of the Second Nature programme, of any gender or SES, and able to consent to take part without support from someone else. Potential participants were sent an invitation email from Second Nature which gave a brief outline of the study and instructions for taking part (see Appendix 5). Those interested in taking part contacted me via email. Following the expression of interest in the study, I phoned or emailed participants to provide further information, answer any questions, and note the participant's starting date at Second Nature. Participants providing a phone number were telephoned, otherwise, details were sent via email. Participant consent forms, information sheets, privacy notices, and consent forms were emailed to participants ahead of study participation (see appendices 6-11). Participants could opt into taking part in the surveys, the interview, or both. Depending on the participant's preferences, I organised an interview slot or sent the survey link with the study materials, or both.

Recruitment for the surveys and interviews ran from mid-October until January. Due to the delays incurred by COVID-19 this was the timeframe which permitted survey follow-up and all analysis to be completed within the timeframe of the PhD. With the delays to the project, convenience sampling was used to recruit participants to the surveys and interviews. The qualitative study had an aim of recruiting 50 participants to increase the likelihood of having a representative sample of both "successful" and "unsuccessful" participants. Recruitment for the interviews continued until early January when 50 participants were booked in and until the end of January for the surveys to collect as many participants as possible.

3.5.1 Consent

All participants were sent the information sheet, privacy notice and consent form ahead of taking part in the research and advised to contact me with any queries or concerns. Survey participants completed the consent form for both surveys at the start of the first survey. Interview participants were sent the information sheet and consent form in advance and asked to return them via email before the interview. Any incomplete forms were queried. Participants without the facility to complete the consent form electronically could either respond by agreeing to the terms via email which would be saved, or consent would be taken over the telephone. Telephone consent involved the researcher reading each line of the form and the participant stating whether they agreed to the terms. This would be recorded and stored separately from the rest of the interview. Consent forms were formatted using word and made so participants could only edit the tick boxes and add their name/date to the form. Electronic signatures were not required.

3.5.2 Participant flow

After initial contact to participate, there were three potential pathways through the study.

- Pathway 1: surveys and the interview

- Pathway 2: interview-only

- Pathway 3: survey-only

Figure 3-1 shows a summary of the recruitment and participant flow in the study.

Figure 3-1 Participant pathways in primary studies.
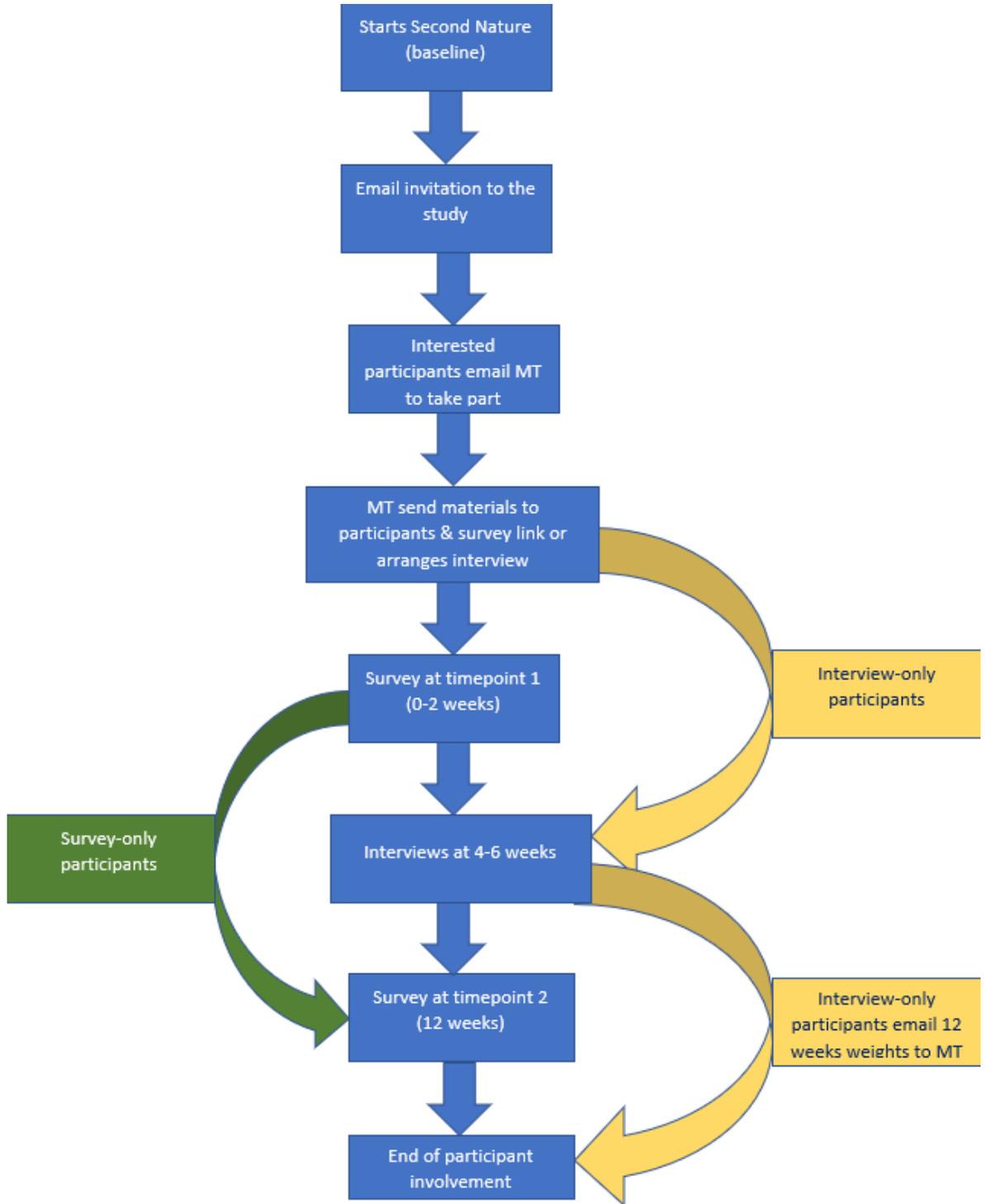
3.6 Survey methods

Surveys were selected as a quantifiable way to explore factors impacting weight loss during participation. They were administered at two-time points to identify factors associated with success or failure to achieve a 5% weight loss. Surveys were administered at baseline (within 2 weeks of beginning the programme) and at the end of the programme (12 weeks). Surveys were selected as a more objective way to measure any factors which may affect weight loss and to measure any changes participants might report which could be associated with levels of weight loss success (e.g. changes to the environment, mood, or social support).

3.6.1 Survey content

The survey consisted of sections, guided by the SEM, which aimed to shed light on factors that affect the individual's weight loss experience. An overview of the content of the survey is shown in Table 3-1.

Table 3-1 Summary of content in survey 1 and survey 2

Section	Survey 1	Survey 2
"Welcome" pages	• Introduction to the study • Study materials • Online consent	• A reminder of the purpose of the study.
Demographic information	• Participant ID number (to link surveys) • Gender • Ethnicity • Date of birth • Current employment status • Level of education • Household annual income • Postcode • Whether they live alone	• Any changes to previous information • Current weight
Weight Loss History/Details	• Second Nature start date • BMI & weight data • Past weight loss attempts	
COVID-19 impact	• Amount of change to routine • The positive or negative impact • Impact on social life	• Amount of change to routine • The positive or negative impact • Impact on social life
Interpersonal factors	• Levels of support • The people they spend time with lead a healthy lifestyle • Personal network data collection	• Levels of support • The people they spend time with lead a healthy lifestyle • Personal network data collection
Environmental factors	• Food in the house • Food preparation • Takeaways • Places for PA	• Food in the house • Food preparation • Takeaways • Places for PA
Programme factors	• Likes • Goals • Use of dashboard • Interaction with their online support group & health coach • Changes so far in food intake and PA	• Status with Second Nature • Factors affecting goal achievement • Sessions attended • Interaction with the health coach • Lifestyle changes made
Intrapersonal factors	• Motivation • Enjoyment of a healthy lifestyle • Weight locus of control scale (262) • WEL-SF for eating self-efficacy (263) • Exercise self-efficacy scale (task & scheduling subscales) (264) • GAD2 (265)	• Motivation • Enjoyment of a healthy lifestyle • Weight locus of control scale (262) • WEL-SF for eating self-efficacy (263) • Exercises self-efficacy scale (task & scheduling subscales) (264) • GAD2 (265)

		PHQ2 (266)		PHQ2 (266)
End		• Thank you for taking part • Explanation of the next steps • Whether they would like to do an interview		• Thank you for taking part • Voucher preference

3.6.2 Procedures

Following the phone call or email from me, survey participants were emailed the consent form, participant information sheet, privacy notice, and the link for the first survey. Participants completed the consent form for both surveys at the start of survey 1.

At the end of survey 1, participants who were interested to take part in an interview entered their contact details. Those who did not would receive a "thank you" email and be given the date when the second survey would be sent out. Ahead of the second survey (at 10 weeks), participants were sent a reminder email that the survey would be sent to them and once completed they would be entered into the prize draw. The second survey link was emailed to participants 12 weeks after the participant started Second Nature. It was highlighted in the email that we are interested in all experiences irrespective of the amount of weight loss or if they were still in the programme.

Once the second survey was completed, participants received a "thank you" email and were informed that they would be entered into the prize draw. Participants were sent 2 reminder emails for survey 2 – this was 3 and 7 days after the initial email was sent. Participants who completed both surveys were entered into a prize draw as an incentive. The winner received a £200 voucher of their choice (Amazon or love2shop) which was emailed to them.

3.6.3 Data analysis

3.6.3.1 Survey scoring

Before comparing the groups, scales within the survey were tallied to produce scores (see Appendix 12 for how scales were scored). For questions added to the

survey, which were not from a pre-designed scale, these were structured so participants selected positive/negative impact and then they were coded as higher numbers indicating positive variables (e.g. feeling the coach has a positive impact on weight loss or enjoying a healthy lifestyle) and lower numbers indicating negative variables (e.g. low motivation or low levels of social support).

3.6.3.2 Comparing groups

Participants were grouped as "successful" (>5% weight loss) or "unsuccessful" (<5% weight loss) based on % weight change at 12 weeks, using their self-reported weight at baseline (survey 1) and the end of the programme (survey 2). These two groups were subsequently used for all analyses of the surveys, personal networks, and interviews. All analyses were computed in R.

For an overview of the demographic characteristics of the sample, descriptive statistics were completed for the entire sample and broken down by both groups (i.e. "successful"/"unsuccessful"). This included information on gender, age, ethnicity, employment status, education level, household income, and weight (i.e. both BMI and kg at the beginning and end of the programme and change in weight in kg).

3.6.3.3 Building an explanatory model of success

To assess whether different aspects of the SEM (i.e. intrapersonal, interpersonal, programme, and COVID-19) were associated with weight loss success, this study used a sequential model-building procedure to build an explanatory model from the factors explored in the survey. This model was aimed at identifying key complementary ingredients for success. The following procedure was used (267):

1. Univariate analysis to identify important covariates.
   A series of Welch's (independent) t-tests were run for each variable assessed in the surveys to compare "successful" and "unsuccessful" participants. This was completed for both baseline and end-of-programme survey results. Significant variables ($p<0.05$) were then brought forward into step 2.

2. Fit a multiple logistic regression model for each category of the SEM. The significant factors identified in step 1 were grouped as either intrapersonal, interpersonal, programme or demographic. Once grouped, they were run as multiple logistic regressions. Models which contained a COVID-19 variable at each stage were run twice. This was with and without the COVID-19 variable in case it was confounding the importance of other variables. For each model, factors with a significance level of $p<0.25$ were brought forward into step 3, as suggested by Agresti (267).

3. Fit a multiple logistic regression model combining different categories of the social-ecological model.
   Factors from step 2 were run together in multiple logistic regressions. Models were run consecutively, with factors with higher p-values being removed. Model fit was determined using the Akaike Information Criterion (AIC) score and McFadden's R^2. The AIC score indicates which model offers a better explanation of variables impacting success. AIC scores for each model are compared against one another, with lower scores indicating a better-fitting model (268). McFadden's R2 shows the proportion of variance in the dependent variable ("successful" or "unsuccessful") explained by the predictor variables (269,270). Higher scores indicate better model fit.

3.7 Qualitative interview methods

Semi-structured interviews were used as they can be aligned with the original research aims and questions, but also offer flexibility to explore additional points. Rather than finding observable or quantifiable data, this allowed exploration of the lived experiences, meanings, and connections that participants identified and explained themselves (271). This interview style allows the researcher to create a list of questions to explore the participant's answers in line with the research questions but maintains a degree of flexibility where the researcher can alter the course of the interview and questions asked depending on the participant's responses (272). The researcher begins the interviews with a list of questions related to the research. Throughout the interview, the researcher can respond accordingly to the participant and either probe for further information on given answers or move on to new questions.

This format offers guidance and structure for the researcher but also allows for a degree of flexibility where participants can introduce new themes which can be explored in depth. Throughout this project, interviews were guided by the interview schedule, but points brought up by participants were explored further.

3.7.1 Interview content

The interview schedule questions were grouped as follows: *weight history* (i.e. exploring factors leading to weight gain and participation in the programme), *programme* (i.e. likes and dislikes of the programme), *environment* (i.e. COVID-19 impact, local and home environment), *intrapersonal* (i.e. motivation, mood), and *interpersonal* (i.e. support, influence, norms) questions (see appendix 13 for the full interview schedule). The social factors section included collecting information on the participant's personal network (see section 3.8).

3.7.2 Procedures

Following receipt of the invitation email from Second Nature, participants emailed me if they wanted to take part. I emailed the PIS, privacy notice and consent form to the participant with a proposed interview date. Participants were asked to return the completed consent form ahead of the interview. A reminder email one week before the interviews was sent to confirm the date and time was still suitable.

Interviews were conducted via telephone at a mutually suitable date/time. Interviews took place when participants were 4-7 weeks into the programme. This was to gain insight into what participants were experiencing in the middle of the programme while it was still fresh in their minds and to give a bit of leeway for availability.

Interviews were audio-recorded using a password-protected encrypted digital voice recorder (Olympus DS-9000). Participants were informed of this as part of the consent process and reminded at the beginning of the telephone call before the recorder was switched on. Telephone calls began with a brief overview of the study and a verbal agreement that the participant was happy to continue. Before the interview, participants were asked about their body weight when

they started the programme (this was either via email or if they completed the first survey) and at the time of the interview. Interview-only participants were asked for the following demographic information: gender, ethnicity, date of birth, employment status, level of education, household income and postcode. They were also asked for their Second Nature start date, starting weight, height, and weight at the time of the interview.

Participants were reminded to try not to state any identifiable information during the interview (e.g. full names, place names). When the voice recorder was switched on, the researcher stated the participant's unique ID number and refrained from using the participant's name during the recording. Once all questions were addressed, participants were asked if they wanted to add anything else and the recording was ended. Participants were then thanked for their time and the £20 voucher of their choice (Amazon or love2shop) was emailed to them. End of programme bodyweight was collected at 12 weeks either through the second survey or via email (for interview-only participants).

3.7.3 Data analysis

First, it was important to consider different qualitative approaches and their suitability to the aims of the interviews. The interviews aimed to gain insight and compare factors across domains of the SEM which influenced success in behavioural weight management programmes. This supported the research by giving insights into the quantitative results, identifying novel factors, and understanding how factors interact with real-life experiences between participants.

There are multiple approaches to analysing qualitative data including narrative analysis, interpretative phenomenological analysis (IPA), grounded theory, and thematic analysis. Each approach has different prerequisites and outlooks.

Narrative analysis collects people's stories and analyses what they mean (273). This includes aiming to understand the way stories are reported and how that shows their views of the world. While this approach can provide insights into mindsets, perspectives, and attitudes its focus is on how people tell stories rather than capturing the ideas and factors influencing outcomes.

IPA acknowledges that people perceive the world in a variety of ways depending on their previous experiences (274). It aims to capture a detailed account of the lived experience of participants through a smaller number of in-depth interviews. This was not considered an appropriate approach for this thesis, since the aims were to identify, explore, and compare factors impacting success from both "successful" and "unsuccessful" participants, which involved recruiting a lot of participants for interviews to enable experiences to be compared between groups.

Grounded theory aims to use data to build a theory to explain the processes of a given phenomenon (274). Grounded theory requires codes to be developed from the data and not influenced by pre-existing conceptualisations (275). This was also not in line with the aims of the qualitative interviews which needed to be informed by the literature on SEM and weight management to capture themes from each domain. It also was not the remit to build a model from the data, rather the data was to compare and understand how different factors impacted success between participants.

Following consideration of other approaches, a thematic framework approach was adopted to analyse the interview data. Thematic analysis allows for patterns in the data to be identified through inductive and deductive coding and for them to be grouped according to similarities (i.e. themes) rather than being shaped by a particular theory or epistemology (276,277). To structure and analyse my data I specifically used a thematic framework approach. This involves creating a framework for coding the data and generating a matrix to compare the generated themes between different groups (278). This allows for responses to interview questions to be grouped by different attributes (e.g. "successful"/"unsuccessful") to identify commonalities and differences between participants (278). The thematic framework approach has seven key stages (276,278): transcription of the data, familiarisation with the interviews, preliminary coding of initial transcripts, development of a coding framework, application of the coding framework, charting the data into a framework matrix and interpreting the data.

Interview analysis was completed alongside data collection. Throughout data collection, I kept a reflexive journal to note key points from interviews and

reflect on my interview schedule. After the first few interviews, I began developing a coding framework. I familiarised myself with the data by reviewing transcripts and notes and listening to the audio files. Following this, I met with 2 supervisors to discuss the emerging ideas and we created a map of ideas emerging from the interviews and grouped these into SEM constructs. We also included potential aspects of the SEM which we thought could be influential but had not yet been derived from the interviews. After this discussion and mapping of ideas, I developed a preliminary framework which we tested against 5 transcripts independently. The framework was developed using a hybrid of inductive and deductive theme generation (277,278). Codes were both deductive (i.e. generated from the interview schedule and research questions) and inductive (i.e. generated from the interview data). Overarching/categorical themes were used to group data according to the social-ecological constructs (e.g. intrapersonal, interpersonal, programme, environment & COVID-19). Once these had been reviewed, we arranged a meeting to discuss the preliminary framework and any discrepancies in coding. From the discussion, the framework was then updated and finalised for analysis of the subsequent transcripts. If novel ideas were discovered from subsequent interviews the framework was updated to incorporate these.

Throughout the qualitative study, I was blinded to participant outcomes at the coding stages to limit potential preconceptions or biases I had relating to success influencing how transcripts were coded. After transcripts were coded, participants were then categorised as "successful" (>5% weight loss achieved over the 12-week programme) or ""unsuccessful"" (<5% weight loss achieved). This was calculated using their baseline weight (i.e. collected in survey 1 or the interview) and their end-of-programme weight (i.e. collected in survey 2 or via email). Weights were also collected at the interview. If participants did not complete survey 2 or respond to emails to collect their final weight, the weight collected at the interview was used. Once participants were grouped as "successful" or "unsuccessful", a framework matrix was generated in NVIVO 12 (279). This has two rows of data – one for "successful" and one for "unsuccessful" participants and the columns had each theme in the framework. This method allows you to select a cell according to theme/group and input summaries of the data and themes (280). Themes were compared between those

who were "successful" and those who were "unsuccessful" to explore any differences in barriers and facilitators related to success. The COREQ checklist was used as a guide when reporting the qualitative data results (281).

3.8 Personal network methods

Personal networks were selected as a method to explore how a participant's connections and interactions could impact their success in the programme. This involves the participant (the ego) naming people (alters) who they have interacted with over a certain period (160). Participants are guided through this process using a series of questions and prompts to help them name each alter (i.e. name generators) and answer questions on their characteristics (i.e. name interpreters). The process ends with participants stating which alters know one another well enough to speak or spend time together on their own to create a sociogram (i.e. alter-alter ties).

As explained by Due and colleagues, identifying the structure of a social network can reveal how it can influence the ego's behaviour and attitudes by influencing the flow of information and resources which shape opportunities and restraints on behaviour and experiences (282). The density and homogeneity of the network can reduce the likelihood of novel information and opportunities being introduced to the ego. For example, if everyone in the ego's network knows one another then they likely share the same resources and information, but if the ego has a solitary alter or different groups of alters who know each other then it is likely they have different information and resources from the main group (283,284). The structure of the network could, therefore, have an impact on the ego's success in the weight management programme by guiding the flow of information and supporting/introducing new healthier behaviours. The characteristics of the alters and the composition of the network provide evidence of what the social norms are in the network (i.e. norms towards healthy body weight and leading a healthy lifestyle) and analysis within this context can reveal how the characteristics of the alters may influence the ego's weight loss (285).

The influence of the network on success may also be evident through the levels of support the ego receives. Network support is usually categorised as either

informational, instrumental, or emotional, and has been found to have both positive and negative effects on an ego's outcomes (286). Levels and forms of support can be directly related to health outcomes by acting as both preventative and/or curative in the management of physical and mental health (287,288). From the alcohol misuse literature, it is evident that to achieve behavioural change there are many cases in which the ego's network must change to support this (289). This included changes to who they spent time with (i.e. severing ties or introducing new ties) and the amount of time spent with alters. Arguably, the changing or stability of networks may also play a role in behaviour change for people engaging with weight management programmes.

Personal network analysis allows for the characteristics of the network and the alters to be analysed to see how those characteristics may affect, interact, or predict behaviours, beliefs, and actions in the ego (160). The purpose of using this approach was to see if characteristics of the network were predictive of change (i.e. "successful" weight loss) in the ego or if "successful" egos had changes in their networks/in the characteristics of their alters. The aim was to understand the network structure and characteristics, influence, and social norms within the ego's network.

3.8.1 Personal network content

The personal network method was used to address some of the research questions in a different way and to provide additional useful insights. By exploring who a participant interacts with in this way, quantifiable comparisons around interpersonal relationships and success can be made. Table 3-2 shows the RQs from table 1-5 and the associated personal network questions.

Table 3-2 Personal network RQs

Research Question	Personal Network Sub-Question	Timepoint
SQ2.2 – Do levels of social support differ between those who are successful and "unsuccessful"?	1. Does having someone to confide in about your weight aid success? 2. Are egos who have support within their household more "successful"? 3. Does an increased frequency of contact with supportive alters impact success?	Survey & Interview
SQ2.6 – Does a participant's network structure relate to success? **SQ2.5 – Do characteristics of a participant's network impact success? (i.e. their bodyweight, whether they are also trying to lose weight)**	4. What network structures and characteristics are associated with success in the programme? 5. Do egos with more alters have greater weight loss success? 6. Are egos with alters with healthy body weight or who are trying to lose weight more likely to be "successful" in their weight loss? 7. Are egos with alters with a healthy body weight who they admire more likely to succeed?	Survey & Interview
SQ2.7 – Do "successful" participants change who they spend time with or avoid those who are a negative influence?	8. Are egos who have fewer alters that they are trying to avoid more likely to succeed in their weight loss attempt? a. What are the characteristics of alters that egos try to avoid? 9. What are the main reasons ego reports for avoiding or changing contact with an alter?	Interviews

The personal network data collection involved participants nominating people they had spent time with in the last 2 weeks, answering questions on their characteristics, and stating whether nominees knew one another. Table 3-3 shows the alter characteristics collected at each time point. Due to limitations with the survey software, it was not feasible to have all the questions at each timepoint (see section 7.5.3 below).

Table 3-3 Alter characteristics collected at each time point

Alter Characteristic	Timepoint
Demographic information (i.e. age, gender)	Surveys & interviews
Relationship to the participant (i.e. type and duration)	Surveys & interviews
Form of contact with the participant (i.e. format, context, and frequency)	Surveys & interviews
Support (i.e. provides advice or is a confidant of the participant)	Surveys & interviews
Admire (i.e. Whether the participant admires them as a measure of influence)	Interviews
Weight status (i.e. under, over or a healthy weight)	Surveys & interviews
Weight loss (i.e. Whether they were trying to lose weight)	Interviews
Avoidance (i.e. whether it was someone the participant was trying to avoid while losing weight)	Interviews

3.8.2 Procedures

Typically, personal network collection involves respondents listing all their social connections, then answering questions on their characteristics, and then stating which connections know each other without the participant being present (159,160). This order was not possible due to the limitations of the survey software. The software would not allow for multiple question answers to be brought forward into subsequent questions (i.e. to enable participants to identify which participants knew each other). This meant the survey networks had to collect one alter at a time, then go through the attribute questions, and then state whether they knew other alters before nominating the next alter and repeating the process. This process increased the overall number of questions and the length of the survey. Since this was embedded in the wider survey it was decided to limit nominations to 12 alters. This was because the survey software was limited in how many questions could be included and to prevent the survey from being too time-consuming for participants. However, the personal networks collected during the interview had more flexibility and the questions/number of nominees were not limited. Participants were asked to use first names or nicknames and were informed these would be changed to an ID for analysis. Responses during the interview were typed directly into an excel spreadsheet.

3.8.3 Data analysis

3.8.3.1 Survey & interview personal network analysis

Descriptive statistics were run to show the ego and alter characteristics at each time point. Summaries were created showing the mean and standard deviations of the ego characteristics including employment status, education level, income, gender, age, and network size (i.e. number of alters nominated). Counts and percentages were calculated for the weight loss category (i.e. how much weight was lost) and programme status (i.e. whether they completed or dropped out of the programme). Alter-level descriptive statistics included mean and standard deviations of age, gender, weight status (i.e. whether they were overweight, underweight, or healthy weight), relationship length, relationship type, number of situations they encountered in and the number of alters they would confide

in. Survey personal networks were only described due to several issues with the quality of the networks collected.

3.8.3.2 Interview-only personal network analysis

The interview personal networks provided richer data that could be analysed in more depth. For network descriptions and analysis, the Egor package in R was used (290). Table 3-4 below provides definitions of the variables analysed. The description included the number of egos, total number of alters, network size, density, multiplexity, and entropy (160). The multiplexity variable showed whether an alter was a uniplex (i.e. someone the ego encountered in a single setting) or a multiplex tie (i.e. someone the ego encountered in more than one setting). This was considered as it was theorised that alters the ego was exposed to in more than one context may be more influential over the ego's weight loss. Given the structure of the questions, entropy measures were used to assess whether the alters had a similar weight to one another. This was due to ego providing actual weights for themselves but only giving alters a category of overweight/underweight/healthy weight. The Egor package was used to visualise the density of the network and its composition to see how connected the alters are. Within Egor, the visualisation runs as a shiny app that allows you to filter different ego and alter characteristics to view the network.

Table 3-4 Personal network variable definitions

Personal Network Variable	Definition
Network Size	The number of alters in a network
Network Density	The proportion of alters who are connected and how interconnected the network is
Uniplex Tie	An alter who was nominated in only one setting (e.g. home)
Multiplex Tie	An alter who was nominated in more than one setting (e.g. home and work)
Entropy	Shows the degree to which alters are similar to one another

Finally, Pearson correlations were performed to identify any relationships between alter or network characteristic variables and weight loss success. Qualitative explanations for avoiding alters were also extracted from the interviews to provide more insight into the reasons and types of avoidance.

3.9 Ethical considerations

The project had several ethical considerations. These are split into data collection and management, participant well-being and researcher wellbeing.

3.9.1 Confidentiality & security of data

3.9.1.1 General data management

All data collected during the study was stored on the University of Glasgow Social and Public Health Sciences Unit (UofG SPHSU) secure project drives. Personal data was stored separately from study data in different drives and folders. Personal data was only accessible by myself, with study data folders being only accessible to me and supervisors who were based at the UofG SPHSU.

Personal data included contact information, raw audio files from the interviews, and the participant key. The participant key was used to link participants to their unique ID to monitor progress during the study and to know when to contact participants. All study data were labelled with the participant's unique ID number and included survey responses, progress in the study and qualitative interview transcripts. Data management of the survey, interview and personal network data are described below. The full data management plan for this study can be found in Appendix 14.

3.9.1.2 Survey data management

Participants were given an ID number to input for each survey (this was also used for their interviews where relevant). All participants who completed survey 1 were asked for their contact details and a name for correspondence. This was so the researcher could send them the follow-up survey, reminders to take part in the second survey and arrange the interview. All contact information was stored in an excel file next to the participant's ID number. This was used as a key and stored on the servers in the SPHSU. Surveys were stored on the survey platform until the second survey data was collected. The online survey tool for research meets data protection and confidentiality standards. It is GDPR compliant and certified to ISO 27001 standards.

All data was then downloaded as excel files and stored on the UofG SPHSU secured network drives. Personal data collected at the end of the surveys was removed and then the excel files were imported into the statistical software package R for analysis.

3.9.1.3 Interview data management

For the interviews, electronic consent was stored in the secured drives within the SPHSU which are specific to personal data. These were labelled with the participant ID and stored separately from other data. In cases where audio consent was needed, this was recorded separately from the interview recording and stored with other consents. Before interviews began, participants were encouraged to try and avoid disclosing identifiable information (e.g. full names, place names). The audio recording began with the researcher stating

the participant's ID number.

Audio recordings were labelled with the participant's unique ID number. Recordings were then sent via the UofG SPHSU secured cloud server to an independent, approved transcription company. Interviews were transcribed verbatim and returned via the secured cloud server. All transcripts were then checked against the original audio recordings for accuracy and amendments were made where necessary. Any identifiable information was removed from the transcripts and replaced with a pseudonym (e.g. a partner's name would be changed to "partner").

All the interview transcripts were saved as a Microsoft Word Document and stored on the project drives, labelled by the participant ID. Each transcript was imported into NVivo for analysis (291). Demographic data collected by interview-only participants were stored on an excel spreadsheet next to the participant's unique ID number on the UofG SPHSU secured drives.

Audio recordings were retained as source data until the study was completed. Audio recordings and transcripts were stored separately on the secured study project drives at the UofG SPHSU.

3.9.1.4 Transcription company

1st Class Secretarial was used for transcription as they have a confidentiality agreement with UofG SPHSU which all employees must sign before working on any audio recordings. Audio recordings transferred to the transcription company were transferred using UofG SPHSU's cloud with encryption and password protection.

3.9.1.5 Personal network data management

The personal networks recorded during the surveys were stored on the survey software until both surveys had been completed. They were then downloaded as an excel file and stored on the secure drives at UofG SPHSU. The excel files were then imported into R for analysis. The personal networks collected during the interviews were stored on an excel spreadsheet which was also imported

into R. Data were analysed using the Egor package which shaped how the data was structured for analysis. Personal network data was separated from the survey data and structured so there were three files: one with ego data (demographic information and amount of weight loss/categorisation of weight loss success/failure), the second with each of the alters that the egos nominated with the alter characteristics and the third file with the alter-alter ties.

3.9.1.6 Protection of personal data

Every step was taken to manage participant identification risk and to adhere to Medical Research Council (MRC) guidance on confidentiality and data security. Information that could be used to identify individuals is removed from the main data files. Transcripts, personal network data and audio recordings were uploaded to UofG SPHSU project drives via remote desktop at the soonest possible opportunity and deleted from all recording equipment and laptop after they have been securely transferred. Transcripts will be analysed using NVivo on the UofG SPHSU servers via remote desktop. To minimise the risks associated with identification, only named team members will be able to access the raw data files. The procedures required, even by study team members, to access the data were thorough. This included adequate security of data transfer, storage, and working space and will cover technical aspects such as data encryption and password protection.

3.9.2 Participant ethical considerations

3.9.2.1 Informed consent

There was the potential that participants may not fully understand the project. To mitigate this, participants were invited via the weight management programme to the study. The invitation had a brief description of the study and the contact details of the researcher. Participants needed to email the researcher to take part, who responded via telephone or email with further information. All participants who provided a phone number were called before study enrolment to discuss the study and what it would involve. All participants were emailed the PIS and consent ahead of each study component. Participants were encouraged to contact the researcher if they had any questions and were given time to discuss or think further about taking part in the study with others.

The researcher gave a brief reminder at the start of the interview of the goals of the research, and this was summarised at the start of survey 2.

3.9.2.2 Psychological/emotional wellbeing

Overall, the topic of weight loss and the challenges associated with this may be difficult for participants to discuss. Participants may have faced stigma due to their weight and felt excluded from social activities or judged because of their weight. This could have made the content challenging to discuss for participants. To address this, person-first language was used, and content was discussed with patient representatives for appropriateness. Discussions with patient representatives and reviews of the literature guided the phrasing of questions to ensure they used sensitive language and content while allowing participants to speak about their experiences. To minimise any distress the surveys were set up so participants could skip any questions they did not want to answer except questions we needed – these questions were their body weight, participant ID number, contact information and questions which involved a redirection in the survey.

The participant information sheet (PIS) also advised participants to contact the researchers with any queries about the study and to contact their health coach from the programme or their health care providers for any queries or worries about the programme or their health. Interview participants were able to pause the interview or skip any questions they do not want to answer. Participants were informed that they are free to stop or withdraw from the study at any time without providing a reason and without it affecting what they receive from Second Nature.

4 Results: Online surveys

4.1 Chapter outline

The following chapter presents the results of the online surveys. Survey data were collected at two-time points: one at baseline (0-2 weeks) and one at the end of the programme (12-14 weeks). In this chapter, I present descriptive data on the sample and explore the differences between "successful" and "unsuccessful" participants.

4.2 Comparisons of "successful" & "unsuccessful" participants

A total of 129 participants completed the survey at baseline and 102 completed the survey at the end of the programme. 2 participants withdrew from the study after completing survey 1, and 10 were excluded from analysis due to having a healthy weight at baseline (as determined by BMI <25) and 15 were lost to follow up for the second survey. This resulted in a total of 119 eligible participants completing survey 1 and 102 participants completing both surveys.

Table 4-1 summarises the characteristics of the sample. "successful" participants are those who lost equal to or more than 5% of their body weight between baseline and the end of the programme. "Unsuccessful" participants include those who did not achieve a ≥5% weight loss and those who only completed the survey were lost at follow-up (i.e. only completed survey 1). It was assumed that those who were lost to follow-up had not achieved their weight loss goal.

Table 4-1 Descriptive characteristics of the survey sample.

	All (n=119)	"Successful" (≥5% weight loss) (n=53)	"Unsuccessful" (<5% weight loss) (n=66)
Gender (n (%), female)	101 (84.87)	44 (83.87)	57 (86.36)
Age (mean, SD)	49.45 (+/-11.48)	51.77 (+/-10.09)	47.55 (+/-12.26)
Ethnicity (n (%) white)	107 (89.92)	51 (96.23)	56 (84.85)
Employment Status (n, (%))			
Full-time employment (30+ hours per week)	67 (56.30)	34 (64.15)	33 (50.00)
Part-time employment (<30 hours per week)	20 (16.81)	7 (13.21)	13 (19.70)
Unemployed and not seeking work	6 (5.04)	2 (3.78)	4 (6.06)
Unemployed and seeking employment	1 (0.84)	1 (1.89)	0
Retired	14 (11.76)	7 (13.21)	7 (10.61)
Student	3 (2.52)	0	3 (4.55)
Carer	2 (1.68)	1 (1.89)	1 (1.52)
Furloughed	1 (0.84)	0	1 (1.52)
Other	3 (2.52)	0	3 (4.55)
Missing data	2 (1.55)	1 (1.89)	1 (1.52)
Household Income (n, (%))			
£0-14 999	2 (1.68)	1 (1.89)	1 (1.52)
£15 000 – 24 999	4 (3.36)	1 (1.89)	3 (4.55)
£25 000 – 34 999	13 (10.92)	4 (7.55)	9 (13.64)
£35 000 – 51 999	33 (27.73)	14 (26.42)	19 (28.79)
£52 000 – 69 999	22 (18.49)	7 (13.21)	15 (22.73)
£70 000+	44 (36.97)	25 (47.17)	19 (28.79)
Missing	1 (0.84)	1 (1.89)	0
Education (n (%))[2]			
High school	10 (8.40)	7 (13.21)	3 (4.55)
Formal training at work	18 (15.12)	5 (9.43)	13 (19.70)
Non-college/university qualification	36 (30.25)	11 (20.76)	25 (37.88)
Degree from college or university	50 (42.02)	26 (49.06)	24 (36.36)
Higher degree (Master's, PhD)	32 (26.89)	14 (26.42)	18 (27.27)
Baseline bodyweight (KG) (mean, SD)	94.11 (+/-17.64)	93.84 (+/-16.98)	94.33 (+/-18.28)
Baseline BMI (mean, SD)	33.92 (+/- 5.65)	33.61 (+/-5.22)	34.17 (+/-6.00)

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[2] Participant were able to select multiple answers for education.

End of programme bodyweight (mean, SD)	90.51 (+/-17.18)	85.79 (+/-14.90)	94.30 (+/-18.04)
End of programme BMI (mean, SD)	32.64 (+/-5.64)	30.73 (+/-4.49)	34.18 (+/- 6.02)
Change in weight (KG) (mean, SD)	3.60 (+/-5.86)	8.04 (+/-3.56)	0.03 (+/-4.81)

The survey also collected data on whether participants completed the programme and reasons for discontinuation of the programme. These are summarised in tables 4-2 and 4-3 below. Overall, more "successful" participants completed the programme than unsuccessful. Dropout reasons varied amongst participants, but "unsuccessful" participants provided more reasons for dropping out, with personal circumstances and not enjoying the programme being the most cited. Participants could select more than one reason for dropout. "Other" reasons.

Table 4-2 Programme status by group in the survey sample

	"Successful" (n=53)	"Unsuccessful" (n=49)
Completed the programme and still using it (n (%)	27 (50.94)	13 (26.53)
Completed the programme and stopped using it (n (%)	18 (33.96)	13 (26.53)
Incomplete (n (%)	8 (15.09)	21 (42.86)
Other (n (%)	0	2 (4.08)

Table 4-3 Dropout reason by group in the survey sample

	"Successful" (n=8)	"Unsuccessful" (n=21)
Did not enjoy the programme	1	8
Did not have enough time for the programme	1	4
Health issues	2	0
Personal circumstances	1	11
Lack of progress	4	6
Other	Caught COVID-19 (1) Poor tech on the programme (1)	Christmas (2) COVID-19 lockdown (1) Didn't start (1) Disliked group (1) Expensive (1) Tech issues (2) Lack of facilities at home (broken fridge) (1) Dislike programme (1) Lack of support from the programme (2) Lack of accountability from the programme (1)

4.3 Building an explanatory model of success

To build an explanatory model of success, I used a sequential model-building procedure (see section 3.6.3.3). First, I used t-tests to identify factors which

were significantly associated with success. Table 4-4 shows the results of the t-tests conducted in step 1. Factors which were significantly associated with success are highlighted in green.

Overall, the results showed that more end-of-programme, compared to baseline, variables influenced success. The baseline variables (within 2 weeks of starting the programme) related to success include: lower levels of depression, more dietary changes, higher levels of motivation, and lower takeaways consumption. The intrapersonal end-of-programme variables related to success were lower levels of depression, lower levels of anxiety, more dietary changes, more total lifestyle changes, higher motivation, internal weight LoC, and higher eating self-efficacy. The end-of-programme interpersonal variables related to success were more support from the household, more support from those closest and more support overall. Programme variables related to success were higher engagement with the programme dashboard, higher engagement with the programme recipes and perceiving the coach and group as having a positive impact on their weight loss. COVID-19 factors included perceiving COVID-19 as having a positive impact on weight loss, and perceiving changes to social interactions due to COVID-19 restrictions as having a positive impact on weight loss.

Table 4-4 Survey t-test results from stage 1 in building an explanatory model of "success".

Social-ecological construct	Variable	Timepoint	t	df	p-value	Sample Estimates		95% Confidence Interval of the Difference Between Groups	
						"Unsuccessful"	"Successful"	Lower	Upper
Intrapersonal	Depression	Baseline	2.67	115.45	<0.005	3.41	2.79	0.16	1.07
		End	3.79	87.76	<0.001	4.12	2.91	0.58	1.85
	Anxiety	Baseline	0.76	112.71	0.447	3.62	3.42	-0.33	0.74
		End	4.14	90.96	<0.001	4.59	3.30	0.67	1.91
	Enjoyment of healthy eating	Baseline	-1.38	116.86	0.17	4.09	4.28	-0.47	0.08
		End	-1.06	92.32	0.29	4.10	4.25	-0.42	0.13
	Enjoyment of PA	Baseline	0.37	107.91	0.71	3.56	3.49	-0.30	3.49
		End	-1.92	99.00	0.06	3.45	3.82	-0.77	0.01
	Dietary Change	Baseline	-2.38	116.79	<0.05	3.47	4.08	-1.11	-0.10
		End	-4.14	99.65	<0.01	2.63	3.85	-1.80	-0.63
	PA Change	Baseline	-0.67	112.13	0.51	2.06	2.22	-0.66	0.33

Category	Measure	Time							
		End	-1.90	99.43	0.06	2.06	2.66	-1.22	0.02
	Total lifestyle changes	Baseline	-1.97	116.67	0.05	5.53	6.30	-1.55	0.00
		End	-3.66	99.96	<0.001	4.70	6.51	-2.80	-0.83
	Motivation	Baseline	-2.44	117.00	<0.05	5.71	6.21	-0.90	-0.09
		End	-3.62	95.56	<0.001	3.82	5.08	-1.95	-0.57
	Weight Locus of Control	Baseline	0.86	116.86	0.39	9.41	8.79	-0.81	2.04
		End	2.11	95.53	<0.05	10.41	8.60	0.11	3.50
	Eating Self-efficacy	Baseline	-1.64	114.39	0.10	37.93	42.42	-9.89	0.94
		End	-3.49	99.14	<0.001	34.82	46.42	-18.19	-5.01
	Exercise Self-Efficacy	Baseline	-0.46	102.03	0.64	15.76	16.47	-3.77	2.35
		End	-1.67	99.94	0.10	24.69	29.20	-9.87	0.84
Interpersonal	In-person peers follow a healthy lifestyle	Baseline	-0.77	108.86	0.44	3.05	3.19	-0.52	0.23
		End	-0.84	98.85	0.40	3.29	3.45	-0.56	0.23
		Baseline	0.27	112.89	0.79	3.13	3.09	-0.19	0.26

	Online peers follow a healthy lifestyle	End	-1.93	98/66	0.06	3.16	3.40	-0.49	0.01
	Support from Household	Baseline	-1.10	110.4	0.28	3.70	3.92	-0.61	0.18
		End	-3.-8	97.53	<0.005	3.46	4.13	-1.11	-0.24
	Support from closest	Baseline	-0.79	116.92	0.43	3.76	3.91	-0.52	0.22
		End	-2.92	96.16	<0.005	3.73	4.25	-0.87	-0.17
	Overall Support	Baseline	-0.9	109.73	0.36	3.76	3.92	-0.53	0.19
		End	-2.06	99.98	<0.05	3.69	4.06	-0.71	-0.01
Programme	Dashboard use	End	-2.66	97.91	<0.01	2.46	2.96	-0.88	-0.13
	Programme recipe use	End	-2.93	99.55	<0.01	2.63	3.19	-0.93	-0.18
	Impact of daily information articles	End	-1.28	95.82	0.20	3.96	4.15	-0.49	0.11
	Interaction with the group	End	-1.86	57.21	0.07	2.14	2.89	-1.54	0.06
	Group impact	End	-2.69	90.48	<0.01	3.18	3.68	-0.86	-0.13
	Interaction with the health coach	End	-1.6-	91.98	0.12	2.08	2.32	-0.54	0.06
	Health coach impact	End	-2.19	91.32	<0.05	3.39	3.71	-0.63	-0.03

Environment	Number of people in household	Baseline	-0.89	95.85	0.37	1.86	2.07	-0.69	0.27
	Physical activity facilities in area	Baseline	-0.99	110.28	0.33	2.62	2.72	-0.29	0.10
	Number of takeaways within 15-minute drive of home	Baseline	0.11	114.36	0.91	2.39	2.37	-0.27	0.31
	Number of takeaways consumed	Baseline	2.17	107.63	<0.05	0.29	0.11	0.02	0.33
		End	-1.18	94.67	0.24	4.00	3.17	-0.56	2.22
COVID-19	Impact on typical routine	Baseline	-0.48	109.17	0.63	1.82	1.91	-0.45	0.27
		End	-1.00	99.61	0.32	1.82	2.04	-0.66	0.22
	Impact on weight loss	Baseline	-1.54	105.49	0.13	2.27	2.57	-0.67	0.08
		End	-2.45	99.95	<0.05	2.39	2.91	-0.94	-0.10
	Impact on social life	Baseline	0.33	111.31	0.74	2.92	2.87	-0.28	0.39
		End	0.91	97.58	0.37	2.94	2.75	-0.22	0.58
	Impact of changes to social life on weight loss	Baseline	-1.72	107.02	0.09	2.68	2.96	-0.60	0.04
		End	-2.6-	98.49	<0.05	2.71	3.17	-0.81	-0.11

Significant factors were then tested in multiple logistic regression models, in which variables were grouped by each social-ecological construct and timepoint (i.e. models 1-3 were intrapersonal, model 4 was interpersonal, model 5 was demographic, and model 6 was programme-related factors) (see Table 4-5). In each model, T1 refers to baseline variables and T2 refers to end-of-programme variables. Variables in each model with significance p<0.25 (highlighted in green) were then included in a subsequent series of regression models which began to integrate different levels of the SEM (see table 4-6).

Factors from Table 4-6 with a significance level of <0.1 (highlighted in green) were then run in a series of models in Table 4-7. Table 4-7 aimed to finalise the explanatory model (267). The AIC scores were used to select which model had the best fit. McFadden's R^2 was also computed to determine how much variance the models explained. Model 4 was the best-fitting model with an AIC of 110.75 and had the highest R^2 score of 0.29, indicating 29% of the variance in success is explained by these models. The combination of the AIC and R2 suggests model 4 offers the best explanation of factors contributing to success. This suggests that greater dietary changes (at T1 and T2), lower takeaway consumption (at T1), lower levels of anxiety (at T2), and more perceived support from the household (at T2) contribute to "successful" weight loss outcomes.

Table 4-5 Survey multiple logistic regression model results from stage 2 in building an explanatory model of "success" – grouping variable together by social ecological construct.

Variable						
	Dependent variable: Success (>5% weight loss)					
			Models			
	(1)	(2)	(3)	(4)	(5)	(6)
Consumed Takeaways (T1)	-0.99* (0.51)					
Motivation (T1)	0.20 (0.21)					
Dietary Changes(T1)	0.35** (0.15)					
Depression (T1)	-0.33* (0.18)					
Motivation (T2)		0.17 (0.16)				
Anxiety (T2)		-0.39** (0.177)				
Weight Locus of Control (T2)		-0.09* (0.06)				
Eating Self-Efficacy (T2)		-0.00 (0.02)				
Dietary Changes (T2)		0.42**				

	(0.17)			
Depression (T2)	-0.32* (0.16)			
Total Lifestyle Changes (T2)	0.20** (0.09)			
COVID-19 Impact on Weight Loss (T2)	-0.04 (0.27)			
Social Changes due to COVID-19 Impact on Weight Loss (T2)	0.37 (0.32)			
Support from Household (T2)		0.60* (0.33)		
Support from Closest (T2)		0.89* (0.47)		
Overall Support (T2)	-0.79 (0.54)			
Gender (T1)			0.34 (0.53)	
Age (T1)			0.03* (0.02)	
Programme dashboard use (T2)				0.40 (0.25)
Programme recipe use (T2)				0.48** (0.24)
Coach impact				-0.11 (0.39)

Group impact (T2)						0.56[*]
						(0.31)
Constant	-1.54	0.47	-0.99	-2.69[**]	-1.90[**]	-3.94[***]
	(1.59)	(1.37)	(1.27)	(1.16)	(0.89)	(1.27)
Observations	119	102	101	99	118	100
Log Likelihood	-72.71	-55.52	-59.71	-62.01	-78.95	-60.54
Akaike Inf. Crit.	157.43	123.04	129.42	132.01	163.90	131.08

Note: $^{*}p<0.1^{**}p<0.05^{***}p<0.01$

Table 4-6 Survey multiple logistic regression model results from stage 3 in building an explanatory model of "success".

	Dependent variable: Success (>5% weight loss)				
	Models				
Variable	(1)	(2)	(3)	(4)	(5)
Age	0.03 (0.02)				
Depression (T1)	-0.52** (0.21)				
Dietary Changes (T1)	0.52** (0.20)				
Consumed Takeaways (T1)	-1.15* (0.61)				
Dietary Changes (T2)	0.48*** (0.18)				
Anxiety (T2)		-0.31* (0.19)			
Weight locus of control (T2)		-0.10* (0.05)			
Depression (T2)		-0.18 (0.19)			
Total Lifestyle Changes (T2)		0.19** (0.09)			
Support from household (T2)			0.48	0.60*	

			(0.33)	(0.33)	
Support from Closest (T2)			0.86* (0.47)	0.89* (0.47)	
Overall Support (T2)			-0.78 (0.55)	-0.79 (0.54)	
Social Changes due to COVID-19 Impact on Weight Loss (T2)			0.44* (0.26)		
Programme Dashboard Use (T2)					0.38 (0.23)
Programme Recipe Use (T2)					0.47** (0.24)
Group Impact (T2)					0.52** (0.26)
Constant	-2.91* (1.57)	1.72 (1.06)	-3.44*** (1.26)	-2.69** (1.16)	-4.09*** (1.15)
Observations	101	102	98	99	100
Log Likelihood	-51.20	-57.80	-60.12	-62.01	-60.58
Akaike Inf. Crit.	114.40	125.59	130.24	132.01	129.17

Note: *p<0.1**p<0.05***p<0.01

Table 4-7 Survey multiple logistic regression model results from stage 3 – refining and finalising an explanatory model of "success".

	Dependent variable: Success (>5% weight loss)				
			Models		
Variable	(1)	(2)	(3)	(4)	(5)
Depression (T1)	-0.33 (0.23)				
Dietary Changes (T1)	0.54** (0.21)		0.44** (0.21)	0.42** (0.20)	0.42** (0.20)
Consumed Takeaways (T1)	-1.15* (0.63)		-0.96 (0.65)	-1.04* (0.63)	
Dietary Changes (T2)	0.52* (0.29)		0.36* (0.20)	0.44** (0.19)	0.40** (0.17)
Total Lifestyle Changes (T2)	-0.10 (0.17)				
Anxiety (T2)	-0.33* (0.18)		-0.36** (0.17)	-0.35** (0.17)	-0.39** (0.17)
Weight locus of control (T2)	-0.09 (0.06)				
Support from Closest (T2)		0.11			

		(0.35)			
Support from Household (T2)		0.34 (0.27)	0.45* (0.23)	0.45** (0.23)	0.49** (0.23)
Social Changes due to COVID-19 Impact on Weight Loss (T2)		0.44 (0.28)			
Programme Recipe Use (T2)		0.51** (0.26)	0.30 (0.27)		
Group Impact (T2)		0.28 (0.27)			
Constant	0.35 (1.17)	-5.38*** (1.45)	-3.63** (1.65)	-3.00* (1.54)	-3.09** (1.54)
Observations	102	98	100	100	100
Log Likelihood	-50.33	-58.00	-48.75	-49.38	-50.95
Akaike Inf. Crit.	116.67	128.01	111.50	110.75	111.91

Note: *p<0.1**p<0.05***p<0.01

4.4 Reported barriers to success

The surveys also included some open-ended questions. This was to identify barriers that the survey scales missed. In the survey at the end of the programme, participants were asked a series of questions about their status with the programme and their goals and any barriers they faced in achieving their goals.

Of the "successful" participants 22 reported they achieved their goal, 26 partially and 5 did not. Of the "unsuccessful" participants, 3 reported that they achieved their goal, 24 partially, and 22 did not. Table 4-8 below summarises reported barriers for those who did not or who partially achieved their goals in both groups.

Table 4-8 Participant reported variables inhibiting goal achievement

	"Successful" (n=31)	"Unsuccessful" (n=46)
Did not enjoy the programme	1	11
Did not have the time	6	7
Family commitments	8	9
Difficult to implement the changes	8	20
Work commitments	9	13
Other	Boredom (1) Christmas (2) Lack of results (2) Tech problems (3) Illness (3)	Accident (1) Christmas (4) Lack of facilities at home (fridge) (1) Lack of results (1) Enjoy alcohol (1) Unrealistic goal setting (1) Illness (1) Finances (1) Poor weather (1)

4.4.1 COVID-19

Participants were also specifically asked open-ended questions about the impact of COVID-19 on their weight loss. This was deemed important due to the unique circumstances surrounding the pandemic. Since there are no historical comparisons to how this would impact weight management, these were open-ended. Tables 4-9 and 4-10 provide an overview of reported barriers and facilitators incurred by COVID-19 reported by participants in survey 2 at the end of the programme. Overall "unsuccessful" participants stated more negative impacts of COVID-19 on their weight loss, with reduced access to facilities, work/money worries, and feeling down or worried being the most common barriers. "Successful" participants reported both negative and positive impacts of COVID-19. They reported similar barriers to "unsuccessful" participants. The most common facilitators were being at home, having more time for the programme and having reduced social commitments.

Table 4-9 Participant reported impacts of COVID-19 that were identified as barriers to weight loss

	"Successful" (n=23)	"Unsuccessful" (n=28)
Limited food availability	6	6
Reduced access to exercise facilities	12	18
Restrictions on how often they could go out	9	8
Additional/new family commitments within the household (e.g. teaching kids)	5	3
Additional/new family commitments outside the household (e.g. grocery shopping for parents)	3	3
Feeling down or worried	13	15
Work/money worries	4	15
Decreased time for the programme	6	7
Social Distancing	7	9
Other	2	6
Other Reasons	Health (1) Work (1)	Mobility (1) Feeling constrained/uncertain (1) Unable to access healthcare (1) Death of parent from COVID-19(1) Working from home (2)

Table 4-10 Participants reported impacts of COVID-19 that were reported as facilitators to weight loss

	"Successful" (n=19)	"Unsuccessful" (n=9)
Reduced food availability	7	2
Increased time for programme	14	7
Increased time spent at home	15	5
Increased time for exercise	7	6
Decreased work commitments	4	3
Decreased social commitments	13	6
Other	0	0

4.5 Results summary

This chapter presents the results of the two surveys and highlights that there were significant differences between "successful" and "unsuccessful" groups in intrapersonal, interpersonal and programme domains, and perceptions of COVID-19. The data was used to build an explanatory model of success which suggests baseline dietary changes and takeaway consumption, and end-of-programme dietary changes, anxiety and support from the household are key facilitators.

5 Results: Qualitative interviews

5.1 Chapter outline

The following chapter presents the results of semi-structured interviews which took place 4-7 weeks into the programme (i.e. midway through). This chapter presents the barriers and facilitators experienced by both "successful" (i.e. achieving >5% weight loss) and "unsuccessful" participants (i.e. achieving <5% weight loss) and compares differences between "successful" and "unsuccessful" participants.

5.2 Characteristics of participants

A total of 49 adults participating in an online behavioural weight loss programme were interviewed between November and December 2020. One participant was excluded from the analysis due to not fulfilling the inclusion criteria (i.e. their baseline BMI was below 25 kg/m^2). Table 5-1 shows the characteristics of the sample.

While many themes arguably overlap across levels, I have tried to structure these in a coherent way to reduce repetition. Figures 5-1 and 5-2 provide an overview of the themes in common and those which differed between "successful" and "unsuccessful" participants aligned to their social-ecological level. The following sections and subsections of this chapter will describe these in further detail.

Table 5-1 - Descriptive characteristics of the interview sample.

	All (n=48)	"Successful" (n=22)	"Unsuccessful" (n=26)
Gender (n (%), female)	40 (83.33)	18 (81.81)	22 (84.62)
Age (mean, SD)	49.09 (+/-10.16)	50.91 (+/-8.32)	47.48 (11.46)
Employment Status (n (%))			
Working full-time (30+ hours per week)	26 (54.17)	14 (63.64)	12 (46.15)
Working part-time (<30 hours per week)	11 (22.92)	5 (22.73)	6 (23.08)
Unemployed and not seeking work	3 (6.25)	0	3 (11.54)
Retired	3 (6.25)	2 (9.09)	1 (3.85)
Student	2 (4.17)	0	2 (7.69)
Carer	1 (2.08)	1 (4.55)	0
Furloughed	1 (2.08)	0	1 (3.85)
Missing data	1 (2.08)	0	1 (3.85)
Education (%)			
High school	3 (6.25)	2 (9.09)	1 (3.85)
Non-college/university qualifications	15 (31.25)	5 (22.73)	10 (38.46)
Degree from college or university	16 (33.33)	9 (40.91)	7 (26.92)
Higher degree (Master's. PhD)	13 (27.08)	6 (27.27)	7 (26.92)
Other	1 (2.08)	0	1 (3.85)
Household Income (%)			

£0-14 999	1 (2.08)	0	1 (3.85)
£15 000 – 24 999	3 (6.25)	0	3 (11.54)
£25 000 – 34 999	4 (8.33)	2 (9.09)	2 (7.69)
£35 000 – 51 999	11 (22.92)	5 (22.72)	6 (23.08)
£52 000 – 69 999	10 (20.83)	5 (22.72)	5 (19.23)
£70 000+	19 (39.58)	10 (45.45)	9 (34.62)
% weight loss from baseline to end	-4.64%	-8.11%	-1.83%
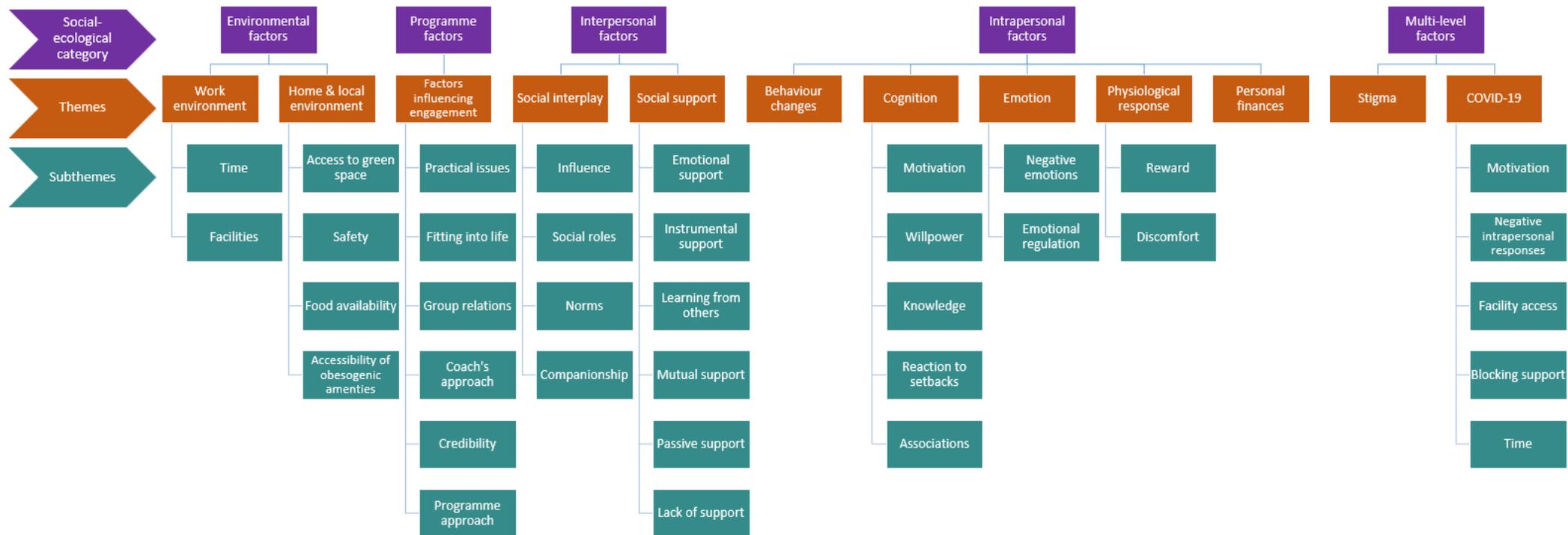
Figure 5-1 Barriers & facilitators of weight loss in both "successful" and "unsuccessful" participants
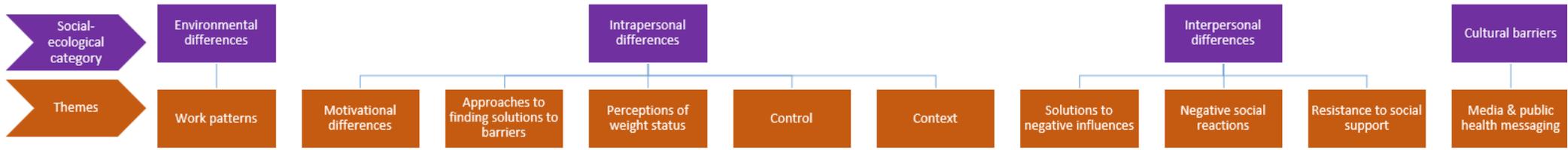
Figure 5-2 Differences in barriers and facilitators of weight loss between "successful" and "unsuccessful" participants

5.3 Commonalities in identified barriers and facilitators

The following subsections show the common themes which were identified for "successful" and "unsuccessful" participants. There were overlaps in the types of barriers and facilitators participants identified in their weight loss journeys. Themes have been mapped against constructs of the SEM. Many themes are relevant in different aspects of the SEM, but for the purposes of this research, they were categorised under the most suitable construct. Stigma and COVID-19 were labelled as multi-level themes (i.e. themes which cover more than one level of the social-ecological model and could not be allocated to a single level) since these could not be clearly aligned to a specific aspect of the SEM.

5.3.1 Intrapersonal factors

Items coded under the intrapersonal construct of the social-ecological model related to how factors within or initiated by the participant impacted success. Five key overarching themes were identified: *behaviour changes, cognition, emotion, physiological response,* and *personal finances.*

5.3.1.1 Behaviour changes

Behaviour changes referred to actions undertaken by participants to facilitate weight loss. Mainly, this included making dietary changes, planning meals, increasing PA, using prompts (e.g. labelled water bottle), and self-monitoring *(further behavioural factors are noted in sections 5.4.4.2, 5.4.5.2, 5.5.2.2, and 5.5.3.2).*

Most participants emphasised the importance of planning their diet and PA into their own and wider household schedule to facilitate weight loss. Often this included being mindful of dietary constraints and preferences of the wider household and adapting recipes or planning cooking to suit these:

"I think it's a learning process where because they're so used to having a certain taste that yeah, it will take a while to get to…there's a few recipes in the book where they've gone, yes, I like that, so I'll do that…that's the one I put an asterisk on, yes, they like that. They don't like a certain one so that one gets crossed out. And as I say, that will help if they have tasty food, my wife and daughter, then they'll eat it again. Whereas if it's a bit hmm, you know, they won't, they'll pick at it." (p44, "unsuccessful", male)

Participants also used planning to build new routines in their lives that they could embed in the longer term. This included routines around PA (e.g. set walking times throughout the workday), diet (e.g. fasting, shopping schedule) and sleep (e.g. set bedtime, getting up at alarms):

"So, I'll be in the habit of doing certain things that…doing dips when I first get up out of bed, and that sort of thing, or getting up when the alarm goes off rather than snoozing it. And I find that I don't even think about it now, I simply get on with it and get up, it's not something I have to think about at all. Drinking more water in a day. I've got into a habit where I'll drink water, and that's every time I go in the kitchen – most days, anyway. And there are a few other, I would say, habits that aren't embedded yet." (p34, "unsuccessful", male)

Participants reported such routines facilitated their weight loss by keeping them on track and improving their general wellbeing. Participants also purchased goods to be used as visual prompts for PA and increasing water intake. Participants used these as cues/reminders to engage with changes and to avoid social pressures:

"So he's at home all the time. So that's a bit harder for me 'cause he keeps getting cups of tea and things to eat that I might not necessarily want. He feels that he has to offer them to me. But I've got my water bottle now and I'm quite good at refusing" (p21, "successful", female)

As well as purchasing tools to encourage the engagement of such behaviours, self-monitoring was routine:

> *"I have two of these big bottles, it's got the times on, on the side of the bottle, you know, sort of drink this by a certain time?" (p15, "successful", female)*

Many used either the programme application or the purchased tools to monitor mood, weight, PA, and calorie intake:

> *"So, you can put your moods in and your feelings, or write down how you feel and stuff. And then if I take today, like I say, okay, I'm feeling like this on that day and then I compare it to how much active I was or how I managed to follow my diet. It gives me clues on overall like well-being or what I'm thinking and how it affects my activity levels or how it affects my mood and things like that." (p14, "successful", female)*

5.3.1.2 Cognition

Cognition defined thinking processes which acted to either support or hinder weight loss. This was broken down into the sub-themes of *motivation, willpower, knowledge, reaction to setbacks,* and *associations.*

<u>Motivation</u>

Motivation relates to the reason for beginning or continuing to engage with the programme and weight loss behaviours. Motivation was broken down into *reasons for beginning the programme, emerging motivation,* and *lack of motivation.*

Reasons for beginning the programme most commonly were either for health or specifically for weight loss. Generally, most participants cited both as their reason for beginning the programme and stated these factors continued to facilitate and motivate their weight loss throughout the programme. Some participants also reported being role models for others as their motivation (see section 5.4.3.1 above). Those focused on weight loss referred to specific

occasions (e.g. weddings) or hoping to improve their appearance, self-esteem, and confidence as their main reasons:

> *"I think, just body, being body conscious. I'm very, I'm quite self-conscious, so it's just that, and lack of, I have a real like lack of confidence, and I think recently I've, I mean, I'm now in quite a long-term relationship, and I think that you want to, I'd like to be more body assured." (p13, "unsuccessful", female)*

Health motivation included preventing future ill-health, preparing for an upcoming surgery, or improving current ailments. A lot of participants reported a "turning point" which triggered this motivation such as a bad health assessment, a health warning from a GP, seeing others becoming unwell or reaching a milestone birthday:

> *"But it's just recognising that, you know, you've got better chances in life if you're healthy, and fitter, and you can make these choices, you know. So that's fundamentally it. And there was probably a bit of a penny-drop moment, you know, just going into, you know, into my 60s, and, well if you're not going to do it now then you're never going to do it, you know" (p2, "successful", male)*

When participants began to feel or see differences in their wellbeing or physical appearance/ability this served as emerging motivation during the programme. This also included aspects of positive reinforcement (e.g. feeling good after exercise, receiving compliments on their appearance) and negative reinforcement (e.g. reduction of fatigue or stomach issues from dietary changes):

> *"I've started to think more about me and how I look. I feel less bloated which is really lovely. You know, clothes do fit easier and nicer." (p39, "successful", female)*

Lack of motivation during the programme was described as a barrier to weight loss. The most common factor which blocked motivation was participants

thinking/feeling that they were not getting any results despite following programme advice:

> *"I just want to understand why I never lost any weight although I had done everything right" (p38, "unsuccessful", female)*

Other factors which acted to block motivation were experiencing negative physiological feedback (see section 5.4.4.4*)* or experiencing negative feedback or a lack of support from their household, family, and friends (see sections 5.4.3.1 and 5.4.3.2).

Willpower

Every participant stated their weight loss success was predominantly influenced by their willpower or mindset. Most participants stated it was the main factor which determined whether they would be "successful" in their weight loss efforts/goals:

> *"It's not rocket science really, it's the willpower. And it's the, I don't think that a diet doesn't succeed, it's the willpower that is just really difficult to find" (p29, "unsuccessful", female)*

The presence or absence of willpower seemed to determine how in control participants felt about their weight loss across both groups:

> *"I can quite easily slip into a kind of instant gratification rather than delayed gratification kind of mindset. And it takes quite a bit of awareness for me to notice that I'm doing that before I catch myself going into that state. But once I'm in it, it's very easy for me to just suddenly start eating a lot, or stopping exercise, and that sort of thing." (p34, "unsuccessful", male)*

However, there were small differences in perceived ability to harness their willpower (see section 5.5.2.4*).*

Knowledge

Knowledge referred to acquiring or lacking information/understanding that could act as a barrier or facilitator to weight loss. Where participants felt they were acquiring knowledge this was seen as a facilitator. Many participants found learning things about diet, PA, stress, and sleep enabled them to adopt new behaviours by challenging their previous knowledge:

> *"I've learned that a lot of it is all about making good habits and things and not, and I didn't realise that was such a bit part of it before." (p8, "successful", female)*

Also, learning about typical weight loss trajectories and plateaus enabled them to manage any setbacks and set realistic goals:

> *"You know, you plateau out, you stay with it and it will happen again, you'll start to lose weight again, just kind of hold fast to it." (p28, "successful", female)*

When participants felt they were lacking knowledge, or understanding, or did not fully trust advice from the programme this acted as a barrier:

> *"Well, having said that, possibly just that all the information that's out there is just so damn confusing, just all the: are carbs good, are carbs bad? Is fat good, is fat bad? The whole thing. The more you look into it, the more confusing it gets." (p25, "unsuccessful", female)*

Reaction to setbacks

Reaction to setbacks was another bidirectional theme. Participants discussed reactions which involved resetting and analysing triggers for setbacks as approaches which facilitated weight loss and prevented further setbacks:

> *"I will probably still have something to eat, but I'm able to resist much more than I used to be before. So, I would say by being aware*

of my triggers and being aware of my reaction to my triggers helps
me to resist them." (p14, "successful", female)

Furthermore, participants who took the attitude that a setback was a single incident and occasional slip-ups were inevitable and okay reported this as facilitating better coping after a setback:

"Okay, so if I had a hiccup, for example, if my wife and daughter say,
okay, we fancy pizza tonight and I go, okay, I'll have a slice. Then I
reset the next day and start again, you know, go okay, I had a slice…
myself, so I'll start again." (p44, "unsuccessful", male)

Participants who reacted badly to setbacks, described this as either having an "all or nothing" approach where they would invest heavily in their weight loss but after a slip-up, they would continue to make bad decisions, feel defeated and give up or engage in emotional eating (see section 5.4.5.3 below):

"If I'm very honest my reaction would be to just, like, have
something nice to eat to just say, you know, sod it, and, yeah, that's
something that, you know, I'm really, really guilty of, just, ach, well,
it's not working so there's no point kind of thing. And then that's
that whole cycle of feeling guilty and things that I'm trying to
break." (p10, "unsuccessful", female)

Both "all or nothing" attitudes and emotional eating were described by participants as barriers.

Furthermore, participants recognised negative behavioural patterns which hindered their weight loss. Typically, these patterns were elicited through apathy, stress, low mood or to relax after the working week. For some, this could be a gradual reset into old habits and for others, it could become a slippery slope where they struggled to get back on track in their weight loss journey:

"So what happens is if I have a bad week… what will tend to happen is I will think, oh do you know what, I'm going to have a glass of wine tonight and I'll end up having a lot more wine and then I'll have loads and loads of nibbles. You know, and I get some crisps and and even to the point in my bad week, I didn't have any of that in the house. But I was so fed up I went out and got that and I got crisps, I got chocolate, I got wine. And then I had a bottle of wine, I had a massive bag of crisps, I had a big bar of Galaxy chocolate. And it was great. And then the following day, what happens is you're thinking, I really shouldn't have done that, but I've already done it, so maybe I've done that now already, so what's the sense in doing anything about it, I might as well just do the same again tonight." (p1, "unsuccessful", male)

"I think probably generally in the last few years I've probably been drinking too much. But I don't drink during the week at all. But I would probably quite happily drink a couple of bottles of wine over the weekend… So, yeah, alcohol, my relationship with alcohol is definitely one of the habits that I definitely have to address, she says, sitting drinking a glass of prosecco. But I've finished work today and it's Friday night and I have to" (p24, "successful", female)

Associations

Participants reported associations they made with food as a barrier to change. Most of these were long-term and ingrained in their understanding and use of food from childhood. This included using food as a "treat" or a reward. This association was often reinforced by others in the participant's life who would encourage the participants to "treat" themselves for doing well.

Further, associations with food made in childhood included having to clear the plate to avoid food waste, having big Sunday meals, and using sugar to recover when feeling unwell:

"I think, like, growing up my family, you know, you had to clear your plate, you know, second helpings were always offered, you know, and my mum would probably still be a bit like that, you know." (p10, "unsuccessful", female)

"I think because we're almost taught about the addictive sugar and carbs are the things that make you feel better, so there's a lot of unlearning to do there, because they don't in the long term. If were not very well when you were a child, we used to have Lucozade, the horrible, sickly sweet stuff now. But sugar is always given as a treat, so healthy food hasn't got that feel-good factor often, or not for me yet." (p25, "unsuccessful", female)

Participants found these persistent associations and habits difficult to overcome and a barrier to their weight loss. Similarly, if advice on nutrition in the programme differed from other credible sources, participants struggled to adopt these.

Participants also used food and alcohol to signal a specific time in the week of the year. Aside from the obvious celebrations, they were used to signal the end of the school term, the end of the workday, and the start of the weekend:

"we've all had fish and chips on the last day of term for the past five years and that's a nice thing to do" (p24, "successful", female)

5.3.1.3 Emotion

Emotional factors relate to how feelings and the reaction to different feelings could facilitate or block weight loss. This was broken down into two sub-themes *negative emotions,* and *emotional regulation*.

<u>Negative emotions</u>

Negative emotions or poor mental health such as boredom, apathy, stress, or low mood were described by participants as a barrier to success. Such emotions would reduce engagement with their weight loss or lead to negative responses such as emotional eating (also see sections 5.4.3.1 and 5.4.5.2).

"I think probably the sort of frustration I'm talking about probably means I have relapses to the diet and exercise I would say more often than if it wasn't happening, just because of the sort of the stress with the situation" (p19, "unsuccessful", male)

Emotional Regulation

Emotional regulation refers to how participants reacted or coped with their emotions and how this influenced their weight loss. This theme could act as a barrier or a facilitator. Some struggled to regulate their emotions to stimulate more positive feelings, and this led to hindering behaviours or a reduction in motivation:

"Well, when I feel good and dieting and moving around, I feel good emotionally. It's when something changes within my mood that I suddenly give up. And I don't know what it is but, definitely, a change of mood that, you know, stops me from carrying on." (p7, "unsuccessful", female)

However, those who were able to harness more positive feelings when faced with negativity noted that this facilitated their weight loss. Some specifically used PA to regulate stress and improve general wellbeing:

"I do think being where I am…there's times where I can walk now and sometimes, I walk just for exercise and sometimes I walk to just spend a bit of time being very present with what's going on and that's part of the mental health thing." (p1, "unsuccessful", male)

Others used reasoning strategies to cope with the current issue, and took the attitude that it did not set a precedent for the rest of their day or weight loss:

"I tend to sort of try and find a plus side. So, if I haven't lost the weight, I expect I tell myself it's because I'm putting on muscle instead and then I kind of try and find some muscles that I might have found and think, oh, yes, there they are. So that's sort of a bit uplifting because actually your weight shift is bananas, isn't it?" (p11, "unsuccessful", female)

5.3.1.4 Physiological response

This theme referred to physical responses to dietary or behavioural changes the participant was making which could act as a facilitator (e.g. reward) or barrier (e.g. discomfort).

<u>Reward</u>

Physiological rewards such as not feeling hungry generally acted as a facilitator of weight loss. In instances where it acted as a barrier, this was due to the enjoyment of unhealthy dietary choices either through it providing comfort or being used as a treat/way to connect with someone (see section 5.4.5.2 for a fuller description). Feeling satiated was a key facilitator. Participants reported feeling satiated by the dietary recommendations preventing them from overindulging and eating unhealthy options:

"I'm enjoying my food more now than ever. Which is really good. And I'm eating lots of food. I'm not…never feeling hungry." (p1, "unsuccessful", male)

Where the dietary or PA changes resulted in noticeable physical improvements this acted as a facilitator. This included alleviation of stomach issues, improved physical ability, and visible changes in appearance:

"The other thing is that I have a huge difficulty with my diet because I am on epilepsy tablets and can have terrible side effects of diarrhoea which can be very debilitating. But since I started with this diet and stopped eating all processed food and it's completely gone." (p16, "unsuccessful", female)

This was also echoed in improvements in energy levels and mood:

> *"I find that having less sugar in my diet especially makes me less tired, definitely. I definitely feel having more energy and even more enthusiasm for doing things. So yes, the main one for me is cutting down on sugary foods that I used to have. It definitely helps with my energy levels and my mood as well improved when I stopped eating so much sugar, and I feel more energy and I'm less tired."* (p14, "successful", female)

Specific physiological rewards did differ between participants. But largely, if it was perceived as a sign that they were losing weight it acted as a facilitator. For one participant, they enjoyed feeling hungry with the anticipation of having a decent meal as part of the programme. They felt this ultimately changed how hungry they felt longer term:

> *"I quite enjoyed the feeling of feeling a bit hungry at the beginning of those. Because if not, if you snack constantly, if… having a week or two where you're actually looking forward to lunch and making lunch at five past 12 because you've waited since breakfast and all that kind of stuff, is good but then after the first couple of weeks that diminishes and I felt full all the time."* (p30, "successful", male)

Another reward for participants was seeing physical changes in their appearance and in how their clothes fit:

> *"I've started to think more about me and how I look. I feel less bloated which is really lovely. You know, clothes do fit easier and nicer."* (p39, "successful", female)

Discomfort

Physiological discomfort could act as both a barrier and facilitator in weight loss. Participants reported feeling pain or developing issues because of PA or dietary changes were off-putting in continuing with the behaviours:

"Well, for a start, for some reason when I diet, I was getting really, really bad cramps, and I looked online and he said that taking magnesium citrate supplements would help with the cramps, and it completely helped with the cramps, because previously on the first couple of weeks of the diet, every time I moved, I was cramping, and it was horrendous." (p26, "successful", male)

However, for some, it facilitated maintenance and continuation of the behaviour due to not wanting to experience those negative physical problems again. Most commonly this was experiencing headaches when reducing sugar intake:

"I had awful headaches and everything for about the first four or five weeks, but I think I've got through that now, so I don't want to eat sugar, and then put myself into the position of having to go through that all again, you know." (p6, "successful", female)

5.3.1.5 Personal finances

Participants reported the change in the cost of their lifestyle due to the programme as a factor which could impact weight loss. Personal finances did not seem to be identified as a barrier or facilitator to weight loss by most participants, but they did acknowledge that their spending changed due to the costs of the programme and lifestyle changes. These have been included as it provides some insight into a challenge that people may face in their weight loss even though it seemed to not apply greatly to this group.

Most participants acknowledged a change to their weekly grocery bills. Some noticed a reduction in their outgoings due to reduced takeaways, alcohol intake, and ready meals:

"…probably saves money in our case, because we, when I'm doing this programme, we're trying to cut back on alcohol and that can be very expensive, obviously, so it's definitely affordable" (p19, "unsuccessful", male)

While others noted an increase in spending due to behavioural changes (e.g. attending the gym, cooking more) and changes to diet:

> *"Probably for sure, my electricity and everything's jumped up dramatically because of the amount of time the oven's on, and my gas bill must be…must have doubled for the amount of time I use the hob" (p26, "successful", male)*

5.3.2 Interpersonal factors

Items coded under the interpersonal construct of the social-ecological model related to how the participant's weight loss was affected by other people in their life. Due to COVID-19 restrictions at the time of the interview and during the participant's enrolment in the programme, this was largely limited to the impact the household, family members and close friends had on their weight loss. Two key overarching themes were identified: *social interplay* and *social support*.

5.3.2.1 Social interplay

Social interplay encapsulates the reciprocity of social interaction. This included how others can influence, pressurise, and react to the participant's weight loss. It also included the influence that participants had on those in their social circle. Participants reported interactions with specific people in their life as well as social norms which impacted these interactions. Social norms related to time or situational behaviours or attitudes amongst the participant's friends or family impacted their weight loss. The sub-themes were *influence, social roles, norms,* and *companionship*.

<u>Influence</u>

Influence refers to how the participant influences others and is influenced by them with their weight loss. Participants perceiving their influence on others as positive acted as a facilitator of weight loss through building a sense of responsibility and support:

"And we're influencing other people, so that's the other side of it, you know, like if I'm always reacting angrily to everything that happens or having to eat loads of sweet things or whatever, I'm being the role model…we're all role models to each other, aren't we? So that's what I think, you know, yeah, if you're at a point where you know you're vulnerable to breaking the behaviour you're trying to learn, you've got to remove yourself, but then after that, you've got to just try and be strong and do the right thing, and then you're doing it for each other." (p4, "unsuccessful", female)

They felt what they learned through the programme and the behaviours they followed could influence how their children would act in the future. Many participants remarked that being a role model to their children could influence them to lead a healthier lifestyle in their adulthood, avoid similar weight-related issues in adulthood and impact how participants would be remembered by their children:

"I want my daughters to feel comfortable in their own skin as well, so I think this is about handing something to them as a gift, which is if they were to look at me and think my lovely mum who has a lot of fun, who loves me, that would be my goal really. I don't want to be irritable, inward-looking, fretful about things that are inside my head that I can't share. I want to be a different person to that. So being a role model for them, I think we hand these things down to our daughters." (p27, "successful", female)

"I like to go out as a family, I like to take the kids out, you know, just to make sure they're, kind of, growing up with healthy, you know, ideas and to make sure that I'm, you know, not passing on any, kind of, bad habits to them." (p10, "unsuccessful", female)

Participants reported becoming a role model as a major motivational factor for them to continue in their weight loss attempts and participation in the programme. Similarly, participants reported seeing their behavioural changes impacting others in their life and seeing visible improvements in other's health as a facilitator of following the weight loss programme:

> *"I mean, my partner's not overweight but has diabetes, and since starting the Second Nature programme, his blood sugar levels have been excellent… my goal is to hopefully be able to continue this in some form or factor so it will still benefit from losing weight, and for him who…his sugar levels to remain as good as they have been since we've been doing the programme" (p131, "successful", male)*

Participants also reported seeing other people successfully losing weight as motivational:

> *"So, she used to be a healthy weight and then she gained weight when she was pregnant and after having her child, but then she managed to lose nearly all that weight. So, this encourages me, that's why I admire and look up to her because she managed to do it" (p14, "successful", female)*

Some participants did note that changes to the abilities or preferences of their households were emerging facilitators. This suggests throughout a programme barriers and facilitators may change for participants rather than remain steady. For example, one mother stated her son growing older and learning how to ride a bike was an emerging facilitator as the family could become more physically active:

> *"And my son got much more confident on his bike, so that was also helpful, we were able to go further as a family, because he was able to sustain the kind of cycling, rather than having to sort of keep getting off and walking, or carrying the bike" (p36, "unsuccessful", female)*

Participants reported being reliant on others for making food and alcohol choices when eating socially. This was attributed to not wanting to feel left out or to be a "spoil sport". Some interactions facilitated healthy choices when others were also trying to make healthy decisions, while others acted as barriers due to wanting to feel part of the group/occasion or feeling uncomfortable being the odd one out:

"And I'm like, well I don't want to not have fun. I had two glasses of wine outside with her. And I thought about it and I thought no, I don't want to be a party pooper and I don't want to say no, you drink your wine" (p23, "unsuccessful", female)

Another form of social influence was conflict. Social conflict is related to negative social interactions which participants largely reported as barriers to their weight loss. Typically, this was if the participant received negative comments about their weight or perceived someone as nagging them about their weight or dietary choices:

"So, if I'm having my breakfast with the porridge with the peanut butter and jam, then the comment is always, you do realise that food has sugar in it and you're never going to lose weight if you're having sugar. Or, have you seen how much porridge is in that bowl? You're never going to lose weight if you're going to have a big bowl full of porridge like that. And I'll say, but I'm following a recipe here, this is a weight loss programme. Well, you need to go on another one because that one's not working." (p25, "unsuccessful", female)

There were also some incidences where participants felt others in their life were deliberately sabotaging their efforts:

"my best mate at work …she's quite big too and she's totally pissed off at the moment because she's currently not losing any more weight, like giving me Mars Bars…I think she finds it more comforting, you know, like when we're both a bit overweight and you don't…it's a bit threatening, I suppose, isn't it, when someone else loses weight?" (p12, "successful", male)

A final social influence was comparisons with other people where participants compared their weight and possible outcomes with others in their life. Some reported feeling disheartened when they saw others engaging in unhealthy behaviours but not experiencing the same weight issues. Several participants reported not wanting to have physical illness or disability because of their weight, which they had seen in parents, acted as facilitators of their weight loss:

"But the reality is, is that deep down there's always, I have actually lived with quite a big fear of putting on weight, and almost following in my mother's footsteps…[Lists health conditions]. So she's got quite a few health conditions…And so I, from a physical point of view, I don't want to physically look like that." (p37, "unsuccessful", female)

Social roles

Social roles refer to the participant's role with others. Some participants perceived it as part of their identity to feed others. This was their role within their family (e.g. being a "feeder") and within social roles (e.g. being a member of the Parent Teacher Association). Those who described themselves as "feeders" reported this as bringing temptation into their homes or lives, with some feeling able to manage this and others not:

"I've got a cupboard full of chocolates and treats. I always make everybody a huge hamper up at Christmas. So, in the spare room, I have a wardrobe that's packed with the nicest tins of biscuits and crisps and just all really, really nice food, for their hampers. And every time I open the cupboard, I really want to eat something. I don't, and I don't want to eat it. What I mean is I think, ooh, they look really nice. But I've been good so far." (p5, "successful", female)

Participants from the healthcare sector reported their role as both a facilitator and barrier to their weight loss. One "successful" participant noted that their role as a doctor made them feel they were expected to be healthier and portray a certain body image but being overweight also made him more relatable to patients who were struggling with their weight:

"I had to go out for a meal with, you know, all the other doctors, like wider circle of doctors, and stuff... I was acutely aware of it... but then sometimes...you feel like it's easier for patients...it's easier sometimes for patients when you...if you have to talk about weight or diet or exercise, or whatever, with patients then sometimes it can...it feels a bit easier to talk about it with them if you are a bit overweight...you wonder whether that makes it less intimidating for the patient and less but then, yeah, in terms of the circle of doctors...I mean I don't know...any doctors that are overweight I don't think" (p12, "successful", male)

Other people's reactions to participants' job roles also played a part in temptation accessibility. Healthcare professionals found the norms around giving staff sweets as a "thank you" challenging:

"If I go into the office, then there's always food there. And, you know, nobody ever thinks to thank nurses by bringing in a basket of fruit... And at this time of year, patients who have been on our caseload, we're almost overrun with things like Celebrations... Then if you're in the office and there's four tins that are open, it's easy just to shove them in your pocket." (p29, "unsuccessful", female)

Norms and attitudes

Norms are social expectations on how a person should behave or act held by the participant's social group or local area. Participants stated living in an area where residents were healthier or interacting with people who had a healthier lifestyle as a facilitator to their weight loss:

"I think, currently, sort of attitudes, and things like that, probably are making it a bit easier because there are a lot of drives out there towards kind of looking after yourself, being healthier, being, well, you know, there's obviously, people who are healthier, you know, are portrayed as being, you know, slim and beautiful" (p36, "unsuccessful", female)

Although, some participants, felt living in an area where this was the norm could deflect from their attempts and successes in their weight loss as it was less noticeable which acted as a barrier.

Aside from local area norms, participants came up with very few examples of how norms impacted their weight loss. The discussed examples were vacations and festivities/celebrations. Vacations were reported as both a barrier and a facilitator. Some participants reported the norm was to be more active and eat a healthier Mediterranean diet:

> *"We eat…because we have a house in Majorca, so we have the Mediterranean diet out there, we lose weight when we're out there because we're walking outside all the time and the food is so much better for you that we find that when we're on holiday, we actually lose weight." (p44, "unsuccessful", male)*

Whereas others described it as time off and a time to indulge. Similarly, festivities and celebrations were reported as a barrier due to social norms around eating and indulgence and the increased accessibility of "treats":

> *"What makes it hard? I think general life gets in the way. Christmas for example. I'm on the PTA, so we've been selling and baking lots of cakes the last week for the school. It's…so things like that have been quite hard." (p21, "successful", female)*

Companionship

Many participants also noted food and alcohol were a way to show companionship. This acted as a barrier to change for participants and an obstacle they felt was difficult to overcome without negatively impacting the experience. They associated it with quality time with those they cared for and worried how changes to their diet could impact that companionship:

"I love, for me, wine is all tied up with companionship with my husband so we would have big meals and sit and drink wine and chat and be companionable and sociable and affectionate and I was very worried about how that would impact on that companionship. I have to say it does impact badly on that because it's something we did together and now I sit and look at him when he's drinking his wine and I either feel superior or envious or I feel badly about it. It doesn't generate positive feelings of affection and so that's been hard" (p28, "successful", female)

As well as sharing food or alcohol, receiving or making food for others was perceived to show or feel affection from others. Some even reported it as part of their social role, their identity, and to meet expectations within their social group:

"I think that manifests itself in how much I love feeding people and cooking for people, you know, among our friends, my talents as a cook are renowned, if you know what I mean, everyone loves to come for dinner, to [participant's name], you know, and it's, you know, there's an emotion in that, of me wanting to feed people and make them feel content, and make them admire me by cooking them nice meals." (p6, "successful", female)

5.3.2.2 Social support

Social support refers to whether other people in the participant's life generally tried to aid their weight loss attempts. This incorporates different types of support as well as an absence of support. From participant reports, there seemed to be a continuum of support from none to passive to positive. The subthemes of social support were *emotional support, instrumental support, learning from others, mutual support, passive support,* and *lack of support.*

Emotional support

Emotional support relates to support provided by others which typically involves listening and offering empathy. Participants mostly reported this as facilitating

their weight loss and offered a range of adjectives to describe such support. These included the supporter being interested in their weight loss, accepting the changes they were trying to make, complimenting their appearance or new recipes they were trying or acting as a "cheerleader" or a "confidant".

> *"You know, they ask me about how I'm going, and they listen to me if I talk about my diet, or if I tell them I've lost weight, they praise me… telling me that I look well, that they can notice weight loss and stuff on me" (p6, "successful", female)*

> *"My partner's sat and he's read the handbook, he's looked at recipes. My youngest daughter who's still at home, she's looked at recipes, can we have this? You know, they are supportive as far as recipes go. Supportive of me wanting to lose weight." (p29, "unsuccessful", female)*

Instrumental support

Instrumental support included actions that others could undertake to support the participant's weight loss. This was all reported as facilitating weight loss due to making it easier to implement changes and increasing motivation. Examples included cooking or shopping for food for the participant and utilising the programme guidance, eating the same meals as the participant, reminding them not to cheat, and setting up competitions with the participant for step counts to motivate PA:

> *"And she's decided not to have a biscuit with her coffee in the mornings now, which is lovely. And my siblings… we challenge each other with steps, in a…it is competitive but not pressured competitive. And I've gone from always losing to usually winning now, which is quite nice." (p3, "successful", female)*

> *"I've got an extraordinary husband who has an attitude who just lets, he'll do the shopping when I'm busy, he'll do the cooking if I ask him to. He'll cook from Second Nature recipes" (p47, "unsuccessful", female)*

Pressure and advice from others to follow a healthier lifestyle facilitated adherence and motivation. Encouragement of healthy choices was described as either modelling (e.g. making healthy food choices in front of the participant) or through suggestions (e.g. suggesting making a healthier choice):

> *"My daughter cooks often and she'll cook healthily. That's also for her, not just for me, so it's a sort of, double support, you know. She likes being healthy, so it suits us both." (p18, "unsuccessful", female)*

> *"My eldest son is a doctor and he is a very healthy eater and he'll always say, wouldn't you rather have this than that? But in a kind way, not a nasty way." (p47, "unsuccessful", female)*

The household's reaction to dietary changes was another key facilitator. This primarily was related to the household adopting dietary changes. Participants who reported their household as willing to adopt dietary changes and offer support were seen as facilitating weight loss:

> *"My wife is not doing the programme, but she's eating the same recipes as me, and we've very much been enjoying them." (p19, "unsuccessful", male)*

> *"I've been cooking the meals for my kids and they've been eating it all up and saying it was delicious, so it's made me feel a lot better. So, I'd say they've helped a lot." (p21, "successful", female)*

Learning from others

Many participants reported that they learned new information and skills from other people in their life. This could be in the form of receiving advice, or informational support (e.g. being sent recipes):

"I have a colleague at work who has run a very healthy lifestyle for the last, well, since I've known him, so he'll give me advice on different stuff, he'll send me through recipes to use and stuff like that." (p44, "unsuccessful", male)

This could also be utilising other people's resources (e.g. copying someone else's workout plan):

"My friend's actually on her own sort of personal trainer programme. So, I've been copying some of her workouts" (p33, "unsuccessful", female)

Or in the form of noticing behaviours in others that facilitate a healthy lifestyle and trying to mimic these:

"I think I've learned a lot from children as well. If they're not hungry, they won't eat. They're very good at listening to their body, a lot more than adults I think." (p21, "successful", female)

Mutual support

Participants described doing the programme or behavioural changes (i.e. diet and PA changes) with a friend or family member as constructive. This was explained as offering support to one another and included sharing similar weight or health issues, doing things together, and coming up with solutions to barriers together:

"we're making better choices, and we've got to think, which is what we've decided, my husband and I, that you're not going to be 100 per cent all the time, so when we had a Chinese, there was a time when we would both, I would get chips and my husband would get fried rice and we'd share both with our meal. But, the other week, when we had a Chinese… we shared it, and it was enough. And we threw half the rice away. So, I don't know, it's just obviously mindset, and like I said, supporting each other" (p5, "successful", female)

Participants also reported using the people in their lives to form social contracts and foster accountability. Participants reported this as a facilitating factor as they did not want to let others down or to feel embarrassed if they failed:

> *"Sometimes getting that external…and being held to account by someone else that you know's going to…I think that's really important because I do connect to people and if I trust them and I know that they're going to hold me to account, I will do things as a result of that… it's like my wife and I…we were going on a charity walk, a 50K walk and we were doing it, great, we were training together." (p1, "unsuccessful", male)*

<u>Passive support</u>

Passive support typically involved participants describing the social support from people in their lives as "easy-going". This form of support was interpreted as a barrier or facilitator by participants. Some participants found it helpful that their supporters backed them whether they were being "successful" or not whereas others found this unhelpful due to a lack of accountability:

> *"You know, when I'm drinking and it's Wednesday night and go, oh, I've had a really hard day, let's have a glass of wine he might have a glass of wine with me. But when he says on Friday night, oh, are we having a glass of wine and I go, oh, I'm really trying not to he'll go, okay, I won't." (p18, "unsuccessful", female)*

> *"Totally unsupportive. Doesn't understand. I love you fat or thin, that sort of thing. But that's not helpful to my goals to what I want to do. It's nice, but when you've got that attitude there could possibly be a part of you that would think well, do you know what, I'm just going to balloon" (p32, "unsuccessful", female)*

Some participants noted that their households were happy for them to take part in the programme and their weight loss as long as it didn't affect them:

"…they are not bothered as long as they get tea on the table and there's food in the fridge and it doesn't and I've not suddenly made them start eating, you know, kale" (p24, "successful", female)

Lack of support

More generally, participants described feeling like they had a lack of support, and this acted as a barrier for participants with both "successful" and "unsuccessful" weight loss journeys. This included not being able to see friends/support networks due to COVID-19 restrictions and physical proximity: and there being a lack of groups in their area. Participants discussed a discomfort with speaking about weight amongst peer groups and people either being unwilling, uninterested or dismissive when they tried to speak to them. This could also be in the form of a lack of acknowledgement of their weight issue or attempts to lose weight as a barrier:

"So, they don't see it as a big issue if you understand what I mean, my weight isn't a big issue for them. And so, you know, sitting down and opening a bottle of wine or getting some chocolates out or getting a bag of nuts out and sitting there and snacking themselves. Or maybe, you know, we have a meal which is really, really lovely and then one of them goes to the freezer and gets some ice cream out, or just does something else. That's what I find really difficult." (p29, "unsuccessful", female)

Or when people in their lives had different ideas about what the participant should either look like or be focused on could make change difficult:

"Even if someone comes and tries to, like my partner does like a larger man, and I know that he can fed up with things" (p26, "successful", male)

"So, my husband's not bothered, doesn't really understand. He's the one mostly who's kind of, why would you want to try and lose weight when you're ill? My son is, He's kind of in the young carer's level of things and he's just very distressed that I'm a bit malfunctioning because who wants a malfunctioning boring parent?" (p9, "unsuccessful", female)

Lack of support also encompassed others creating barriers to success for the participant including the encouragement of unhealthy choices or ignoring the participant's goals of following a healthy diet. Other people's behaviour included actions performed by the participant's social group which hindered their ability to make a healthy choice (e.g. topping up their drink, making excess food, or making a meal that doesn't support their diet):

"But then that was annoying because at one point I went to the toilet and I came back and someone had ordered me another drink and it was there. And I drank it because it was there." (p23, "unsuccessful", female)

"…my partner, who is not IT literate, so can't online shop or anything, and of course right in the middle of the first lockdown, and provided me for my 50th birthday a bag of skittles. I said, I'm fecking obese, and you buy me a bag of skittles for my 50th birthday, so that went down a lead balloon, as you probably imagine." (p26, "successful", male)

The encouragement of unhealthy choices usually involved telling the participant they deserved it or should treat themselves:

"Maybe more on the difficult side where my partner will maybe say, oh well, you've been doing really well so it's okay for you to have this, you know, that type of thing. It's okay for me to have another wee bit of wine because it's not going to do any harm." (p31, "successful", female)

Participants also described if members of their household were unwilling or disliked the new dietary changes as a barrier to change:

> *"Well not to blame him but my partner, he gets a bit pissed off with the recipes, and stuff, because… he likes to, yeah, you know, have chips and basic food, and stuff, lots of potatoes." (p12, "successful", male)*

5.3.3 Programme factors

Programme factors included aspects relating to how the participant's weight loss was affected by the programme itself. These included programme components and aspects of the programme which involved different levels of the SEM (e.g. intrapersonal, interpersonal).

Factors influencing engagement

Factors influencing engagement with the programme either encouraged or discouraged participants from using the platform or materials/advice. The sub-themes for this were *practical issues, fitting into life, group relations, coach's approach, credibility,* and *programme approach.*

Practical issues

Practical issues were described as a barrier by participants. This related to the use of the materials and how they could be incorporated into the participant's life. Participants felt the way the programme tasks were laid out in the online application was impractical:

> *"I think logging it is really important for me, but the planning, and planning and logging in two separate places, that was really annoying" (p4, "unsuccessful", female)*

The supporting material describing how to use the online application and what tasks were expected of participants was lacking for some participants making it difficult to engage in behaviours:

"I wish it was a lot easier to work out what you're supposed to be doing. I still haven't worked out how to register my weight loss on the thing… I wanted it to be a lot more straightforward and I want the supporting literature to actually have diagrams saying, press these things to do this, and just make it much more instructional. There's a lot of assumptions that you know what to do and I don't and I haven't got time to sit there thinking about finding out." (p11, "unsuccessful")

Participants also found it difficult to use and navigate the materials on a mobile device. In terms of following the conversations from the group and coach many could not view the full conversation or see all of what they typed in reply:

"The chat boards are quite tricky. I mean, you can't always be [break in signal 13:36] to see elements on my 'phone. Not immediately obvious who's talking. Who said that? You know. Where the message is placed next to the chat." (p23, "unsuccessful", female)

Participants who did try to access the materials on their computer reported that the layout was incompatible with the computer:

"I find it difficult that everything's on the app, the app I don't think is particularly great designed, and yeah, it's slightly difficult, because sometimes I feel like I'd rather do things on the computer screen, but the computer screen doesn't have the same…when you log in on the computer, it's not the same as the app, and it's difficult to find things" (p26, "successful", male)

Group relations

Group relations could act as a barrier or facilitator depending on participants' preferences on what they felt was the appropriate amount and topic of conversation. Within the Second Nature programme, participants are placed in a group that has an allocated "health coach". All the interactions are in the application through a group messaging forum. Those who found the group as a facilitating factor said the group was a source of social support. This was due to

feeling they were with people with shared interests, experiences, obstacles, and weight issues:

> *"But every time I do go on Second Nature with conversations with the other folks in my cohort, I've explained just like, oh, I'm overwhelmed with stuff and it's been good and I've found a few people, there've been two or three other people with chronic illnesses and we've been…started chatting I guess about, you know, we've been up front in the group saying…chronic illness stuff and then also kind of grouped off sideways and…side chat… and extra bits, and exercises on chairs and some extra support." (p9, "unsuccessful", female)*

> *"You feel supported and you feel like other people are also struggling with weight and trying to lose weight, and it gives you a greater sense of motivation." (p14, "successful", female)*

It was noted that it was beneficial to be in the same group from start to finish because even though some other members left there would be a core group of support:

> *"It was nice to think that you were on your journey with somebody else at the same point in time. Rather than, you know, like, if you go to a weight loss group, you're all at different stages of your journey." (p8, "successful", female)*

Participants found the group to be supportive and encouraging when they had a setback in their weight loss. Ultimately motivating them to return and continue with the programme:

> *"It helps in the chat page, when you see, like this week, I lost half a pound, which I was hoping I'd lose a pound at least, I was aiming for a pound a week. But I looked on the page, and there were several people that had lost half a pound and some that hadn't lost any, and it makes you feel like you're not failing." (p5, "successful", female)*

Those who reported the group as a barrier reported finding it burdensome and feeling unsure of how to interact appropriately. The sheer number and content of posts by other group members was overbearing for some participants:

"I think with, like, 30-odd people in one group it's just constant. And it's not very personal and no-one really knows each other personally, what they're going through, apart from the people that chat… all day long." (p7, "unsuccessful", female)

Some also felt uncomfortable sharing information about themselves or became anxious at the idea of posting to the group so disengaged:

"You don't really know who you are talking to and, y'know, how serious you should be or how relaxed you should be or how…you're not really able to pitch the right level because I haven't met these people." (p16, "unsuccessful", female)

"I don't feel a drive to, you know, put…write anything down or…in the group chat, and stuff. Though I do…I even find that a little bit not anxiety provoking but I feel like I need to…I'm meant to put something into it, type something into it and, you know…or like chase something up, contribute to the group, but I just don't to be honest. And then I feel a bit guilty about not doing it." (p12, "successful", male)

<u>Coach's approach</u>

The coach's approach refers to how the coach shared information and interacted with the group that they led. How useful the coach was perceived varied amongst participants, with some finding them a facilitator, a barrier or feeling their input was neutral and did not affect their weight loss or engagement with the programme. There were many positive facilitating attributes described by participants regarding the coach including being responsive to posts in the forum, showing empathy, encouraging interaction, being informative, and being knowledgeable. Participants who felt the coach was particularly helpful tended

to explain how the coach would support them to source their solutions to barriers rather than providing the answer:

> *"I think they give a good balanced approach, because it's not a one size fits all, so I think they tread a fine line. But I think generally, they're really, really supportive, and non-judgemental. And they point you back, they don't just give you a piece of advice, they'll point you back to a bit of evidence, which I like." (p2, "successful", male)*

> *"And she just told me to focus on one or two things that you can just commit to for this week and just focus on those. And actually, that worked really well. So, I've done…did that and committed to, I think, three things actually. And absolutely did those and now I feel right back into it again." (p1, "unsuccessful", male)*

Or making suggestions that meant participants could continue doing things they enjoyed that were compatible with the programme. For example, adapting recipes so they could still eat things they enjoyed while following the dietary principles of the programme:

> *"And she will look for, oh, well, actually you could do it this way or you could tweak this. So you're not stopping. My husband loves apple crumble and we've actually made apple crumble without any sugar at all and it's delicious." (p3, "successful", female)*

Those who did not find the coach engaging thought their communication was scripted or robotic:

> *"I mean, the answers she gives are very party answers so if you ask a question, it's often a cut and pasted reply from one of the articles." (p28, "successful", female)*

> *"It seems like she's cutting and pasting whatever she's supposed to put in at the beginning of the week" (P9, "unsuccessful", female)*

Not having direct contact (i.e. one-to-one personal messaging) with the coach was also felt to act as a barrier due to a lack of personalisation for advice and a check-in:

> *"I think the only one that I'd change… is being able to privately message your instructor... Because, sometimes, even though you don't know these people, you feel a bit self-conscious about over-sharing things." (p8, "successful", female)*

> *"It didn't feel enough, and you know, it's the same again, you couldn't really build up a rapport with them" (p4, "unsuccessful", female)*

<u>Credibility</u>

Credibility was another theme which could act as a barrier or facilitator. Where participants felt the programme was credible this acted as a facilitator to engagement. Participants particularly liked the programme was endorsed by the NHS and advice backed up by scientific research:

> *"It said Second Nature, it's supported by the NHS. And I thought if it's supported by the NHS then it's got to be good." (p44, "unsuccessful", male)*

> *"I really love the scientific articles, I've got a background in science, and you know, to me, that's really, really interesting to know more about" (p35, "successful", female)*

Lack of credibility could act as a barrier to engagement and adopting the advice when participants were dubious about the advice given or if it countered advice given by other sources that they felt were credible:

> *"I disagree with some of the advice given and I would disagree with some of the psychology around habit forming and stuff like that. I think some of it's a little bit…it's not particularly based on good science, it's pop psychology." (p30, "successful", male)*

"I know they're very big on drinking two litres of water a day. They're saying two litres of water, whereas if you talk to dietitians, they say I think two litres of liquid [...]. So, I did try and do the two litres one day and I was just on the loo every two minutes. It was ridiculous." (p141, "unsuccessful", female)

Programme Approach

The programme approach refers to the content of information/advice shared and delivered. Participants felt the holistic approach to weight loss advocated by the programme facilitated success. It allowed them to consider their wider lifestyle and wellbeing which translated into improved outcomes. According to participants, this was particularly effective if it supported them to connect their understandings of weight loss:

"I think they're really good, because they focus on so many different aspects, like the time you have the healthy choices that you make, your food or your sleep patterns, how they influence your choices of food and things." (p14, "successful", female)

"It has given a thread, or a connection between what I knew. So, it's given the sort of joined-up thinking on it, yeah, because it allows you to put the science of calories in and calories out, and how your metabolism works, and then goes into the good and bad fats, and then throws in a bit of mindfulness" (p2, "successful", male)

Participants also enjoyed how the programme introduced information to them and felt they were treated in a mature way:

"It seems quite grown up and doesn't talk down to you, it's intelligent. And I like the fact that the articles are well written and clearly explained and without being too basic. There's some interesting scientific stuff." (p23, "unsuccessful", female)

A barrier to the approach was how information was introduced to participants. Many felt the initial introduction was overwhelming or difficult to understand:

"it wasn't really focused to a broad readership of people that perhaps don't have any clinical background. And I thought it was a little bit too technically written to be understood by everyone, even me, like even I didn't understand every point that was being said." (p26, "successful", male)

For some, this continued throughout the programme and made it difficult for them to engage with the group or the programme. The demand to keep on top of different materials was overwhelming:

"There is an article and then there's…it tends to be sometimes a discussion on it and I'm thinking, I haven't read it yet. I haven't read the last five…So every day there is an article to read and I just find that a little bit…it's too much information. At the moment, you know, I'm still trying to stop having cereal in the evening. I can't think about anything else." (p41, "successful", female)

5.3.4 Environmental factors

Environmental factors included barriers and facilitators in the participant's local environment (i.e. the town/city/village where they lived), their workplace, and within their home. The overarching themes generated were *workplace environment* and *home & local environment*. Home and local environment were merged into a single category as most home-related barriers and facilitators were relational and are discussed in the interpersonal section below (section 5.4.3).

5.3.4.1 Work environment

The work environment category incorporates aspects of the workplace which acted as barriers or facilitators to weight loss. Largely, barriers were identified across both groups related to facilities in the workplace while facilitators related to improved time management from working from home.

Time

Participants who were working from home (mainly due to COVID-19 guidance) reported the home environment as a workplace as facilitating weight loss due to having more time to engage with meal preparation (e.g. shopping, preparing fresh foods and cooking) and PA (e.g. going for walks):

> *"I feel I have space; I have time to do it, simply because I am at home and I'm not so distracted with too many other things and also I'm cooking, I don't have to prepare lunch to take with me I can just nip down to the kitchen and do it." (p38, "successful", female)*

> *"It's been easier because I can go out for a walk at lunchtime without people noticing when I'm leaving, and when are you coming back, knowing that I'll make the hours up anyway by starting earlier or finishing later." (p34, "unsuccessful", male)*

Despite this, some participants did report working from home as a hindrance to their weight loss due to a lack of separation between work and home, not having time to unwind after work, and becoming more sedentary. Lack of separation could result in long work hours and participants seeking easier options for food after work. This hindered their weight loss by reducing time and motivation for meal preparation and engaging in the consumption of unhealthy options unsupportive of their diet:

> *"I walk out of my bedroom in the morning, grab a cup of tea and I'm at my desk at let's say 6 o'clock…it might be 7 o'clock in the evening when I actually finish…I would then do is first thing I'd do is a great big glass of wine, what's the quickest thing that I can do to put food on, what's ready in 20 minutes, you know, and I stick it in the oven. I go and drink my wine and then I get my food out, have my food by which time I'm pouring my next glass of wine." (p1, "unsuccessful", male)*

Likewise, long work hours and being at home led to a reduction in typical PA:

"I'm working from home permanently, so I used to walk to work, which is only 20 minutes away, most days… when you're working from home, you work that little bit longer, and you sit still for longer. You've got people, maybe, that are at home, bringing you a drink, whereas you'd have maybe gone for a walk round at work, so I've probably not been as, I've just been more sedentary" (p15, "successful", female)

Facilities

Some participants still went to work due to either being key workers or due to lessening COVID-19 restrictions allowing people to return to work with social distancing in place. Those who were able to return to work in this study were mostly in the healthcare sector and one from the prison service. Participants who were in the workplace described a lack of suitable facilities in terms of places to purchase food or prepare food and the accessibility of sweets in the workplace as a barrier:

"I would be buying things in the canteen and its quite big meals and not the healthiest, and also people bringing things in, you know, like for everybody, like sweets and cakes and, you know, that type of thing, that can make it difficult. That bit temptation" (p31, "successful", female)

"…if I go into the office, then there's always food there. And, you know, nobody ever thinks to thank nurses by bringing in a basket of fruit or a bunch of bananas, it's always, you know, we get very lovely boxes of chocolates. And at this time of year [Christmas], patients who have been on our caseload, we're almost overrun with things like Celebrations and Heroes… but that is actually very difficult when you go into the office and, you know, I wouldn't be on a diet if I could stop at one. So, I don't and then you just think, oh, I'll just put some in my pocket for later… Then if you're in the office and there's four tins that are open, it's easy just to shove them in your pocket." (p29, "unsuccessful", female)

With those working from home, participants reported both barriers and facilitators to this arrangement. Participants had more flexibility with their schedules to fit in and use facilities to engage with cooking and meal preparation, and PA throughout the day:

> "…it's actually quite helpful because my swimming pool opens at six thirty and it's a ten-minute walk, so I can go for a swim, come home, get showered and dressed, whereas if I was actually at work or in uni physically I wouldn't have time to go to that early". (p46, "unsuccessful", female)

> "It's all about planning your menu isn't it, whereas before it was crash, bang, wallop, you know, it was lasagne already made, in the oven. It was pre-packaged food… that was just laced with sugar and nastiness. But being at home has enabled me to plan and start cooking earlier." (p44, "successful", male)

However, the convenience of kitchen amenities when working from home acted as a hindrance due to the accessibility of snacks.

5.3.4.2 Home & local environment

Home and local environment themes could act as both a barrier or a facilitator. The sub-themes of home and local environment were *access to green space, safety, food availability,* and *accessibility of obesogenic amenities,* which are described below.

Access to green space

The presence of green space was described as a facilitator of weight loss. Participants reported green space as encouraging PA and a way to socialise with friends or family:

"I think local environment is a massive factor actually. When I step out… I can go in any direction and end up in a green space if I wanted to. We're in a built-up town area as well, so we've got the combination of convenience and utility and also green space in a suburb. So, I think that is a massive influence on our ability to live a healthy life." (p27, "successful", female)

Public green space as an opportunity for managing mental and physical health was unanimous amongst participants. Having a private garden was also reported as a factor at home that supported weight loss.

Barriers associated with the use of outdoor or green spaces were those of being able to use such spaces. These included issues with terrain and accessibility due to their physical ability or location:

"But we are kind of cut off from walking out the door and going and exercising. I mean, I use a walking stick so I can't walk up the farm track, yes, so it does make it more difficult in that respect" (p4, "unsuccessful", female)

Additionally, outdoor areas which were suitable in terms of terrain but had other issues such as busyness or pollution could act as a barrier to PA in the area:

"It's quite built up around here, so some people won't go running around here because of the traffic fumes and all that kind of stuff, but by the same token it's quite flat." (p30, "successful", male)

"I am finding a nice place to walk… but I have to time it very carefully because nearly 1,000 children come out of school at three o'clock. And of course, they're going to school in the morning. So, I have to think carefully about it and encounter a lot of traffic which I don't like" (p16, "successful", female)

<u>Safety</u>

Perceived safety in the local environment influenced if participants would use their local area to engage in PA. Dark and wintery weather made participants less likely to go out. This was due to conditions being unsuitable to walk (e.g. muddy) or the local area not having adequate facilities for walking in the darker weather (i.e. street lighting):

> *"…it's a bit more difficult in the winter, 'cause it's very muddy, which is a shame, but we'd be doing it all year round, otherwise, and the lack of light." (p15, "successful", female)*

> *"I do when it's daylight hours. If it's on a night, there is no street lighting there anyway, it's literally the edge of the river…, but at the moment it's really boggy, I mean, I got my shoes stuck the other day, trying to go that way, so I came back and walked on the path, but yeah, that's been really the only bit of green space there is here, is along the river at the back of where the houses can't be built" (p17, "unsuccessful", female)*

The knowledge/perception of criminal activity in their area also inhibited PA in their local area:

> *"It's made me feel quite nervous about going out as well, it's made me feel quite nervous about people. It really has, and people are, like this woman was raped in this neighbouring area recently, by some really young people and all, it's just so shocking, and you know, I already felt a bit vulnerable, you know, because my health had got worse" (p4, "unsuccessful", female)*

> *"Sometimes I don't like going on my own… we've got, like, a park with a big, sort of, like, lake in it and it's beautiful. But, beyond that park, over the other side, there's a really rough housing estate and so, I would, there's certain times of the day that I wouldn't walk through there." (p8, "successful", female)*

Food availability

Participants reported the proximity of supermarkets and independent shops (i.e. butchers, and green grocers) as facilitating their weight loss.

> *"I think the fact that I can walk locally and support my local shops is another thing that is good…We've got a local butcher's, we've got a local grocery, those sort of things are useful too." (p3, "successful", female)*

These amenities being within walking distance and supporting local businesses seemed to motivate participants. Participants noted barriers to purchasing healthy foods in their local environment included problems with the quality of the food (e.g. fruit and vegetables expiring quickly) and sweets being visibly available in aisles and at the checkouts:

> *"You can go to the market near us, that has a stall has incredibly cheap fruit and veg on, but it's all got to be used within a couple of days, otherwise it starts to go off." (p5, "successful", female)*

> *"…there are plenty of, you know, sort of nice little places that are, you know, but it's not sort of screaming out at you. Whereas, obviously the gaudy colours of the, you know, yellow Ms, or you know, bright red KFCs, or you know, those are the things that are in the retail parks, they're right in front of you. Or you go shopping and there's, you know, massive cake aisles, and sweet aisle." (p36, "unsuccessful", female)*

Accessibility of obesogenic amenities

The final environment theme is access to obesogenic amenities. Participants reported living near shops and food outlets as a barrier to their weight loss:

> *"…we moved house a couple of years ago and we're literally round the corner from like a wee high street that have, you know, corner shops and a little Tesco on it, and stuff, and a whole row of takeaways. So, like just that easy accessibility of being able to just nip round the corner and get Ben & Jerry's, or whatever, or pick up a takeaway"* (p12, "successful", male)

Participants also reported eating at food outlets as a barrier due to a lack of control over menu options and portion sizes:

> *"I think eating out is a problem. I think one of the main problems is portion size, eating out is always too much. Always too much."* (p3, "successful", female)

One participant also reflected on unhealthy takeaway foods being more affordable and the pressure from restaurants to indulge when eating out by offering financial incentives:

> *"The trouble is that if… you're going out for dinner, trying to select a healthy option, it's more expensive than if you were to go to, I don't know, one of these all-you-can-eat buffets for £5.99 or whatever. It's always the more expensive option to eat healthily in a healthy restaurant...the healthy option is, 99 per cent of the time, more expensive than the full-fat option shall we say"* (p44, "unsuccessful", male)

Some participants also simply enjoyed the experience of eating or drinking alcohol and did not want to give that up or reduce their enjoyment of these activities by changing their eating habits:

> *"We like eating out. I think, there's always the appeal of someone else cooking for you."* (p13, "unsuccessful", female)

Within the household having food and alcohol nearby also acted as a barrier due to increasing temptation to indulge in them:

"I think it's hard to do it this time of the year, particularly with everything that's around the house…because my willpower is bad to try and eat well all the time." (p20, "unsuccessful", female)

"Obviously, the fridge is constantly there, and there's always food around" (p13, "unsuccessful", female)

5.3.5 Multi-level factors

Multi-level factors include themes which influenced weight loss across different levels of the SEM. These themes were *stigma* and *COVID-19*.

5.3.5.1 Stigma

Stigma was a multi-level factor which was present at the intrapersonal, interpersonal, and wider cultural levels. This was described as a barrier as it negatively impacted wellbeing.

Participants reported experiencing stigma related to their weight from other people in their lives. This could involve negative comments about their weight or their dietary choices. This happened within the household, with friends and at work and participants reported this as a barrier:

"I feel as though other people... sometimes the way that they treat me and, you know, there's a man at work as well who, kind of, joked about I was moving house and, you know, I was saying that it's a good thing because there aren't any takeaways nearby so that'll stop that and he was, kind of, laughing and saying, oh, yes, you can do without the takeaways" (p31, "successful", female)

Some participants noted wider cultural influences such as media portraying people living with obesity as perpetuating the stigma they faced from others (see section 5.5.4). One participant noted that this seemed to be also influenced by the education system since her son's stigma towards her weight increased following education on obesity and living a healthy lifestyle:

"…there's actually a lot of discussion about unfit and overweight at school and it's not really had a positive…it seems like more stigma rather than less coming out of that discussion at school, and I'm not really pleased about that." (p9, "unsuccessful", female)

Participants also seemed to be influenced by such stigma when choosing their social connections. Some reported being drawn to others who were more overweight to make themselves the smallest in the group and alleviate some of the pressure to lose weight:

"I'm wondering whether the people that are around me overweight because I'm drawn to them because then I feel part of and this is the normal. And that then I think defeats itself because you then don't have the desire to need to lose weight because there's always somebody that's fatter than you." (p3, "successful", female)

While others reported being drawn to people with a lower body weight due to finding obesity off-putting:

"I tend to gravitate more to friendships where the person isn't overweight, interestingly. I find having friendships with people that, well I think this is personally my problem. I don't have a positive view of someone that's overweight, so yeah. I think I went through part of my life feeling that it was quite an ugly thing. So if I saw someone that was overweight, I automatically thought they were ugly…I just would make sure that I sort of surrounded myself with people that were not overweight" (p37, "unsuccessful", female)

The stigma around obesity seemed to be ingrained in some participants that their use of language was often derogatory to either themselves or towards others living with obesity, including words like "fatty" or implying negative connotations/perceptions of being overweight:

"I don't want to be a fat old man" (p30, "successful", male)

5.3.5.2 COVID-19

Participants from this study were recruited during the varying levels of lockdown throughout the UK. This meant at the time of the interview participants were experiencing different levels of restriction in how they could interact with people in their lives and with facilities in their environment. COVID-19 impacted weight loss across environment, interpersonal and intrapersonal constructs of the social-ecological model. The findings from this data related to weight loss and COVID-19 have been published (292). For the purposes of this chapter, the sub-themes of *motivation, negative intrapersonal responses, facility access, blocking support* and *time* will be discussed.

<u>Motivation</u>

A facilitator to weight loss from COVID-19 was that it enhanced motivation. Many participants became more motivated to engage and pursue losing weight due to the associated risks of obesity and COVID-19 severity:

> *"I think it was COVID more than anything else… When you're reading all the reports avidly like everybody was and seeing that being overweight was a definite problem and diabetes was a definite problem… then you thought, well, frankly what else am I going to do for the next seven weeks?" (p11, "unsuccessful")*

This also fostered support from people in the participants' lives who felt motivated to support their weight loss efforts. Participants found this support aided the behavioural changes they were trying to make but, in some cases, it could be overbearing:

"It's interesting because that's why we started going for the walks in the first place. My husband is very active and very slim and very fit, so as soon as this became known, that those who were overweight were more likely to have a negative outcome, that was when the alarm was set for 6 o'clock each morning and we were out on a walk at 6.30 each morning. So it wasn't my choice at all at first and I thought I was going for a nice little stroll and instead it turned out to be a fast march, so it wasn't quite what I was expecting." (p25, "unsuccessful", female)

<u>Negative intrapersonal responses</u>

Negative intrapersonal responses were also created as a response to perceived risk associated with obesity and COVID. These acted as barriers to weight loss. Participants stated the risk prompted feelings of shame or embarrassment due to their weight:

"It makes me feel a bit embarrassed… if I did catch COVID, you know, like, being overweight was the factor that made me, like, you know, die from it, it feels a bit embarrassing. It's a bit, like, you know, you would feel, yeah, a bit ashamed that that was, you know, because you're fat, so that was the thing that tipped you over the edge." (p10, "unsuccessful", female)

Such feelings seemed to both result in enhanced motivation and negative behavioural responses. Feeling at risk for worse COVID-19 outcomes or general COVID-related anxiety also led participants to disengage from others and from going to places where they may encounter other people. This made it difficult to engage with some of the programme behaviours (e.g. using exercise facilities, going to supermarkets):

"I definitely feel like, because I've shied myself away because I feel like I'm more at risk, I haven't done the exercise that I should have done, that's weighing on my mind quite a bit." (p8, "successful", female)

Facility access

Reduced access to leisure, food, and support facilities acted as a barrier to engaging in PA and new dietary behaviours:

> *"The only problem is that the weather is getting colder and colder and colder, and so I'm not sure if we're going to not open at the beginning of December and then I don't have all these other facilities like playgroups or soft play in place. Whether I will be coming out from the house as much as I used to or I am. And I'm afraid that might trigger some unhealthy habits." (p14, "successful", female)*

However, many felt reduced access to facilities acted as a facilitator to weight loss due to reducing temptation and social pressures when eating socially:

> *"I actually found that easier for me because I wasn't tempted by, you know, restaurants and things like that. And I did actually lose weight over the lockdown rather than gaining it, so that was actually quite good." (p7, "unsuccessful", female)*

Blocking support

As discussed in the social support (section 5.4.3.2) a lack of social support acted as a barrier to success. Many found with the COVID-19 restrictions their access to support from friends and family was blocked:

> *"I haven't really had anybody to offload the problems that I've been facing with my father or at home, with anybody else, where we generally meet up at the local café and have a coffee or a proper catch-up or we get together and watch a movie or something like that. We haven't been able to do that for, it has impacted probably my mental health as well, my focus on being able to give 100 per cent to my diet." (p17, "unsuccessful", female)*

This prevented participants from offloading and handling emotional upset and stress. Similarly, restrictions blocked instrumental support. This particularly applied to engaging in a group or paired PA:

> *"And also actually this year finding group exercise has been pretty impossible with COVID" (p39, "successful", female)*

Time

Concerning COVID-19, the biggest facilitator was having time to focus on the programme, well-being, and weight loss behaviours. Participants felt they had more time to prioritise, learn and engage with the behaviours which supported "successful" outcomes:

> *"I feel I have space, I have time to do it, simply because I am at home and I'm not so distracted with too many other things and also I'm cooking, I don't have to prepare lunch to take with me I can just nip down to the kitchen and do it. So it was a trigger to do it now simply because of, yeah, now you have more time, you have more space so I can actually do it." (p38, "unsuccessful", female)*

5.4 Differences in identified barriers and facilitators

The following subsections describe the differences identified between "successful" and "unsuccessful" participants. This can be either perceptions or where reports within a theme differed or if it was only reported by one group.

5.4.1 Intrapersonal differences

When comparing "successful" and "unsuccessful" participants there were a few intrapersonal differences. There were more differences at this level than at other levels of the SEM. These themes were *motivational differences, approaches to finding solutions to barriers, perceptions of weight status, control,* and *context*.

5.4.1.1 Motivational Differences

When comparing motivational differences between "successful" and "unsuccessful" participants, there was some evidence that "successful" participants' motivation was rooted in protecting the well-being of others or when preparing for future hardships. While both groups reported the importance of being a role model for their children, "successful" participants who were motivated due to others seemed to have a higher sense of duty to protect others from emotional harm by maintaining their health:

> *"What's hit me is how badly my two sons have reacted to their father's death, and it's made me realise, I don't want to put them through that. I know eventually they will, but I don't want to do it in the next five or ten years, I want to be staying fit and be healthy."* (p6, "successful", female)

"Successful" participants also reported engaging with their weight loss through motivation guided by others to prepare for future hardships:

> *"The other thing is, my husband has cancer…And I also got to the point that I was really aware, and this is quite a serious motivation for me… And he, you know, over the past two years since he was diagnosed, you know, occasionally he's said, you really need to look after yourself, because I know, you know, you need to be healthy because I'm not. And really, I got to the point in October that I was just thinking, this sounds quite stark, but I know that I am going to have to face some really bad stuff in the maybe not too distant future…And, I didn't want to feel, I wanted to be in the most positive place I could be, in order to manage that and, part of that was about my feeling about myself and my weight."* (p24, "successful", female)

5.4.1.2 Approaches to finding solutions to barriers

All participants sought solutions to their problems. Commonly this was in the form of removing barriers (e.g. not purchasing crisps or sweets for the house) and setting up facilitators (e.g. preparing water bottles in the morning, purchasing exercise equipment). However, "successful" participants were more

pragmatic with their solutions. Rather than simply adding or removing items they were more thoughtful and proactive about overcoming their barriers and considered ways beyond removal or addition of items to address these.

Participants changed their home environment to support healthier living by moving where they worked from home away from the kitchen or by physically changing their environment:

> *"I'm getting my own wee gym in my garage, and things like that."*
> *(p2, "successful", male)*

"Successful" participants were more analytical about what they perceived as a reward and how this could hinder success. They were more likely to try and reformulate what they perceived as a reward to support longer-term healthier habits:

> *"So I've had to change my rewards. My rewards at the moment are*
> *bath bombs. I do enjoy a nice bath and I'll spend a lot of time in*
> *there. So every time I lose, I get to the next kilo lost, I treat myself*
> *to a nice bath bomb. Rather than what I would normally do is treat*
> *myself to a chocolate bar." (p3, "successful", female)*

Both participant groups did remove items which didn't suit their diet from their house to reduce temptation. However "successful" participants were more reflective of what was "diet worthy" and actively removed temptation from the house rather than not purchasing it. In one case the participant donated food items, generating positive reward (i.e. making them feel good):

> *"I went through my kitchen cupboards and looked, is this diet worthy,*
> *it this not diet worthy, packaged up everything and took all the food*
> *to a food bank, so I did that last weekend, which made me feel kind*
> *of good, and yeah, it made me feel, okay, it's not going to be there*
> *to tempt me, but the other thing is, I'm not going to get back into it*
> *again, and it's gone. And the new way of eating will continue, so that*
> *was kind of good." (p26, male, "successful")*

"Successful" participants also found ways to continue doing the things they enjoyed and built takeaway agreements with their households (i.e. a set day they would have a takeaway) and sourced healthier ways to have takeaways (e.g. ordering healthier items):

"Fridays are my husband's day off and we used to have perhaps a takeaway on a Friday but there's… a very good company called Cook which do sort of meals that are like homemade meals…they're a little bit more expensive than the standard ready meal but that, we've substituted that instead, probably just have a night off from cooking and a really nice meal but it's not unhealthy." (p48, "successful", female)

When eating out, most participants noted choosing to drive to avoid pressure to drink alcohol another way was avoiding dessert, but "successful" participants discussed preparation in more detail. This included planning what they were going to eat in advance by reading menus or bringing their own food items so they could maintain a low-carbohydrate diet:

"we've made a decision that one meal out of the week, we will have a takeaway of some sort, and we've tried to stick as good as we can with Nando's, and this week we're going out for lunch on Saturday lunchtime, and we're going to a Mexican, so I'm kind of hoping that I can…I was thinking of making my own keto fajitas and taking my own wraps and asking them to serve it with my own wraps, rather than their wraps." (p26, "successful", male)

5.4.1.3 Perceptions of weight status

One difference that was discovered was that "unsuccessful" participants seemed to be less aware or in denial of their weight status or BMI than "successful" participants:

"I don't know where I am on the BMI scale either" (p34, "unsuccessful", male)

"Unsuccessful" participants also seemed to feel they had less control over their BMI (see section 5.5.2.4 for further discussion) and attributed their weight to genetics. In some cases, participants perceived their recommended healthy weight as unappealing:

> "I'm trying not to say big-boned but I am. I've just got very solid bones and when I had the photographs taken of my hip at the hospital the other day my hip bones go right out to the edge of me. So I'm never…I'm going to be a big skeleton with no flesh on if I keep going down to my BMI weight which I think is 10 and a half stone. I'd just look absolutely dreadful." (p11, "unsuccessful", female)

Contrary to denial or finding their recommended weight unappealing, "successful" participants were more aware of their current weight status and many had set their target weight to be within the healthy BMI range:

> "What are my goals? Yeah, well obviously to reset, to get back to a healthy BMI would be good." (p12, "successful", male)

They also were more proactive in learning about the risks associated with their weight and health:

> "I was looking on the NHS website, you put your weight in and your height and it shows you your BMI and it tells you about the risks and then gives you options, suggestions, like you should try to speak to your doctor." (p14, "successful", female)

5.4.1.4 Control

Both "successful" and "unsuccessful" participants found it difficult to feel like they had a sense of control over their weight. This was a particular struggle if the participant thought they were doing all the right things but seeing little or no results. There was also a consensus that stress or emotional upset could make participants go from feeling in control of their weight loss to quickly losing control. Overall, participants stated their ability to control their behaviours was

internally driven and down to their willpower and/or motivations, and few acknowledged external factors as an important factor in their sense of control.

Where participants did differ, was in their attitude towards control. "Unsuccessful" participants were more likely to say they had a lack of control over their environment or in social situations and were unsure how to change this to support their weight loss:

> *"I just don't get why I can't get back into it. Whether it's because of the added stress of, you know, doing school runs or at weekends it's only just me and my son, so not being able to have that flexibility and trying to fit it all in during the week. I don't know, it's something I can't work out." (p20, "unsuccessful", female)*

Whereas "successful" participants were thinking of ways to try and make more permanent changes in their lifestyle which could enhance their feelings of control over their weight loss (see section 5.5.2.2 for examples).

Both groups had participants who reported using mindfulness as a technique to gain control over emotional eating. However, this was more commonly reported in "successful" participants, where it empowered them to harness behavioural control:

> *"It's difficult because I am a natural emotional eater. The good thing is, I am really conscious about what I put in my mouth now, basically." (p8, "successful", female)*

"Successful" participants reported planning their meals to ensure they felt more satiated throughout the day (i.e. to avoid overeating or snacking), becoming more aware of their actions (i.e. thinking about how much they are eating and whether they were hungry), and focusing on reprioritizing their time to reduce stress and engage more with weight loss behaviours:

"I've gone from that sense of everything being out of my control to literally the opposite, I've taken control. I've prioritised different things for me, I'm exercising every single morning Monday to Friday, I have time to go and exercise, either a run or a fitness thing in front of the TV or something before work. And then during the day, I'm getting up, I'm giving myself permission to walk around the house, to talk about something, do a job that's completely unrelated and then come back to my office and continue. Those sorts of things have radically changed my outlook and now I feel much more in control." (p27, "successful", female)

5.4.1.5 Context

There were various contextual factors which participants reported as acting as barriers to their weight loss. These included the participant's health (e.g. injury preventing PA, medication inhibiting weight loss, stress or low mood inhibiting motivation), participant's family member's health (e.g. being/becoming a carer for parents, spouse, or children), work and financial concerns and stress, and disrupted living situations (e.g. moving house, staying in different places during the week and at the weekend). While "successful" participants reported such stressors as motivating weight loss (see section 5.5.2.1), "unsuccessful" participants perceived these as stressors which acted as a barrier to weight loss either by making it difficult to manage time or maintain routines:

"I've got six children, and my father-in-law lives with me as well, most of the time I'm cooking six different meals because they don't want to eat what I'm eating…This is why it's all gone pear-shaped – my husband's dad had a heart attack and pneumonia a few weeks back and it was quickly decided that he should live with us." (p7, "unsuccessful", female)

If the stressor made the participant preoccupied with negative emotions (e.g. grief), if they had other tasks to complete, or had a lack of social support this acted as a barrier:

"I think for me, when my dad got his diagnosis, it was quite a shock that day, I did go into group and I said that I felt I was probably going to go off for a couple of weeks and try and find some sort of way forward with this, because my brother lives in Oxford, my other two brothers are estranged from my dad, and there's me, and I provide a lot of one on one care for him, especially with mobility and shopping and things like that, cleaning, looking after his personal health. So for them to tell us that he may possibly have to go into care and sell the house and things like that, because he may well decline quite quickly, was quite a shock to me. I did eat things I shouldn't have done. I've spent quite a lot of time thinking about it, which has been quite honestly all I can focus on." (p17, "unsuccessful", female)

5.4.2 Interpersonal differences

There were a few interpersonal differences when comparing "successful" and "unsuccessful" participants. The themes where there were differences were *solutions to negative influences, negative social reactions,* and *resistance to social support.*

5.4.2.1 Solutions to negative influences

When considering ways to cope with social relationships which were a bad influence there were subtle distinctions between "successful" and "unsuccessful" participants. In both groups, most participants did nothing to address these influences. When they were proactive in finding solutions, "unsuccessful" participants tended to make attempts to reduce contact or avoid these interactions:

"At the end of the day, what you do with other people, it really does influence you, but if you are going to push to make that change, you've just got to either cut off from them people for that little bit of time, you know, and that's what I did with her before." (p4, "unsuccessful", female)

Whereas "successful" participants tried to source solutions and manage these influences. This could include driving to meet so they didn't have to drink

alcohol, arranging social meetups that involved a walk rather than food or trying to educate others. One participant even referred a friend to the programme as a way of managing her negative influence:

> *"And there's no point talking to her because she doesn't get it. And then it's hard just to have your normal coffee before with her, you know. So I have sent her a referral to this but I don't think she's in the right mental place to do it." (p3, "successful", female)*

5.4.2.2 Negative social reactions

Negative social reactions included reactions others had to the participant's weight loss attempts and the participant's behavioural reactions to social conflict. Negative social reactions from others included not understanding why the participant was trying to lose weight (i.e. either thinking they don't need to lose weight, or thinking they should be focused on other health concerns), or giving feedback that the weight loss made the participant look unwell:

> *"…people kept coming up to me and ask if I was ill because I was…they're used to seeing me with a fuller face, whereas I was kind of gaunt then" (p44, "unsuccessful", male)*

"Unsuccessful" participants reported feeling annoyed when seeing others eating unhealthy or successfully losing weight:

> *"I think as well if I see, like, thin people eating loads of rubbish I think, oh, why can't I do that and maybe if I just have this it won't affect me" (p20, "unsuccessful", female)*

"Unsuccessful" and "successful" participants did have differences in their reactions to social conflict. As discussed in section 5.4.3.1, social conflict relates to negative social interactions such as diet/weight-specific comments or general disagreements. "Unsuccessful" participants became reactive to such negative interactions through a range of harmful behaviours to their weight loss. This included hiding food, secretly eating, comfort eating or rebelling in front of the person by overeating or making unhealthy choices (see section *5.4.5.2)*:

"I think sometimes attitudes a bit like my parents, tend to make me more likely to rebel than conform. So sometimes the fact that they think it's better to be thin just makes me want to be fat. Just to be awkward." (p36, "unsuccessful", female)

"He's nagged for most of the last 15-20 years: you need to lose weight, you need to lose weight, and each time I put dinner out, he will say, I hope you're cutting back. It's almost like the voice in the head, kind of thing. And I guess part of that might be why I still sneak food and hide food, so that he doesn't know it's there either." (p25, "unsuccessful", female)

5.4.2.3 Resistance to social support

Again, there appeared to be subtle differences in how receptive "unsuccessful" and "successful" participants were to support. Both groups reported being discreet and sharing their attempts with a few people. The reasons for this were either fear of failure or hoping that others will comment on their weight loss. However, "unsuccessful" participants were more resistant to support which was accessible to them. In cases where friends or family offered support in the form of reminding them of their diet and encouraging them not to slip, "unsuccessful" participants were more likely to report rebelling against this advice (see 5.5.3.2). "Unsuccessful" participants described purposively not telling others to avoid this kind of accountability:

"I don't always tell everyone if I'm going to go on a diet or a different eating routine because I sometimes find if you do and then you eat something you shouldn't someone might turn round and say, oh, I thought you were on a diet or you shouldn't be eating that" (p20, "unsuccessful", female)

In scenarios where participants did disclose their attempts, "unsuccessful" participants were reluctant to accept advice or emotional support. One participant reported his spouse trying to be supportive, but it caused him to become obstinate and disengaged:

"But my wife's very supportive, probably more supportive than I allow her to be. I can be obstinate. When I don't want to be spoken to, I'll be very difficult about it, so, you know, she's very patient about it." (p34, "unsuccessful", male)

5.4.3 Environmental Differences

5.4.3.1 Work Patterns

An environmental barrier to weight loss which was identified by "unsuccessful" participants was work patterns. This was not reported in the "successful" group. Participants discussed how their work patterns impacted the time they could commit to their weight loss. This included finding time to cook and to engage in PA both within the workplace and once they returned home after work. They attributed this largely to their work routines (i.e. long, or irregular work hours, travel required as part of their job, being on call or their commute) causing them to feel fatigued, unable to fit in PA or mealtimes or unable to plan for their day:

"I could be in the car for about six hours, like, a round trip and then could be out the car for five/six hours and you can't wear your smartwatches or anything like that in there…. I find that difficult because I don't really know my step count. And then sometimes I try and plan my food for the day to take with me but if I'm not prepared then I end up just buying something and that can be difficult. Or if I'm travelling back and, you know, have to stop for fuel and then you think, oh, there's some sweets there, I might just get some of those for the journey home" (p20, "unsuccessful", female)

5.4.4 Cultural barriers

Only "successful" participants identified cultural barriers. This was either in the form of *media* or *public health messaging*. Participants felt media often treated people living with obesity negatively and had a role in shaping how they were being treated:

"…things like social media, watching TV, and the way we are as a society that, you know, maybe it's getting better, and maybe it's because I'm a bit older, and it used to be so much worse, that, you know, just the whole thing about how people who are overweight are treated" (p31, "successful", female)

This seemed to be echoed in public health messaging. While such messaging was recognised as offering some educational benefits, it was noted that often they elicited negative emotions which could be counterproductive:

"I recognise obviously there're health benefits and they should put in, you know, the public health messages about weight loss, and stuff, but equally it also makes people who are overweight constantly feel shit, which often doesn't help to, you know, encourage people to lose weight because if you feel shit you often just need to eat bad stuff because it gives you some fleeting comfort." (p12, "successful", male)

5.5 Reflexivity

While conducting and analysing qualitative data it is important to consider the influence of the interviewer. The rapport and relationship built between the interviewer and participant could influence the direction the interview takes, and the responses collected (293). Accordingly, to reduce the risk of bias, the interviewer must try to minimise their influence over the participant's responses. To do this, the interviewer should adopt a neutral standpoint and set aside their attitudes, beliefs, and experiences. In a semi-structured interview format, the interviewer should follow the interview schedule and respond accordingly to what the participant says, without allowing their expectations to influence the direction of the conversation (294). Striking a balance between following the interview guide and responding to topics brought up by the participant can be challenging but it is important to enquire further to gain as much insight as possible (295). During the interview, the interviewer should express empathy and build rapport with participants to encourage the flow of conversation and to make participants feel more comfortable discussing their experiences (271,296).

Therefore, it is important to consider how my role and experience influenced the results since the interviews were a major component of this work. Before beginning this project, I had completed a MA (Hons) in Psychology and an MSc in Clinical Health Psychology. Both courses provided learning on qualitative approaches and methods. To refresh the learning from these courses, I completed a qualitative methodology postgraduate research course in the first year of my PhD. In previous research assistant posts, I was able to use this training in real life with a variety of groups including patients who had suffered from a stroke, carers, and adults who were on a weight loss trial. This was in different settings (e.g. hospital, in the home, in offices) and formats (e.g. face-to-face, telephone, groups and 1:1). I also had support work experience with older adults, children living with learning disabilities, adults living with autism, and adults living with severe and enduring mental illness. These roles shaped my interviewing style and skills, for example adapting language to suit the individual, active listening skills and the ability to build a rapport quickly with a variety of people. This previous work experience also developed my self-coping skills to manage my mental health if any distressing conversations transpired. While preparing my interview schedule I also recognised that I had my expectations about what participants would talk about. To try and ensure I was not influencing the results, I tried to phrase questions neutrally and consulted patient representatives of people living with obesity in the formulation of the questions (see section 3.3).

I phoned all participants before the interview to provide information on the study and answer any questions. Following this, any queries were discussed via email. This gave participants a degree of familiarity with me and for most of the interviews, this resulted in a rapport to build quickly. All interviews were conducted over the telephone which may have made participants feel more comfortable discussing their weight loss journey due to a sense of anonymity. Throughout the project, I wrote in a reflexive journal at the end of each interview. This included key thoughts/ideas from the interview, and if any areas of the interview schedule should be updated. This enabled me to identify questions which were unclear and consider ways to improve.

Additionally, it is critical to consider my impact on the way the collected data was analysed. My expectations could impact the way data is coded and understood. To address this, a coding framework was created and used on a proportion of the interview transcripts. This was reviewed by two supervisors (SS and AM), and any discrepancies were discussed. Once an agreed framework was developed this was applied to all transcripts. To avoid further researcher effects on coding, the transcripts were not categorised as "successful" or "unsuccessful" until after coding was completed. This enabled an unbiased comparison of themes between groups.

5.6 Results Summary

This qualitative exploration of barriers and facilitators of weight loss for adults living with obesity showed there were many commonalities between "successful" and "unsuccessful" groups. Across all levels of the social-ecological model, both groups reflected on similar factors which could help and hinder their weight loss journey. Overall, participants provided more interpersonal and intrapersonal factors than other aspects of the social-ecological model. The most cited factors were emotional regulation, cognition, and social interplay. This may be due to these factors being easier for individuals to recognise, the focus and learning within the programme, or reflecting wider societal norms (i.e. attitudes that obesity is an individual problem and not a consequence of the obesogenic environment).

When comparing the differences between "successful" and "unsuccessful" participants, the key difference seemed to be in how the groups reacted to different factors. "Unsuccessful" participants noted difficulties in work patterns (i.e. making dietary or PA changes difficult). However, there were "successful" participants with similar professions and work demands. As with the intrapersonal and interpersonal differences, "unsuccessful" participants were less pragmatic and flexible in finding their solutions. It is also noteworthy that only "successful" participants considered the role of the media and public health messaging on wellbeing and motivation in adults living with obesity. Cultural influences were not explicitly explored in the interview, however, only "successful" participants bringing these ideas up may indicate a difference in

how "successful" and "unsuccessful" participants consider barriers to their weight loss.

The following chapter will focus on the personal network data collected as part of the surveys and the interviews. This explores further the interpersonal influences on weight loss.

6 Results: Personal networks

6.1 Chapter Outline

This chapter presents the results of the personal networks data analyses. The personal networks were collected as part of the online surveys and the interviews.

6.2 Survey data (T1 & T3); a preliminary exploration

The survey data results are described below. Due to limitations of the survey (see section 7.5.3 for a fuller explanation) software and in the completion of the surveys, the quality of the networks collected was poor (i.e. missing data, incomplete or incorrectly completed answers). The data collected through the survey would not warrant appropriate comparisons between "successful" and "unsuccessful" participants. Considering this, I opted to provide an overview of the data collected below.

6.2.1 Ego Characteristics

A total of 129 participants (egos) took part in the personal network data collection at T1. Of these, 102 completed the data collection at T3. A summary of ego characteristics can be viewed in Table 6-1 below. Ego characteristics were largely similar at both time points with approximately 86% identifying as female and a mean age of 49 years.

Table 6-1 Descriptive characteristics of the egos from the personal network surveys at T1 and T3.

Ego Characteristics	Timepoint 1 (Baseline, 0-2 weeks)	Timepoint 3 (End of programme, 12 weeks)
Total (n)	129	102
Female (%)	86	85.7
Age (mean, SD)	49.22 (11.36)	49.58 (11.52)

6.2.2 Network Characteristics

The egos identified a total of 566 alters at T1 and 486 alters at T2. The average number of alters nominated was 4 at each time point, with a range of 0-12

alters. These numbers are low compared to network sizes in previous research (297,298). To explore how connected networks were, density scores were calculated (160). The average density at T1 was 0.52 and at T2 was 0.58 suggesting there was variation in how cohesive networks (i.e. with some networks being very interconnected and others being sparse) were at each time point. To explore whether alters encountered the ego in a single setting (i.e. uniplex relationship) or more than one setting (i.e. multiplex relationship) a multiplexity score was calculated (160). Across both time points, alters were encountered mostly in a single setting – which is detailed in Table 6-2 below.

Table 6-2 Descriptive characteristics of the networks collected from the personal network surveys at T1 and T3.

Network Characteristics	Timepoint 1 (Baseline, 0-2 weeks)	Timepoint 3 (End of programme, 12 weeks)
Maximum number of alters	12	12
Minimum number of alters	1	0
Network size (mean, SD)	4.39 (2.72)	4.34 (3.12)
Network Density (mean, SD)	0.52 (0.32)	0.58 (0.34)
Multiplexity (%)		
Uniplex	85.00%	78.40
Multiplex	15.02	21.40
Missing Data	0.00	0.00

6.2.3 Alter Characteristics

The majority of alters were female (65.02% at T1, 63.79% at T3). Most relationships were long-term with 45% at T1, 46.9% at T2 being for 21+ years, and another 21% being greater than 10 years at both T1 and T2.

Egos reported that they would confide or seek advice from the majority of the alters they nominated (70.49% at T1 and 69.75% at T3). The majority of alters were perceived as having healthy body weight (60.25% at T1, 59.67% at T3) with the next majority being described as overweight (35.87% at T1, 34.77% at T3).

The characteristics of the alters are shown in table 6-3 below.

Table 6-3 Descriptive characteristics of alters collected from the personal network surveys at T1 and T3.

Alter Characteristics	Timepoint 1 (Baseline, 0-2 weeks)	Timepoint 3 (End of programme, 12 weeks)
Total (n)	566	486
Female (%)	65.02	63.79
Age (category, %)		
Under 18	2.47	3.91
18-30	10.78	13.79
31-40	15.02	14.20
41-50	19.61	16.87
51-60	28.27	26.54
61+	23.50	24.28
Missing Data	0.35	0.62
Relationship (category, %)		
Child	12.01	16.26
Spouse/Partner	12.90	12.97
Parent	9.36	10.08
Sibling	8.13	7.00
Other Family	3.36	3.09
Friend	39.93	39.30
Colleague	10.78	7.82
Other	4.06	2.88
Missing Data	0.18	0.82
Duration of relationship (category, %)		
Less than 1 year	3.89	2.26
1-2 years	6.01	7.00
3-5 years	12.01	12.35
6-10 years	11.66	9.47
11-15 years	10.25	10.70
16-20 years	10.60	10.49
21+ years	45.41	46.91
Missing Data	0.18	1.03
Advice or confide (%)	70.49	69.75
Weight Status (category, %)		
Underweight	3.71	4.94
Healthy Body Weight	60.25	59.67
Overweight	35.87	34.77
Missing Data	0.18	0.82

6.3 Interview data (T2)

During the interviews, more comprehensive networks were collected (see section 3.8). These were conducted over the telephone so there were no limitations on the number of alters an ego could nominate and the errors that prevented analysis at T1 and T3 were avoided because I was able to answer any queries and direct participants when it seemed they misunderstood the task.

The higher quality data enabled a comparison between "successful" and "unsuccessful" participants in this network data.

6.3.1 Ego Characteristics

A total of 46 participants (22 "successful" and 24 "unsuccessful") took part in the personal network interviews. Two participants from the interviews declined to do the task: one due to time demands and the other due to disliking the survey process. A summary of ego characteristics is available in Table 6-4 below. Most of the egos were female (81% "successful" and 79% "unsuccessful"). The "successful" participants were slightly older than the "unsuccessful" participants, with most participants being in their 40s or 50s. More of the "successful" participants completed the programme than the "unsuccessful" participants.

Table 6-4 Descriptive characteristics of egos from the personal network interviews at T2.

Ego Characteristics	"Successful" (>5% weight)	"Unsuccessful" (<5% weight)
Total (n)	22	24
Female (%)	81.81	79.17
Age (mean, SD)	51.64 (+/-8.39)	46.65 (+/- 11.56)
Programme Status (%)		
Complete	81.81	33.33
Incomplete	13.64	58.33
Lost to follow-up	4.55	8.33

6.3.2 Network Characteristics

The average number of alters nominated was 10.76, with a range of 4-29 alters (see table 6-5). Participants were more receptive to the interview collection of personal networks. Interviewees were asked for their feedback and comparison of both approaches. They reported that they found the task to be confusing or laborious in the online format, potentially contributing to the low network sizes in the surveys.

Table 6-5 Descriptive characteristics of the networks collected from the personal network interviews at T2.

Network Characteristics	All (n=46)	"Successful" (n=22)	"Unsuccessful" (n=24)
Maximum number of alters (n)	29	18	29
Minimum number of alters (n)	4	6	4
Network size (mean, SD)	10.76 (+/-4.56)	11.32 (+/-3.71)	10.25 (+/-5.25)
Network Density (mean, SD)	0.51 (+/-0.21)	0.49 (+/-0.19)	0.52+/-0.23)
Network Weight Status Entropy (mean, SD)	1.05 (+/-0.30)	1.04 (+/-0.28)	1.05 (+/-0.32)
Network Weight Loss Entropy (mean, SD)	1.19 (+/-0.39)	1.17 (+/-0.40)	1.20 (+/-0.39)
Multiplexity (%)			
Uniplex	70.30	67.07	73.58
Multiplex	29.09	32.53	25.61
Avoid[3]	0.62	0.40	0.81

The average density was 0.51 which a standard deviation of 0.21, showing there was variation in how cohesive networks were between participants. However, when comparing the densities between groups they were similar ("successful" =0.49 and "unsuccessful" = 0.52) suggesting that differences in the density of networks were not related to weight loss success. This is reflected in Figure 6-1 below which shows the density of networks grouped by whether participants "successfully" achieved a 5% weight loss or not. The boxplots demonstrate greater heterogeneity in the density of networks across both weight loss categories. Although, visually, the boxplots do suggest "successful" participants have less variation in how connected their networks are (except for a few outliers). Most "successful" participants have 40-50% of their alters connected.

Most alters (70%) were nominated as only interacting with the ego in one setting. 29% of alters were described as someone the ego interacted with in more than one situation (i.e. multiplex, e.g. at home and online). A total of fourteen alters were described by egos as someone they had tried to avoid while taking part in the programme. Three of these were cases where the ego had managed to avoid

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[3] Participants were able to nominate someone they had spent time with as someone they had tried to avoid or minimize time with. The values represented here show the percentage of alters who participants avoided with no other interactions.

and had not been encountered in other settings (these are represented as "Avoid" in the multiplexity section of Table 6-5).
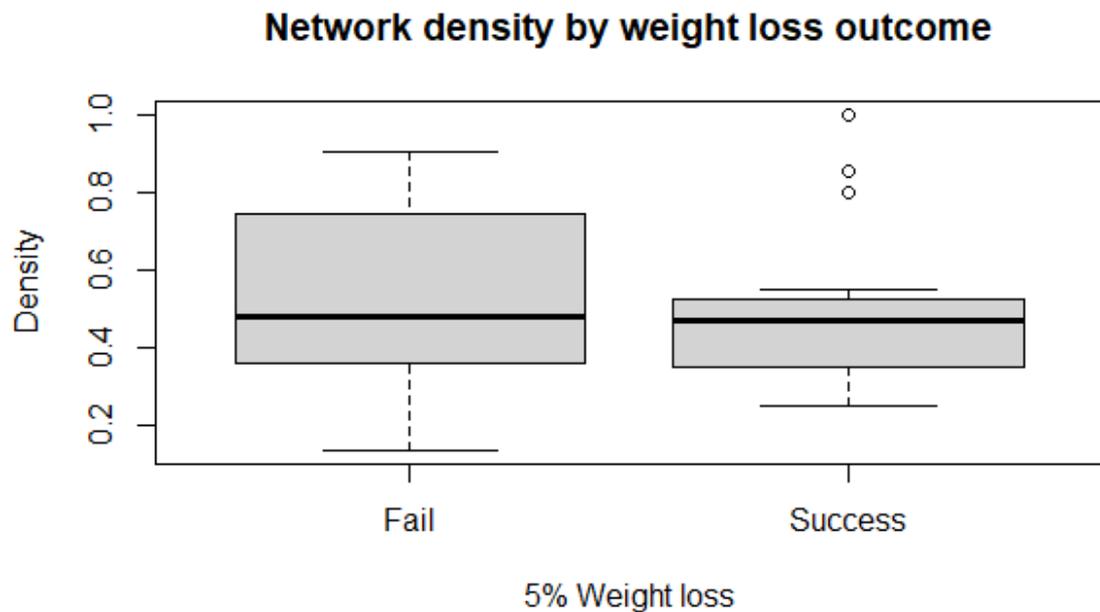
Figure 6-1 Network density of "successful" and "unsuccessful" participants

Network entropy was calculated to assess how heterogeneous the alters were with one another in terms of their weight status and whether they were also trying to lose weight. This measurement shows how similar alters are to one another and shows if particular network characteristics (e.g. having a lot of alters trying to lose weight) influence weight loss. The mean weight status entropy was 1.05 (+/- 0.30) and the mean weight loss entropy was 1.19 (+/-0.39) suggesting low levels of heterogeneity in weight status and weight loss status in alters. This was found across groups.

6.3.3 Alter Characteristics

Table 6-6 provides an overview of the alter characteristics. The egos nominated a total of 495 alters. Just over half of the alters were female (63%) with a mean age of 46 years. Most alters were either family members or a friend, with other nominees largely being neighbours. "Successful" participants seem to nominate more "Other family" members (i.e. nieces, aunts, uncles, cousins etc) than "unsuccessful" participants, while "unsuccessful" participants nominated more

friends and colleagues. Most relationships were long-term, with 44% being longer than 21 years. The majority of alters were in contact with egos at least weekly with 68.7% being described as either daily or 2-3 times per week for contact frequency.

68.69% were described as someone the ego would seek advice from or confide in. "Successful" participants reported more relationships they would use to confide in. To assess the role of influence, participants were asked whether they looked up to or admired each alter. 94% of alters were described as someone they admired. To gain insight into whether the weight status of those in their network related to their weight status, egos were also asked about the weight status of each alter. The majority of nominated alters were described as someone with a healthy body weight by egos (57.8%) and as someone who was not trying to lose weight (59%).

Table 6-6 Descriptive characteristics of alters collected from the personal network interviews at T2.

Alter Characteristics	All (n=46)	"Successful" (n=22)	"Unsuccessful" (n=24)
Total (n)	495	249	246
Female (%)	63.03	65.86	60.16
Age (mean, SD)	46.04(+/-18.88)	46.05(+/-7.11)	44.89(+/-8/64)
Relationship (%)			
Child	14.55	13.25	15.85
Spouse/Partner	7.47	7.22	7.72
Parent	8.69	8.84	8.54
Sibling	6.67	7.22	6.10
Other Family	10.91	14.06	7.72
Friend	32.53	29.32	35.77
Colleague	11.52	10.04	13.01
Other	7.68	10.04	5.28
Duration of relationship (%)			
Less than 1 year	4.65	4.02	5.28
1-2 years	4.65	5.22	4.07
3-5 years	13.13	16.06	10.16
6-10 years	12.53	6.83	18.29
11-15 years	11.11	6.83	15.45
16-20 years	9.49	8.84	10.16
21+ years	44.44	52.21	36.59
Contact Frequency (%)			
Daily	34.74	35.74	33.74
A couple of times per week	33.93	36.55	30.08
2-3 times per month	22.83	22.89	22.76
Once per month	6.06	4.02	8.13
Less than once per month	2.42	0.80	4.07
Advice or confide (%)	68.69	69.88	67.48
Admire (%)	94.14	94.38	93.90
Weight Status (%)			
Underweight	5.86	4.02	7.72
Healthy Body Weight	57.78	57.83	57.72
Overweight	36.36	38.15	34.55
Trying to lose weight? (%)			
Yes	25.45	28.11	22.76
Maintain	8.69	8.84	8.54
No	58.99	59.04	58.94
Don't know	6.87	4.02	9.76

6.3.4 Statistical analysis

To assess whether network or alter characteristics were associated with ego's weight loss, a series of Pearson correlations were performed.

6.3.4.1 Network Characteristics

There were no correlations between the ego's weight loss and the characteristics of the network. There was no significant relationship between ego's weight loss and the network size (r(44)=-0.09, p=0.56), whether alters were also trying to lose weight (r(44)=0.07, p=-0.62), whether alters had a similar weight status to the ego (r(44)=0.02, p=0.89) or in network density (r(44)=0.27, p=0.07).

6.3.4.2 Alter Characteristics

Additionally, no significant correlations were found between ego weight loss and the characteristics of the alters. There were no associations between being exposed to an alter in multiple contexts (network multiplexity r(44)=-0.11, p=0.45), with increased frequency of contact (daily = r(44)=-0.10, p=0.52), 2-3 times per week = r(44)=-0.12, p=0.43) or with support from alters (r(44)=-0.16, p=0.27). Weight status of alters also was not correlated with weight loss of the ego: alters having a healthy body weight (r(44)= -0.08, p=0.61), or alters being overweight (r(44) = -0.12, p=0.44) or alters also trying to lose weight (r(44) =-0.17, p=0.27). Since no correlations were found, no further analysis was performed.

Given the lack of variability in whether the ego admired an alter (i.e. 94% of alters were described as someone the ego looked up to), correlations were not performed. Similarly, only 14 alters were described as someone the ego would avoid, so this was not investigated further, however qualitative reasons for avoidance are discussed below.

6.3.5 Qualitative findings on the role of personal networks

Only 14 alters were described by egos as someone they had tried to avoid or minimise contact with. Due to this low number, avoidance reasons were explored to try and provide some insights into how this may interact with weight loss.

Egos described the feeling that alters would be a bad influence, encouraging them to cheat or to "treat" themselves as a reason they tried to minimise contact with an alter:

> *"one chocolate won't matter and then it would be two chocolates…and you know, you feel like you can't say no and things like that" (p39, "successful", female)*

Participants reported in these situations feeling rude or unable to say no to offers of food or alcohol and so choosing to minimise contact:

> *"At the end of the day, what you do with other people, it really does influence you, but you are going to push to make that change, you've just go to either cut off from them people for that little bit of time" (p4, "unsuccessful", female,)*

Other reasons included the ego feeling embarrassed about their appearance or comparing themselves to an alter who had previously been "successful" in losing weight:

> *"She seemed to lose weight really quickly and she's always been naturally skinny, and I know I would be bigger than her even when she is pregnant" (p20, "unsuccessful", female)*

Finally, egos reported avoiding interactions with alters due to COVID-19. Alters who were perceived as having a higher risk of complications with COVID-19 were avoided.

6.3.6 Egonets

Egonet diagrams (available in figures 6-2, 6-3, and 6-4) were produced to visualise networks. Below are examples of different types of networks which illustrate how information and influence might affect an ego. In each diagram, the ego (participant) is in white and the alters are shown in different colours according to their weight status. shows the alters in different colours depending

on their weight status. Please see appendix 15 to view all the egonets collected from the interviews.

Figure 6-2 shows an ego network from an "unsuccessful" participant. The network shows three distinct groups – friends, family, and colleagues. There is a bridge between the family and friendship groups where information may be shared between these groups. However, the colleagues' group is unconnected to others in the ego's network. This layout of a network suggests the ego has three distinct groups which may influence his/her behaviours and the information they receive. The friendship and family groups are more likely to be similar in the information they have, with the colleague group being the most novel (299). The network is also mostly in the overweight category.
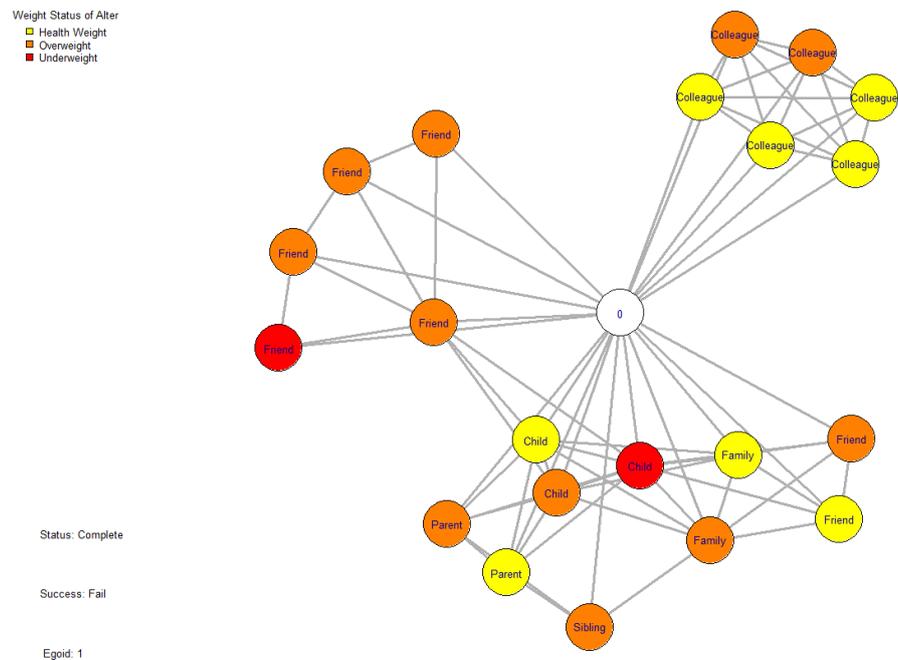
Figure 6-2 Personal network of an "unsuccessful" ego showing distinct groups.

Figure 6-3 shows a "successful" ego. This ego has a highly connected network, and it is likely the ego is less exposed to novel information due to the alters in the networks sharing information amongst each other. This network is mostly in the healthy weight category.
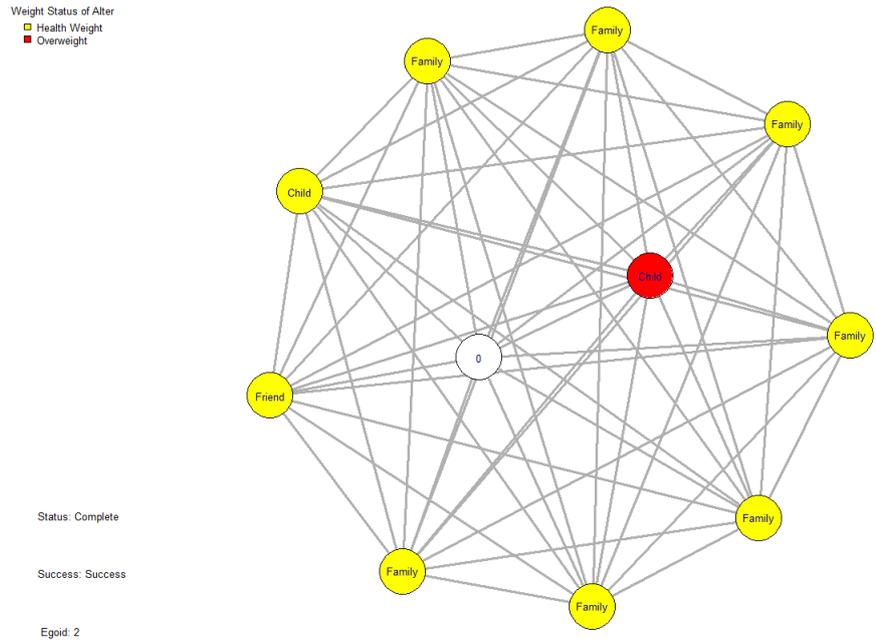
Figure 6-3 Personal network of a "successful" ego showing an interconnected network.

Figure 6-4 shows an "unsuccessful" ego. This network is sparser than the other two. The network has two groups who will share similar information but also has a few isolates suggesting this ego would be exposed to more novel information than the egos above.
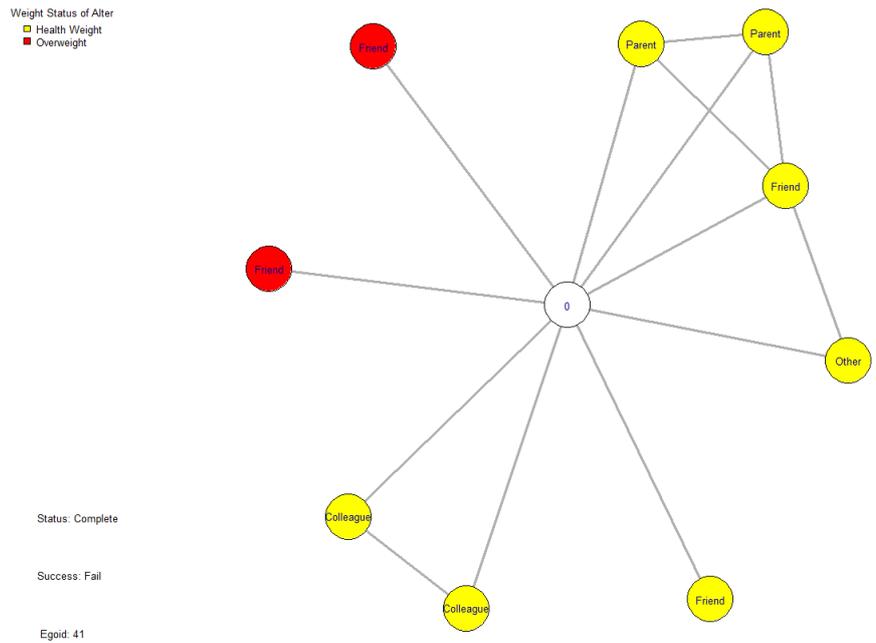
Figure 6-4 Personal network of an "unsuccessful" ego showing fewer connections and isolates.

6.4 Results Summary

Overall, the results did not find any clear differences between the networks of "unsuccessful" and "successful" egos. The average network size collected in the surveys was 4.35 and in the interviews was 10.76. Egos largely nominated alters who were supportive of their weight loss efforts, who they admired, who had a healthy weight status and who were not trying to lose weight. Qualitative reasons for avoiding an alter were also gathered. These included the alter being a negative influence, the ego feeling unable to refuse temptation when socialising with the alter, socialisation having a negative impact on the ego's wellbeing, and COVID-19.

7 Discussion

7.1 Chapter Outline

The overarching aim of this work was to explore the barriers and facilitators, through a social-ecological lens, faced by adults living with obesity taking part in a behavioural weight loss programme. Such programmes are efficacious in supporting healthy weight loss for many people (61,86), yet some participants still struggle to achieve "successful" weight loss (i.e. either due to drop-out or not losing 5% of their body weight during the programme) (65,89). Gaining insight into what helps and hinders success in such programmes and exploring differences between "successful" and "unsuccessful" participants can help build evidence on what can be adapted or added to programmes to foster higher success rates. With the increasing prevalence of obesity and co-morbid health issues, it is in the public interest to improve programmes to manage the personal and societal costs of obesity (e.g. health care costs). Research has shown that progress within the first two months in a programme can predict whether someone will be "successful" by the end of the programme and whether they maintain weight loss in future years (129,300). Yet, there is limited exploratory research on what happens during participation that leads to success or failure. Most of the evidence in this area focuses on baseline predictors of weight loss, or follow-up qualitative and quantitative research. There is, therefore, a need to explore which factors, from a participant's point of view while attending a weight loss programme, explain varying trajectories of success, thus providing valuable information on how to improve programmes and policy.

The overall purpose of this chapter is to discuss the key findings while considering the wider literature and illustrate how the results provide insights into factors which should be considered in future intervention development, research, policy, and practice. I will begin by summarising the findings from each study, then, I will draw on the findings to build a comprehensive summary of the barriers and facilitators experienced across each level of the SEM with comparisons to the literature. Key differences between "successful" and "unsuccessful" participants in perceived/reported barriers and facilitators will be highlighted. The strengths and limitations of the four studies will also be considered.

7.2 Overview of findings & comparison to previous literature

7.2.1 Systematic review findings

The review aimed to systematically gather the evidence and synthesise the barriers and facilitators of weight loss during participation in behavioural weight management programmes. Identified themes were categorised using the social-ecological model (see section 2.4 for further details).

Barriers and facilitators were categorised as intrapersonal, interpersonal, environment-related, cultural, political, or programme-related. This resulted in 14 intrapersonal, 3 interpersonal, 15 programme, 4 environment, 2 cultural, and 1 political barrier(s), and 17 intrapersonal, 4 interpersonal, 16 programme, and 3 environmental facilitators being identified (see section 2.6, tables 2-8 and 2-9 for an overview of the themes).

Overall, the review identified more intrapersonal factors as influencers of success than other constructs, which is in line with other reviews (193). Key factors included motivation, self-efficacy, adoption of specific behaviours, having a sense of control, and emotional regulation. A systematic review of self-regulation mediators for successful behaviour changes in obesity interventions also found these to be ingredients for changes to longer-term weight management and PA habits (142). They highlighted self-efficacy, autonomous motivation, and self-regulation skills (e.g. self-monitoring) as key contributors to PA change and weight control, while evidence on dietary control was unclear. Another review found that self-regulation was important for long-term weight maintenance through managing emotions, sourcing new habits in reaction to stress (i.e. rather than emotional eating), and managing how the person perceives themselves (i.e. their self-concept comprised of their self-esteem, beliefs about how they are managing their weight, their goals, etc.) (301).

Participants' health status influenced their abilities to take part in the programme and visible improvements to their weight or health were associated with success. These findings likely link to the intrapersonal constructs of self-efficacy and motivation. The role health variables play in successful behaviour

change may be understood through the health belief model (HBM) (302). This model poses that an individual's perceived threat/susceptibility of ill-health (e.g. developing type 2 diabetes due to higher weight), self-efficacy of making the necessary behavioural changes, and consideration of barriers and benefits of change are weighed against one another to form an individual's intention to change. A study assessing the HBM against weight management behaviours found perceived threat and self-efficacy of diet and exercise to be significantly associated with intention formation (303). Furthermore, the perceived threat was found to be a mediator for action, perceived benefits, and weight management practices. This suggests an understanding of health risks associated with a higher weight, and an understanding of the benefits of weight reduction could be key in motivation and intention. It may therefore be useful for programmes to consider ways to educate about the potential benefits of weight reduction and consider measurement of intermediate health outcomes during programmes (i.e. including evaluation methods that are not only considering weight measurement, e.g. mood, blood pressure, or glucose levels).

In my review health also interacted with interpersonal constructs. For example, one study included in the review found women were motivated to improve their health and weight to challenge societal stereotypes and stigma concerning lesbian women (206). These participants also wanted to increase acceptability in their group of managing their health and weight. This broadened the concept of a role model being a motivational factor outside of a participant's immediate family to the wider community. Other interpersonal constructs which were identified included feeling part of the group, social support, and comparing to others. The wider literature tends to focus on the influence of social support in weight management programmes (167). A review of the role of social support in behavioural interventions found it was linked to positive health outcomes for participants (304). There is evidence that the perception of receiving support is important for longer-term maintenance and success (157).

Environmental constructs which were discovered from my review included access to facilities (local and work environment), travel, weather, and the programme setting. These constructs acting as barriers and facilitators to programme attendance and weight management have been reported in other reviews

(193,305). Lee and colleagues note how an individual interacts with their environment will be determined by available resources and intrapersonal characteristics s (i.e. demographic factors such as race, age, and SES) (306). Specific to environmental resources, they emphasised deprived areas, higher perception of crime, and areas having an obesogenic infrastructure (i.e. poor walkability or transportation options, lower density of recreational facilities and fresh food) as contributors to obesity. These environmental variables contributed to obesity by reducing levels of PA (i.e. due to perceptions of safety or a lack of facilities) and having more exposure to unhealthy dietary options.

Unique findings of my review compared to other studies, related to the role of the physical environment and culture of in-person programmes. This was not found in the interviews or surveys because participants had been recruited from an online programme. The review identified a "cosy" and welcoming environment, as well as one suited for purpose (i.e. suitable flooring for PA) as contributing to how comfortable participants felt, which ultimately could relate to engagement. The cultural barriers identified were *events* and *norms*. Where programmes were *mindful* of a participant's culture in their approach or content this acted as a facilitator. This was used to describe programmes which acknowledged and incorporated aspects of the participants' culture in terms of their identity, interests, and customs. For example, incorporating a participant's favourite sport, religious beliefs or first language into the programme. Studies suggested this was an important facilitator as it increased enjoyment and adherence to the programme (205,234,240).

Programme-related factors included non-SEM constructs specific to content and guidance. These were included in my review as they interacted with other social-ecological constructs such as intrapersonal (e.g. engagement, like/dislike of the programme), interpersonal (e.g. group relations, comparisons) and environment. Any theme which was specific to the programme was grouped under this construct, meaning the programme category included different levels of the SEM. This enabled influential factors to be easily identified within and outside of the programme.

7.2.2 Survey findings and models

The surveys provided insights into the differences at baseline and the end of the programme between "successful" and "unsuccessful" participants across the social-ecological levels. Figure 7-1 provides a summary of all the factors that were significantly associated with success.
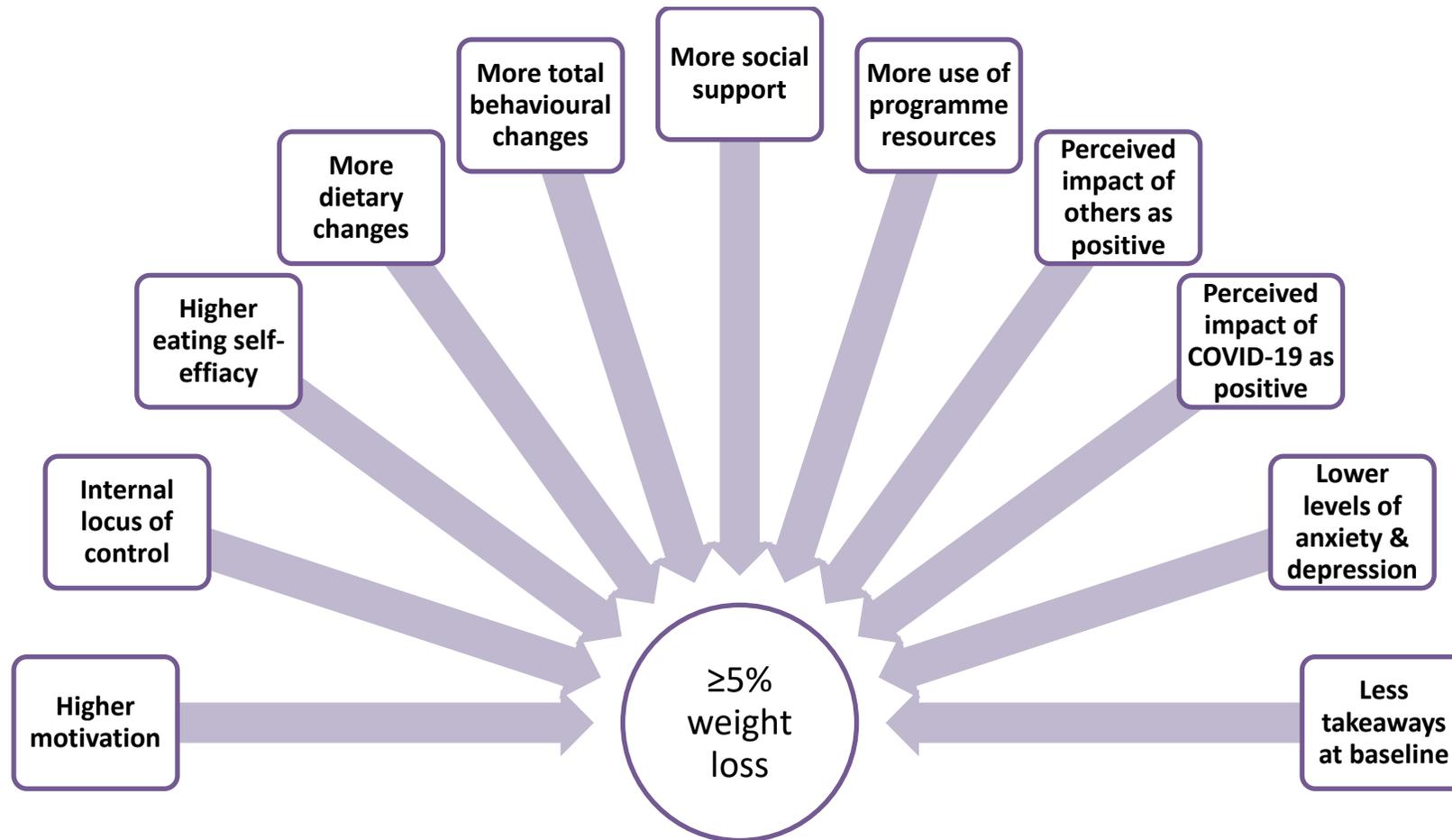
Figure 7-1 Significant factors contributing to "successful" weight loss (≥5%)

Considering the different levels of the SEM, I found significant differences between groups in intrapersonal, interpersonal, and programme-related variables. Compared to "unsuccessful" participants, I found "successful" participants had higher levels of motivation and eating self-efficacy, made more dietary changes and overall behavioural changes (i.e. PA and dietary changes combined), had lower levels of depression and anxiety, consumed less takeaways at baseline, and had an internal LoC. These variables are supported in the wider literature as facilitators of success (307–309) The range of cognitive variables may reflect an interplay of factors. For example, lower levels of depression during the programme may reflect a multitude of interacting cognitive variables associated with wellbeing and success – for example, lower levels of apathy, higher motivation, and higher willpower (310,311). While adopting more overall behavioural changes may be reflective of participants being more aware or feeling more able or motivated to make changes in their lives to support their weight loss. Internal LoC has been associated with more changes in both diet and PA and with longer-term maintenance of changes (312).

The only difference between groups in the interpersonal category was the levels of support at the end of the programme. Successful participants reported higher levels of support at the end of the programme from their household, from those they felt closest to and overall, compared to "unsuccessful" participants. This suggests support during participation in these groups is critical for successful outcomes. Reviews have found involvement and support from friends and family can be instrumental for success (313,314). Participants taking part in a behavioural weight loss programme who reported receiving frequent social support from friends and family were more likely to lose weight than women who never received it from their family (315). Notably in the survey, there were no significant differences in whether the people they spent time with were perceived as living a healthy lifestyle, suggesting levels of support are more critical to "successful" weight loss than the influence of the behaviour of those around them.

There were no significant differences in environmental variables between participants at baseline or the end of the programme (i.e. the number living in the household, PA facilities, the proximity of takeaways, or the number of

takeaways at the end of the programme). However, the number of consumed takeaways at baseline was significantly lower in "successful" participants. This is supported in the literature where healthier baseline behaviours (e.g. lower baseline takeaway consumption) were associated with greater weight loss and adherence to programmes (316,317). Although not found in this study, reduced takeaway consumption during participation has also been associated with longer-term success at follow-up (318). These findings highlight the importance of dietary behaviours for weight loss at the onset and during participation in programmes.

In terms of programme engagement, "successful" participants were significantly more likely to use the programme dashboard (i.e. an online platform to access materials, monitor progress and interact with the group and coach) and the recipes provided by the programme. There were no differences between the groups in the amount of interaction with the online group or coach. "Successful" participants were also significantly more likely to report that their coach and the group had a positive impact on their weight loss journey. There were no differences between groups in the impact of the education articles. These findings suggest engagement with the programme tools and behaviours (i.e. self-monitoring, accessing educational materials, using the recipes in daily life) supports "successful" weight loss. This, alongside feeling the group and coach/facilitator had a positive impact on their weight loss journey, facilitated success. This may be connected to feeling more supported by the programme (i.e. by the coach and thus feeling more enabled to engage with the tools and behaviours) and feeling a sense of camaraderie or belonging with the group (i.e. having people to support, share problems with, and motivate). Using structural equation modelling, Kim and colleagues similarly found facilitator and peer support interactions increased weight loss success in an online application (319). Specifically, they found facilitator support increased engagement with educational materials (i.e. articles read), and peer support (i.e. responses to posts) increased communication from participants (i.e. number of posts), both significantly associated with weight loss (319). This was reported by the qualitative studies found in the systematic review (phase 1 of this thesis) (201,205,206). A study by Nackers and colleagues found group perceptions influenced both adherence and attendance of programmes (320). They found

participants who perceived positive group dynamics (e.g. liking the group members) were more likely to attend, while perceived negative group dynamics (e.g. dislike of the group) was associated with lower attendance and lower adherence.

There were no differences in the impact of COVID-19 on their typical routines (i.e. routines pre-COVID-19) but there was a significant difference at the end of the programme in how participants perceived it as impacting their weight loss, with "successful" participants perceiving it as positive. Similarly, "successful" participants were significantly more likely to perceive changes to their social life caused by COVID-19 as positively impacting their weight loss. These findings suggest although there was little difference in the perceived degree to which COVID-19 impacted their weight loss, how such changes impacted an individual's wellbeing and outlook could impact success (see section 7.3.1 for further discussion).

Figure 7-2 below shows the variables from the strongest explanatory model of success. These were a lower number of takeaways consumed at baseline, more dietary changes (at baseline and the end of the programme), more perceived social support from the household and lower levels of anxiety at the end of the programme. A study by Hartmann-Boyce and colleagues found similar results to this, where higher levels of weight loss in programmes were significantly associated with motivational support and dietary impulse control (321). These findings complement the model in Figure 7-2 and the other associated factors in Figure 7-1 by highlighting the importance of motivation, support, and dietary behaviours. Their finding that motivational support was a key facilitator provides insights into the types of social support which harness success.
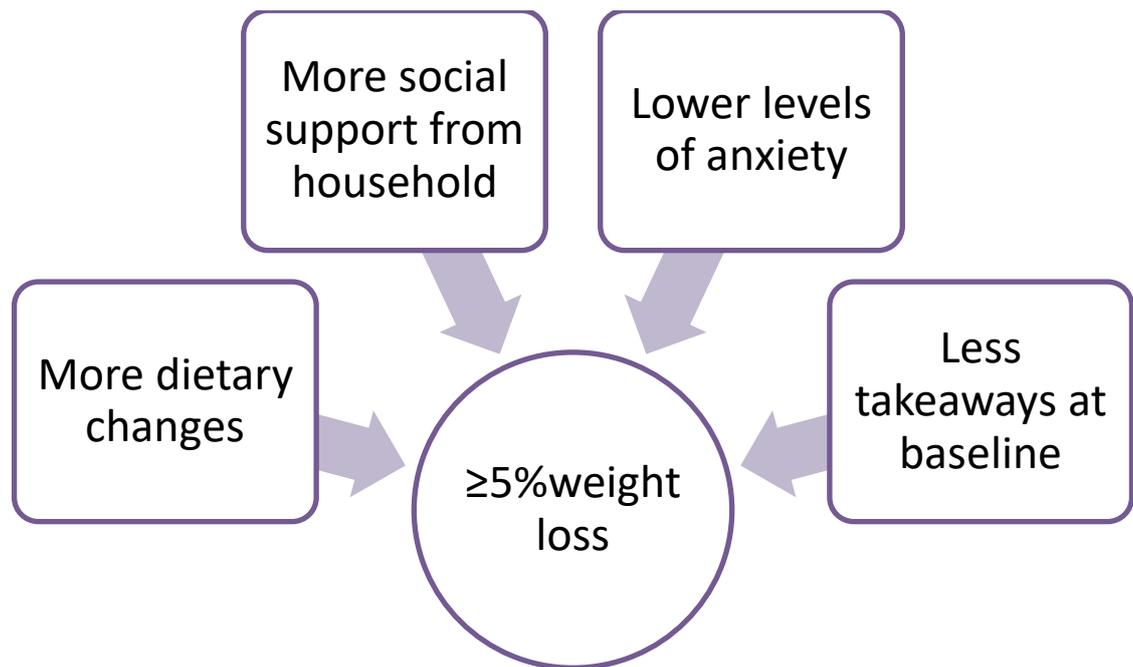
Figure 7-2 Final explanatory model of variables contributing to "successful" weight loss (≥5%)

Dietary changes and lower takeaway consumption being linked to success may be indicative of the participants already having a healthier diet, so the changes they had to make were easier to adopt. It could also indicate taste preferences or cooking skills at baseline and thus related to a smoother transition to cooking and consuming healthier meals. Research has shown that enhancing cooking skills and knowledge is significantly associated with weight loss (322). These factors may also interact and be influenced by eating restraint. For example, Elfhag and Erlanson-Albertsson found participants with a strong fat taste preference found it harder to restrict and control their dietary intake (323). Eating restraint at baseline has been found to be an important factor in weight loss during participation in programmes. Mason and colleagues found women who had greater baseline eating restraint made more dietary changes and achieved higher weight loss while participating in a behavioural programme (324). This suggests baseline behaviours are important to consider when trying to support change.

Lower levels and better management of anxiety have been linked to better weight management (325,326). Although there is some evidence that anxiety can facilitate changes (326,327). A review by Geiker and colleagues found stress and anxiety acted to hinder "successful" weight loss through physiological taste preferences changing because of stress (e.g. preference for higher calorie and higher sugar and fat content), prompting sabotaging coping behaviours (e.g. emotional eating) and participants becoming disinhibited when making dietary choices (e.g. absence of hunger cues or overeating) (328). It is likely how anxiety impacts weight management is linked to participants' self-regulation skills (142,329).

Finally, social support from those they live with seems to be an integral part of weight loss. This indicates the home environment, those they spend the most time with and those they eat with are key influencers on the changes participants are trying to make. How social support and social interplay interact was explored more fully in the qualitative study as discussed in the following section (see also section 5.3.2).

7.2.3 Qualitative findings

The qualitative interviews allowed exploration of the lived experience of participants and a deeper exploration of influential factors and how they interacted with participants' lives and impacted their weight loss. Of those who took part in the interviews, 46% (22/48) "successfully" lost 5% or more of their baseline weight (i.e. weight when they began the programme) by the end of the programme. This allowed the generated themes from the interviews to be compared between "successful" and "unsuccessful" participants.

Consensus on influencing factors appeared across multiple levels of the SEM. Intrapersonal factors included behavioural changes, cognition (i.e. motivation, willpower, knowledge, reaction to setbacks), emotion (i.e. emotional regulation), personal circumstances (e.g. finances), and physiological response (e.g. seeing improvements in health). Interpersonal influences were grouped as either social interplay factors (i.e. social roles, influence, norms) or the presence/absence of different types of social support. Programme constructs were related to how factors influenced engagement with the programme. These

included the cost of the programme, practical issues (e.g. technology issues, fitting into their schedule), group and coach relations, and the programme approach (e.g. mature, non-judgemental, credible).

Environmental factors within the home and local environment, access to green space, access to obesogenic amenities and feelings of safety in the local area affected dietary and PA behaviours. Specific work-related barriers were struggling to manage time (i.e. due to work hours or commute) and a lack of facilities for healthy food. Due to the COVID-19 restrictions in place at the time of the interviews, most participants were working from home so deeper insights into the impact of the work environment may have been missed. A review into workplace barriers for adults living with obesity found the infrastructure can inhibit healthy decision-making (330). Examples included having more access to unhealthy foods through canteens and vending machines, absence of exercise opportunities (i.e. due to sedentary jobs like a truck driver) and facilities (e.g. gym, walking areas, or showers), and perceptions of safety in the area the individual works (i.e. impeding whether an individual would leave the workplace for healthier food options or to engage in PA). Furthermore, they found organisational barriers such as workload affecting a participant's levels of stress and time to engage with healthy weight-related behaviours as barriers.

Although the interviews predominantly revealed commonalities in barriers and facilitators between participants, there were some key differences. Figures 7-3 and 7-4 provide an overview of the factors only reported by "successful" or "unsuccessful" participants, respectively. "Successful" participants were more likely to consider influences across different levels of the SEM (i.e. interpersonal, intrapersonal, and cultural), but "unsuccessful" participants focused more heavily on interpersonal barriers. Interestingly, cultural factors (e.g. public health messaging and media) were only discussed by "successful" participants. Recognising the wider and multiple influences on weight may be supportive of weight loss, as it is not focused on the individual, and more barriers are acknowledged and can be addressed. However, it is not clear whether there are differences between "successful" and "unsuccessful" participants in perceptions of cultural barriers since questions on cultural influences were not explicitly asked in the interviews. This was a limitation of

the interviews and future research should investigate cultural influences more fully.

Furthermore, where differences did appear, it was in how "successful" participants reacted and coped with barriers relative to "unsuccessful" participants. "Successful" participants were more proactive in seeking pragmatic solutions to their barriers. For example, they sourced solutions which would fit into their lives rather than avoiding or eliminating an issue (e.g. still going to a favourite restaurant but taking their food items). In terms of social interactions, "unsuccessful" participants reported experiencing negative social reactions to their weight changes (e.g. being asked if they were unwell), avoiding negative social influences (i.e. people who would encourage them to cheat), or blocking social support from others (i.e. by disengaging or becoming obstinate towards the person offering support). Although avoidance of negative social influences was not significantly associated with success in the personal networks, other personal network studies have found that severing ties with negative influences is not conducive to behaviour change (331,332), which supports avoidance of negative influences being the behaviour of "unsuccessful" participants. These differences in addressing barriers (i.e. pragmatic solutions versus avoidance/disengagement) suggest finding solutions which fit into someone's life rather than making bigger changes (e.g. to their social interactions) is more likely to be conducive to success which may be more sustainable and easier to adopt. This has been supported in the literature where self-efficacy and problem-solving skills have been linked to addressing barriers successfully (142).

Specifically related to weight, "successful" participants sought to understand their weight status and how this impacted their current or future health. "Unsuccessful" participants were more likely to report that a healthy bodyweight (according to BMI) would look unhealthy on them. This showed a difference in the focus of weight loss with "successful" participants focusing more on the relationship of their body weight to health whereas "unsuccessful" participants linked their body weight primarily to appearance. Perhaps this led to differences in weight loss targets and ideas of what success would look like to them (105). Research suggests having an accurate body image and seeing improvements in body satisfaction is related to obesity-related behaviours and

engagement with weight management programmes (333,334). However, there is a lack of evidence on differences between "successful" and "unsuccessful" participants in their perception of what healthy weight looks like. Understanding how differences in these attitudes impact a participant's weight status and weight loss is important for programmes. This could be connected to various aspects and experiences in the participants' lives. For example, Allen and colleagues suggest that initial approaches and subsequent interactions within the programme could play a key role in how a participant understands the health benefits of losing weight (335). This may be linked to feeling the target weight was unattainable or the negative social reactions experienced to weight loss mentioned above.

Participant groups described experiencing different situational stressors while taking part in the programme (e.g. death or ill-health of a loved one) but groups differed in how they reacted. "Successful" participants were more likely to report becoming more motivated to take care of their health and weight to avoid further problems in the future. This protection from future hardships as a motivation extended to protecting others in their life (e.g. avoiding the loss of another parent) or making future hardships more manageable (e.g. coping with caring for someone or preparing for surgery). However, "unsuccessful" participants reported experiencing negative emotions (e.g. feeling overwhelmed) and did not become more motivated in their weight loss journey because of these types of stressors. Research has found the number of stressors experienced is higher in adults living with obesity compared to adults with a healthy BMI range (336,337), and stressors are predictive of dropout and lower weight losses (89,338). Other qualitative research has found similar results with stressors either eliciting motivation or negative emotional and behavioural reactions (e.g. emotional eating) (339), with this being determined by coping strategies, social support and already ingrained beliefs and habits (340).

Figure 7-3 Factors only reported by "successful" participants.
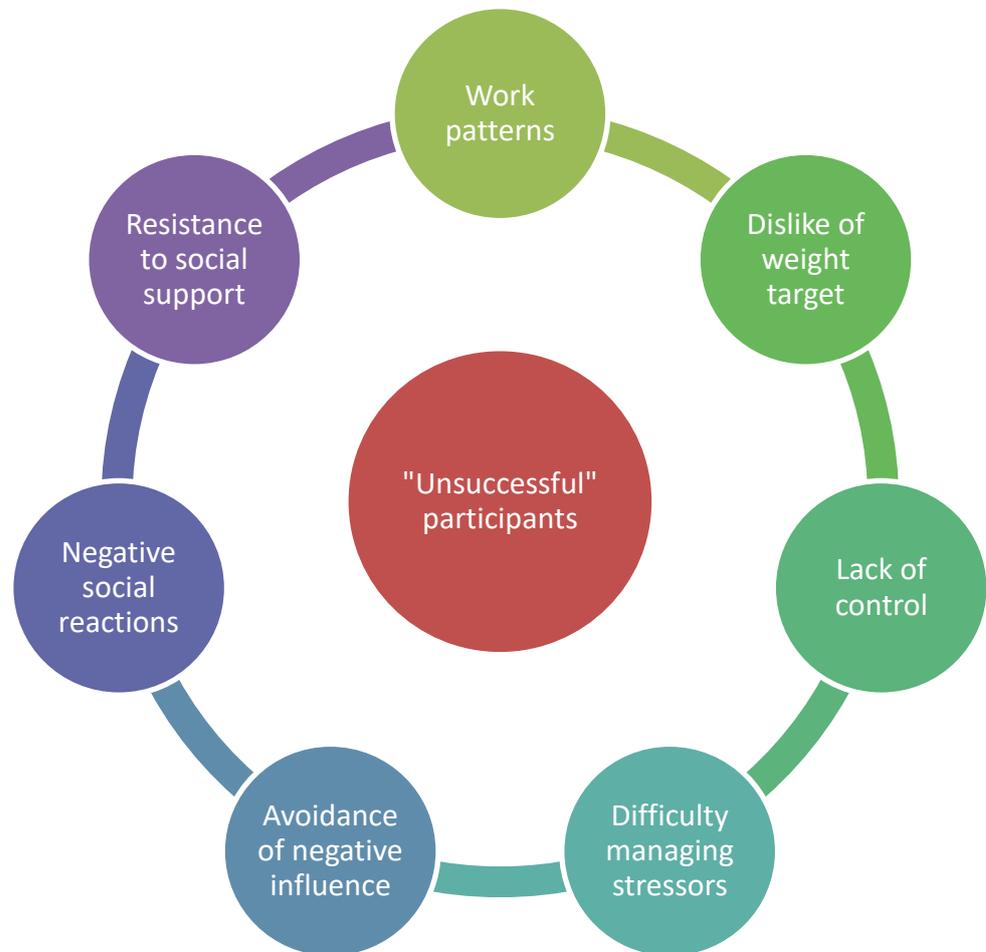
Figure 7-4 Factors only reported by "unsuccessful" participants.

7.2.4 Personal network findings

Personal networks were also collected from the participants at each time point. The aim was to investigate how the network characteristics and structure impacted the participants' weight loss outcomes at the end of the programme. Limited analysis was conducted on the personal networks due to problems with the data collected in the surveys (i.e. surveys being completed incorrectly, limitations of the software) (see sections 6.3, and 7.4.5).

Despite these barriers, insightful observations and considerations remain from the survey and interview data. Egos largely nominated people who had a healthy body weight, were of similar age, and gender, and were not also trying to lose weight. Egos also reported confiding in and admiring most of their nominees. Overall, this study did not find that having someone to confide in, relationship types or duration, frequency of contact, weight status or intentions to lose

weight had any impact on whether a participant would be "successful". However, a study by Wieland and colleagues did find that participants living with obesity had more network members also living with obesity than those with a healthy BMI range (341). They also found participant weight loss intention was associated with positive social norms around weight control, social support, and social cohesion. These results suggest attitudes and support with weight in an ego's network has the potential to impact success, but further investigation is required to establish the relationship with outcomes rather than intention formation. The other studies in this thesis did highlight the importance of social support and interpersonal relationships in success. This suggests that while this network study did not find the network to impact weight loss, it may be a limitation of the study itself (i.e. small sample size) rather than the network having no effect (see section 7.4.5). Furthermore, the influence of an alter may be rooted in different aspects from those explored in this study (e.g. specific types of support or explicit attitudes towards obesity) which warrants further investigation.

Very few participants (i.e. only 3) reported actively avoiding an alter during their weight loss journey, so the statistical analysis was not performed on this variable. However, qualitative data provided some insights into how interpersonal avoidance and behaviour change may interact. The reasons reported for avoidance were the alter being a negative influence (i.e. encouraging the participant to "cheat" or "treat" themselves) and participants feeling unable to navigate these pressures, and participants comparing themselves to alters and feeling self-conscious or down hearted due to their weight status or previous weight loss successes.

7.3 Combined findings from the four studies

Using the findings from the systematic review, survey, qualitative interviews, and personal networks, I identified the key influential factors associated with success. The above studies demonstrated that many of the barriers and facilitators encountered are relevant for both "successful" and "unsuccessful" participants.

Figure 7-5 below provides an overview of all the findings from the studies in this work. The diagram shows each social-ecological construct and the associated factors which acted as barriers and/or facilitators to weight loss. Multi-level and programme-specific factors have been included in the diagram as their own tiers. Multi-level factors occurred across different constructs of the SEM (e.g. COVID-19 included policy, environmental, interpersonal and intrapersonal factors). Programme factors are also muti-faceted (e.g., content, interpersonal relations, intrapersonal engagement) and have been grouped together to highlight programme-specific influencers of weight management. (51)While this overview does not provide insight into how specifically these factors are linked, this would require additional work, it does show an array of factors which should be considered when understanding the weight loss journey. Most studies in the systematic review and participants in the interview study reported factors influencing engagement with the programme or with weight loss behaviours. It is likely the specific factors which are relevant to different individuals will vary due to the different contexts of participants' lives, as well as their different experiences. However, this does provide ideas for future research and where programmes could intervene to improve results. For example, they may wish to consider environmental workplace barriers or provide more support and skills training in sourcing solutions to problems.

Figure 7-5 Overview of social-ecological factors impacting weight loss.
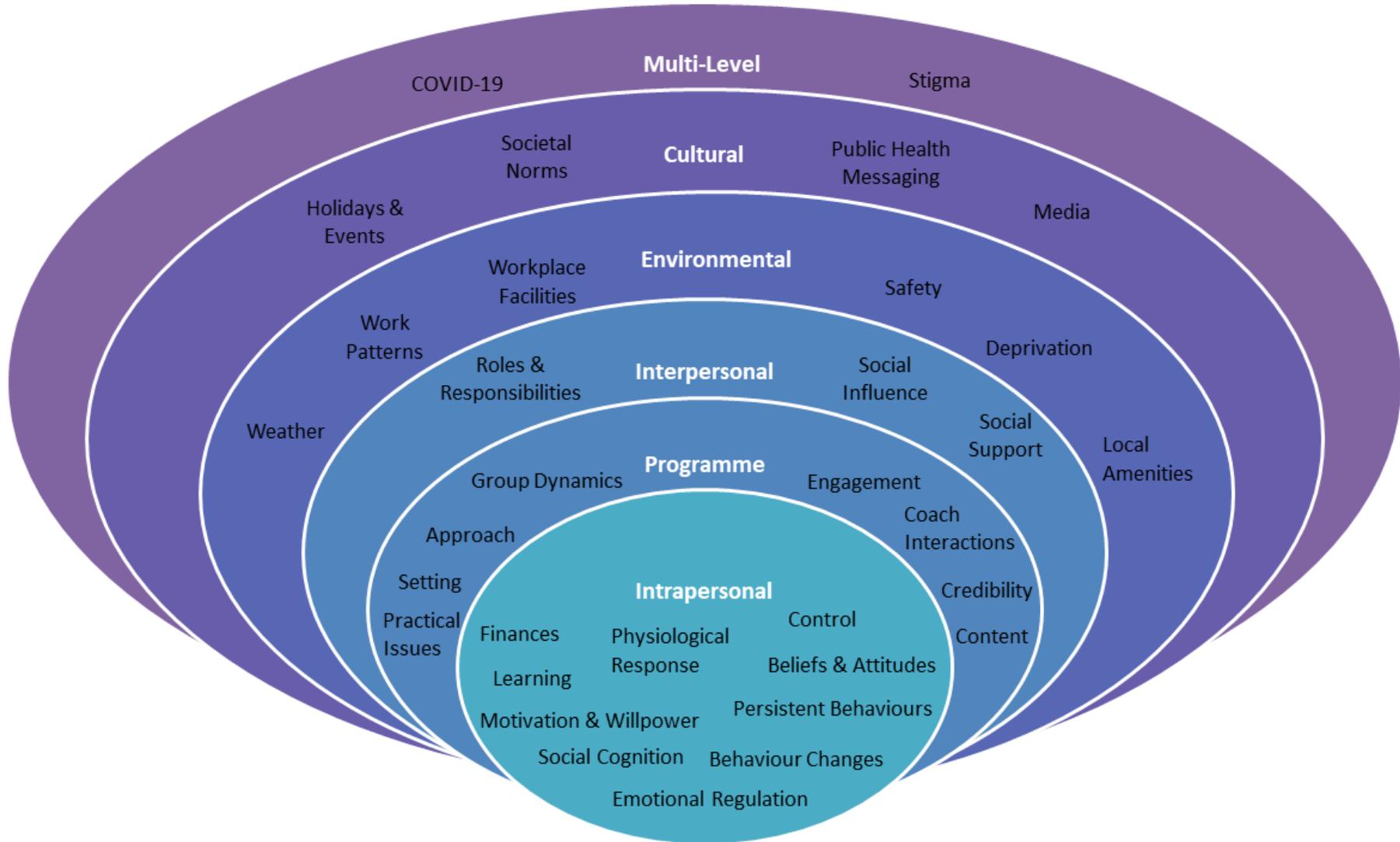
As described above, there were several areas of commonality between "successful" and "unsuccessful" participants in barriers and facilitators, and there were factors which differentiated the groups. The surveys identified which factors were significantly associated with success (e.g. baseline eating habits, social support from the household) while the interviews provided complimentary insights into how and why these factors were important. Notably, both revealed that social support, behavioural change, cognition, and emotional regulation were important factors for "successful" weight loss. Figure 7-6 depicts the themes which were found across all studies (i.e. systematic review, interviews, and surveys) in the thesis as facilitating weight loss.
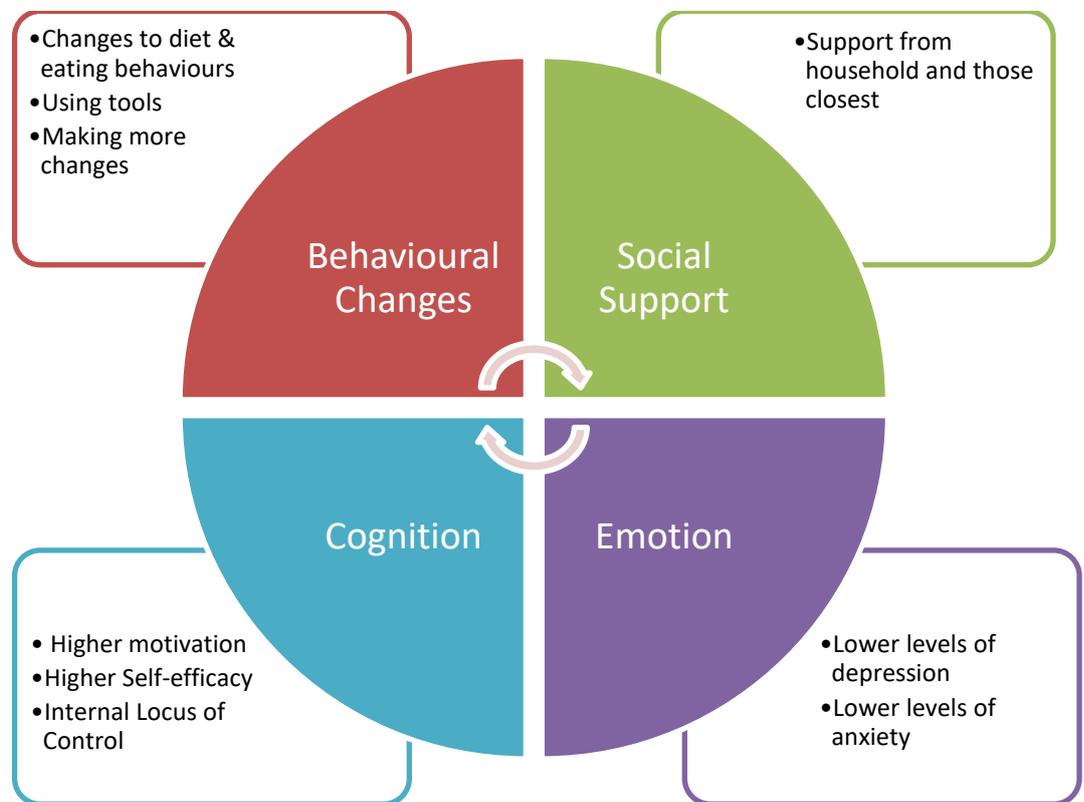
Figure 7-6 Factors influencing "success" across all studies (i.e. systematic review, surveys, and interviews)

7.3.1 Intrapersonal Constructs

Intrapersonal constructs were grouped as behavioural, emotional, physiological/health, and cognitive. The intrapersonal domain had the most evidence across the studies. This could be attributed to the focus of the studies in the review being on intrapersonal constructs, and participants in all the studies having less consideration for the role of external factors on their weight loss.

Overall, I found "successful" and "unsuccessful" participants shared similar intrapersonal barriers and facilitators but there was a difference in how pragmatic they were when sourcing solutions. This may be due to "successful" participants perceiving fewer barriers to their weight loss, so it is easier to overcome the ones they do experience (342). This suggests cognitive differences between participants in their perceptions of the number of barriers to their weight loss and in their perceived ability to overcome them.

Participants in the interviews specifically emphasised that their success was linked to their motivation, willpower, and control. Although they acknowledged the role of other factors, all participants emphasised it was ultimately a result of the presence or absence of these factors. This is an important consideration for supporting adults living with obesity to lose weight. While they do acknowledge the role of external factors, the blame for their weight and weight loss outcomes is focused on themselves. This likely ties in with the other behaviours such as emotional/comfort eating and the importance of visible results for motivation (99). Directing blame to themselves probably affects how they interpret and interact with other influential social-ecological factors. For example, a participant who experiences early weight loss will feel more motivated, impacting their sense of control over their weight, and prompting them to be more solution-focused to barriers to promote more success (101,117,343). Whereas a participant not experiencing weight loss becomes demotivated and unable to think of ways to overcome barriers. It may also be fundamentally challenging for participants to recognise the influence of wider factors because the responsibility of weight management is normally individually focused within wider society. The media uses individually focused language when discussing obesity, perpetuating bias, stigma, and discrimination

(344,345). This could play a role in adults living with obesity focusing on intrapersonal concepts of what helps and hinders their weight loss efforts. Moreover, within behaviour change theories, intrapersonal constructs (e.g. emotion, cognition) are often central or major factors in determining behavioural change (i.e. transtheoretical model, self-determination theory (SDT), HBM) so there could be biases and expectations in the research itself that behaviour change is intrinsically focused (56,110,124).

However, SDT, in particular, may provide insight into how wider social-ecological factors interact with a participant's cognition (109). The theory states that a participant's motivation for change is influenced by their personality, social processes and contexts, and individual differences. These influence the degree to which a person experiences autonomous (i.e. internally rather than externally driven) and controlled motivation (i.e. externally driven to receive rewards or approval from others). A study by Hagger and colleagues found higher autonomous motivation had more of an effect on intentions and behaviours than controlled motivation (346). This does suggest, in line with participants focusing on intrapersonal constructs, that internally driven motivation is important for change. The theory further posits that motivation type influences participants learning, experience, and psychological well-being. The unique barriers found in "unsuccessful" participants (i.e. reaction to stressors, negative social experiences, and challenges overcoming barriers) likely interacts with participants' motivation type (i.e. autonomous or controlled), and their ongoing motivation. Furthermore, this could interact with the three basic psychological needs proposed by the theory – feelings of competence (i.e. being able to do something), autonomy (i.e. independence) and relatedness (i.e. sense of belonging). The degree to which these needs are satisfied impacts functioning, engagement, and motivation. The barriers and facilitators experienced by participants from the wider aspects of the social-ecological model (e.g. the presence of green space) may interact with the fulfilment of these basic psychological needs and overall motivation. For example, a participant who lives in an area with green space begins going for walks or runs. The participant begins to see physical improvements in their weight and is less out of breath when walking. This results in improvements in well-being, increased feelings of competency, and autonomous motivation leading to more engagement with PA.

Visible results (i.e. physiological improvements to health and weight) was a theme which was identified in both my systematic review and interview study which was associated with success. Another systematic review found early success in programmes is related to adherence, with adherence contributing to longer-term success (193). Those who experience positive results earlier may feel more competent and confident in continuing their weight loss journey and tackling problems which are not covered in their weight management programme. This could explain why in this work we saw "successful" participants were more inventive and pragmatic in their solutions to barriers and more likely to accept external support.

When discussing the reaction to setbacks many participants explained that they had an "all or nothing approach" or dichotomous thinking (i.e. a cognitive distortion where they think they can either succeed or fail, with nothing in between). When they "failed" to adhere to their diet they would give up for the day or completely slip back into old habits. Many participants reported these behaviours as cyclical – reacting through emotional eating to negative experiences and then giving up. The "all-or-nothing approach" was also identified in the systematic review (phase 1). Antoniou and colleagues suggest when a participant engages in this type of thinking, a setback causes them to see themselves as less competent and negatively impacts their mood and self-esteem (347).

One factor which may have shaped participants' beliefs that ultimately their weight was down to their willpower is stigma. Participants reported stigma toward obesity was a barrier which impacted their emotions and motivation. This was across multiple levels of the social-ecological model – public health messaging (political), media (cultural), interpersonal and intrapersonal. Participants noted people living with obesity were portrayed negatively in the media, were made to feel bad about themselves in public health messages, experienced negative attitudes from others, and some participants used negative language about themselves or others who were overweight. Pescosolido and Martin discuss how different types of stigma can impact the beliefs a person holds about themselves and how they interact with their environment (348). They list various types of stigma, including perceived (i.e. the belief others will

discriminate against you), self-stigma (i.e. internalised acceptance of stereotypes and prejudice), public stigma (i.e. stereotypes, prejudice and discrimination endorsed by the general public), and structural stigma (i.e. prejudice and discrimination by policies) which are reflected in the results of this work. Stigma may fit with SDT since it shapes the context, social interactions, and attitudes participants experience. The negative connotations associated with being overweight (e.g. laziness) may also impact their belief that they can adopt new behaviours (349). This is considered in detail by Puhl and Heuer who note stigma and discrimination toward people living with obesity are pervasive and have numerous consequences on psychological and physical health (350). They suggest that rather than promoting change, stigma jeopardizes people's health, broadens health disparities, and impedes obesity interventions. More research is needed to understand the impact of these different types of stigma on the weight loss journey.

When asked about the motivation for their weight loss, most participants reported health as a factor. A key differentiator between groups was "successful" participants stated they were trying to safeguard or prepare for future hardships (e.g. surgery, illness progression in a loved one) or to protect others from emotional harm. This motivation seems to be influenced by both social coercion (e.g. weight requirements for surgery) and a sense of personal commitment (e.g. being a parent)(121). Teixeira and colleagues discuss in detail how SDT could explain interaction with weight management programmes and long-term outcomes (124). They suggest motivation that is internally driven (e.g. wishing to protect the wellbeing of others) results in more commitment to weight management than externally driven (e.g. reaching a recommended goal). Furthermore, some of the aspects around health as a motivator may be understood through protection motivation theory (PMT) (118,351). This theory proposes we weigh the threat (i.e. perceived severity and vulnerability) to illness against our perceived ability to cope (i.e. self-efficacy to react and address the threat) to form our intentions and implementation of behavioural changes. Participants perceived threat of obesity-related ill-health, family wellbeing, or managing future hardships would be weighed against their coping beliefs. Where some participants continue to successfully change their behaviour, this would be connected to visible improvements reinforcing change,

increasing their self-efficacy. Studies do suggest incorporating PMT (i.e. supporting participants with intention formation through understanding more about a threat, costs of not acting, and working on self-efficacy) supports weight loss and the adoption of a healthy diet and exercise to reduce the risk of obesity-related illnesses (352,353).

7.3.2 Interpersonal Constructs

Interpersonal constructs identified as important in this work related to social influence, social roles, and social support. When considering the role of interpersonal relationships external to the programme, my research found friends and family to be key facilitators and barriers to success. Marcoux and colleagues also noted that family members were reported as the most and least helpful influence on weight loss (354). Participants reported they were influenced by others in their life and how they reacted could act as barriers or facilitators to weight loss. Weight status and behaviours have been found to spread and are shared between members of the same social groups and predict weight-related behaviours (166,355). Leahey and colleagues found young adults living with obesity were more likely to have overweight romantic partners, friends and family members compared to young adults with a healthy bodyweight (165). Interestingly, they did not find differences between groups in the social norms for obesity and its impact on weight status. However, they did find if social contacts were trying to lose weight this was associated with the participant having a greater intention to lose weight. Another study found participants who enrolled in a weight loss programme with a social contact who either previously or concurrently enrolled experienced more success (356). They lost more weight, attended more group sessions, and submitted more self-monitoring journals than those without social contact. These studies suggest a participants' interpersonal relationships and their attitudes/behaviours toward weight loss are influential in their success.

A factor differentiating between "successful" and "unsuccessful" participants in this work was that "successful" participants were able to maintain relationships with and navigate negative influences effectively. Additionally, we found relationships could act to sabotage weight loss efforts, with "unsuccessful" participants experiencing more of this. These findings are similar to a qualitative

study investigating interpersonal challenges to weight management. The study interviewed adults who had "successfully" lost weight and found they experienced sabotage attempts by others (e.g. encouraging unhealthy choices) but were able to develop solutions to manage these situations and their choices (e.g. eating smaller portions, stating they had designated cheat days) (357).

Participants in my qualitative work also reported other people in their lives influenced their changes and weight loss. Motivation and success were fostered when they saw improvements in others that they cared about (e.g. family members experiencing health improvements due to dietary changes from the programme). This suggests becoming a role model has the potential to be a motivating factor for success for some people. Weight loss programmes where the peer leader/coach is perceived as a leader in the community or who have been "successful" in the programme have been identified as facilitators of engagement and change (234). Strategies to make this a goal for participants in programmes may be beneficial. While it might not be feasible for all participants to become peer leaders, incorporating the idea of being a leader to people outside of the programme and supporting others with their health decisions may facilitate change. As well as the idea of becoming a role model, participants noted their social roles could act as a barrier to change. Specifically, if they described themselves as a "feeder" (i.e. someone known for being good at cooking or the main provider in their family) or associated food with companionship. This may tie into the social influence aspects discussed above around norms towards obesity and weight loss behaviours.

Studies 1-3 highlighted social support as a key contributor to success. The survey particularly emphasised the role of support from the household as a facilitator. Intuitively, this makes sense since those living in the household are likely to be who participants eat with most often and spend more time with. This is supported by a study by Kiernan and colleagues who found women who never experienced familial support were least likely to lose weight whereas women who experienced frequent family and friend support were more likely to lose weight. However, interestingly, women who never experienced friend support were most likely to lose weight – indicating a nuance that needs further exploration (315). Another study found those who regained weight received

more support, but the way support was given differed between groups (19). "Regainers" received more instructions and encouragement while "maintainers" received more compliments and active participation (e.g. doing things together). The authors concluded positive support rather than instructive support seems to be beneficial in weight loss maintenance. Another study found appraisal support was key to weight loss (354). This suggests the type of social support received is important in weight loss success. While the research in this thesis did not find these differences, the interviews did identify that "unsuccessful" participants were more reluctant to receive social support and were more likely to experience negative reactions to their weight loss (e.g. being asked if they were ill). Regarding active support, participants (both "successful" and "unsuccessful") in the qualitative study did note instrumental support from friends and family as the biggest interpersonal facilitators for making healthier choices (e.g. going for walks together, and meal preparation).

The interpersonal constructs identified in my review and interviews may be understood through social cognitive theory (SCT) (358). SCT posits that learning and behaviours are shaped through reciprocal interactions between the individual (i.e. shaped by previous learning and experiences), actions of others, the environment, and behaviour (i.e. responses to stimuli to achieve the desired outcome). By acknowledging the reciprocity of behaviour and social environment, this theory recognises that behaviours are not static and can vary over time (359). Observational learning (i.e. observing others' behaviour and reproducing them), reinforcement (i.e. positive, or negative to influence whether a behaviour is continued or adopted), self-efficacy, and expectations determine the individual's perceived acceptability and likelihood of adopting a new behaviour. Within the findings of this thesis, these constructs could be moulded by the support they receive, supporting others in their wider community, and being part of a group that influences the development and maintenance of new behaviours and attitudes towards weight management. A review by Adhikari and colleagues identified social support and self-efficacy as vital SCT constructs for obesity prevention which will likely be important for weight management/loss also (360). Studies have shown that SCT variables (e.g. social attitudes towards healthy eating) support healthy weight loss (361,362). However, a systematic review of obesity interventions in adolescents using SCT

found weak evidence for this approach (363) suggesting that SCT may need to be adapted to the weight management context. Anton and colleagues suggest adding a component of "biological factors" (i.e. feelings of satiety, physiological responses to changes) into SCT to adapt it to the context of weight management (364). They propose biological factors interact with behavioural, environmental, and personal factors to determine whether an individual will successfully manage their weight and adhere to programmes.

7.3.3 Programme Constructs

Programme constructs identified included engagement (i.e. with the programme and weight loss behaviours), the approach of the programme (i.e. content and culture), the setting, and the group/coach interactions.

Research has shown engagement and adherence to weight loss programmes are associated with success in the short and long term (365,366). The degree to which a participant engages with a programme may be influenced by the other programme-factors identified in this work as related to success. The approach of the programme seems to influence the degree to which participants engage with the programme. In the interviews and systematic review participants who liked and enjoyed the content, and its delivery were more engaged. In the interviews, participants reported a mature approach (e.g. explaining things in a scientific way with supporting evidence) was preferable. Within the systematic review, preferred approaches included those which incorporated aspects of the participants' culture such as language, beliefs, or interests. Additionally, engagement was facilitated if they found the content and the people delivering the content to be credible. This referred to both the information delivered in programme materials and the coach. The information delivered by a credible source (e.g. in an obesity setting by a nurse or nutritionist) is highlighted by Michie et al. as a BCT which encourages adherence and engagement with guidance (78). Furthermore, the systematic review picked up that setting and credentials could also influence how credible a participant perceived a programme (e.g. being delivered by someone with lived experience or relevant qualifications or being delivered in a healthcare setting). The setting suitable for activities was also highlighted as a facilitator in the review (e.g. soft floors for exercise).

Social support and having a positive perception of the weight loss group were also identified as facilitators of success in this research. Weight management programmes which involved a group setting have been found to increase the likelihood of a participant achieving a 5% weight loss at 12 months compared to one-to-one interventions in a systematic review by Abbott and colleagues (367). In the research reported in this thesis, participants described the group as a source of support, camaraderie, and providing a sense of belonging/being with people with shared problems. This is echoed in other qualitative studies in the field of obesity where participants report the importance of group dynamics in their weight loss journey (117,205,206). This sense of belonging/camaraderie to the group and the need to perceive the leader as credible identified in this work suggests interventions which are peer-led, or which have a buddy system may improve results. Research has found peer-led interventions to be efficacious both in terms of long and short-term outcomes and cost (368–370). Peer support has been found to facilitate weight loss both in-person and in online formats, with larger peer networks increasing long-term adherence (371).

7.3.4 Environmental & Cultural Constructs

Environmental factors were grouped as the home, local or work environment. Mainly, factors within the home environment related to interpersonal relations within the household but participants did note temptation accessibility as a barrier. This referred to unhealthy or "treat/cheat" foods being available in the household. Ahlgren and colleagues found the home environment to be a critical factor for participants in maintaining dietary changes or relapsing into former habits (372).

In the local environment, influencing factors related to deprivation, are the perceived safety, access, and proximity of resources (i.e. the presence of places for PA, and proximity to obesogenic facilities). Higher levels of deprivation in areas are associated with reduced facilities and more health inequity (373). Specifically, in a Scottish study, a linear association was found between deprivation and weight status where men and women living in more deprived areas had a higher BMI (9). However, another study found this interaction was not present in women from deprived areas with higher levels of education (13). This suggests education (i.e. provision of information and teaching of skills) may

act as a mediator for "successful" weight loss. Access to the obesogenic environment works similarly to household accessibility where being able to see temptations increases the risk of making unhealthy choices. A systematic review found research is variable on whether access to obesogenic facilities (e.g. fast food outlets) is associated with obesity (374). There is evidence, however, that cognitive variables may differentiate whether proximity/access can interact with weight loss. Martin and Davidson discuss cognitive factors which may impact whether the environment affects weight loss. For example, those who struggle more with the obesogenic environment have an attentional bias towards unhealthy words and food usurping their weight loss (375).

In the interviews, participants emphasised the role of green space in managing their mental health during COVID-19 and their weight loss journey. They reported the presence and interaction with green space facilitated mental well-being (i.e. helping them to stay positive and motivated) and PA in their weight loss plans. Attention restoration theory poses that types of environments can affect an individual's levels of recovery from fatigue which influences their ability to direct attention and engage with other cognitive processes such as problem-solving or how a situation is understood (376). When an individual experiences high levels of fatigue, their ability to pay attention and other cognitive processing suffers. This arguably has a role in behaviour change since this is cognitively intensive due to reforming behaviours and learning. Natural environments (e.g. green space) are more conducive to recovery from fatigue than urban environments due to the types of stimuli (376,377). Natural environments involve stimuli which modestly grabs attention (e.g. woodland) by being interesting while urban stimuli demand more attention (e.g. to avoid being hit by a car) (377). There is strong evidence that green space is related to positive mental health and lower mortality rates, with some evidence it improves general health (378). How green space interacts with health is still being explored but Barton & Rogerson suggest green space can contribute to the management of mental and physical health by influencing how people interact with their environment (e.g. encouraging walking) and offering positive psychological experiences (e.g. time to relax) (379). A systematic review by Bowler and colleagues found engagement with natural environments had a positive impact on wellbeing in particular emotional regulation and improving

attention (380). Specifically, in weight management, the presence of green space may act as a mediator in these ways to support weight loss. This is reflected in a study by Ghimire and colleagues who found counties in the USA with more forests, public recreation areas, and publicly available outdoor recreation resources (e.g. parks) had lower rates of obesity (381).

With regards to the workplace, the findings indicated that work patterns (i.e. hours, shifts, commute) and resources (i.e. food choices and meal preparation areas) were key barriers to success. A qualitative study by Clancy and colleagues on barriers to weight loss in workplace weight management programmes similarly found the nature of work (i.e. sedentary and work hours/shifts) and lack of gym provision acted as a barrier to PA and engagement with the programme (382).

The cultural factors associated with success identified here are related to the delivery of or portrayal of obesity through public health messaging and the media. In the interviews, participants felt highlighting obesity risks and negative portrayals of obesity facilitated wider societal stigma and made them feel and think badly about themselves leading to unhealthy choices (e.g. emotional eating). There is evidence that public health messaging can impact intentions around health behaviours and influence wider societal attitudes (383). A study by Frederick and colleagues found the use of negative language towards people living with obesity in the media was related to stigmatising beliefs and attitudes, supporting the notion that exposure to negative framing can influence attitudes (345).

7.3.5 COVID-19

Participants' reactions to COVID-19 restrictions also impacted success. Although COVID-19 is a result of public health policy, this is categorised as a multi-level construct since participants reflected on how it impacted their environment, relationships and support, and their thoughts and emotions. The surveys emphasised that if participants perceived the impact of COVID-19 as positive this was conducive to weight loss. This was also found in the qualitative interviews where the reaction to the changes in daily life impacted engagement with weight loss behaviours and motivation (292). The COVID-19 data also revealed

that key barriers included access to facilities and emotional/comfort eating, while facilitators included having more time to plan and engage in green space. Other studies found similar results that COVID-19 restrictions presented new challenges for participants; emotional eating was a barrier and more time for meal planning/cooking and PA acted as facilitators (384–386).

7.4 Strengths & limitations

7.4.1 Overall

This work used a mixed methods approach to collate evidence on barriers and facilitators to weight loss and explore differences between adults who were "successful" versus "unsuccessful" at losing weight, in participating in behavioural weight loss programmes. This work adopted a social-ecological lens to try and capture multiple levels of influence. Taking such an approach moves the focus from individual responsibility for success or failure when participating in such programmes, and recognises the wider environmental, social, and societal influences which play a role. Understanding the interplay of these multiple influencing factors will facilitate recommendations for policy and practice which recognise the complexity of the issue and are therefore more likely to address the problem effectively.

Combining qualitative and quantitative methodologies allows for complex and multi-faceted questions to be addressed (250,387). A mixed methods approach can complement findings from one methodology and provide a breadth of in-depth considerations. The surveys and systematic review were able to identify what factors are influential, while the interviews, personal networks and some of the systematic review data explored how, if, and why factors influence weight loss. The systematic review identified the available evidence which informed the content of the other studies. The surveys facilitated the collection of data from a larger number of participants across the UK and provided insights into what factors play a role in weight loss. The interviews provided more description and depth regarding participants' experiences and how identified factors interacted with weight loss attempts.

When highlighting the factors which were identified across all the studies, the data focused on intrapersonal and interpersonal factors. However, this should be expected partly due to the focus of published research (i.e. individual or group interventions focusing on intrapersonal, interpersonal, and programme factors), the variability of the impact of factors (e.g. programme, environment, and culture) across contexts, and the limitations of the primary studies in this project (i.e. within the context of COVID-19 and participant demographics, see discussion below). Importantly, participants may have a limited understanding of the wider influences on behaviour or due to wider cultural factors (e.g. media) feel they cannot recognise external factors as impacting their success.

By combining the data from all the studies, the influencing factors can be easily viewed, considered, and discussed by stakeholders (i.e. people developing, using, or referring to such programmes). The thesis also highlighted many commonalities between "successful" and "unsuccessful" participants as well as differences. Differences were apparent in how participants reacted to and coped with stressors and barriers, social support, the work environment, sense of control and feelings of motivation. Utilising this knowledge may help stakeholders consider gaps in our understanding and prompt ideas for improvements in research and programmes.

Despite these strengths, the work has several limitations. These occur both in the data itself and the wider context in which the data were collected. Study-specific strengths and limitations are discussed below.

Grouping participants as "successful" or "unsuccessful" based on whether they achieved a 5% weight loss during the programme poses its own limitations. The strict cut-off may have resulted in some participants being labelled as "successful" or "unsuccessful" who were on the cusp of either category (i.e., participants who had lost 4.9kg or 5.1kg). It could be that there is no meaningful difference between these participants (in terms of weight loss and the barriers/facilitators experienced). Moreover, there is evidence that a 3% reduction in weight can offer similar improvements to health suggesting the 5% cut-off misses "successful" changes to health (66). However, the cutoff of 5% was adopted as this is more widely accepted in the literature (62,63) and enabled a clear way to compare experiences between those who do and do not

achieve this weight over the course of the programme. A specific limitation related to the interviews is they were conducted mid-programme and participants were grouped as "successful" or "unsuccessful" based on their weights at the end of the programme. This may have resulted in categorization errors where the interviews reflect the participant's experiences at a particular point in time, where they may have been on a different trajectory in regard to their weight loss. Different barriers or facilitators may have emerged post-interview changing the outcomes of their weight loss which are not captured in the interviews.

Limitations relating to the generalisability of the findings include that the primary data (i.e. surveys, interviews, and personal networks) were collected from participants of an online behavioural weight loss programme. This was not the original remit of the thesis which was to consider in-person programmes delivered by the NHS. Arguably, therefore, the thesis may lack insight into the barriers and facilitators experienced during in-person programmes whether this is related to barriers/facilitators in delivery, location, or interpersonal relationships. The participants in the primary studies also sought out weight loss guidance and paid for the programme themselves which may mean that they are different from those who are referred to free NHS services. The thesis therefore potentially lacks insight into the barriers/facilitators experienced by people living with obesity who are receiving free weight loss guidance and are NHS-referred (i.e. due to health concerns). There may be differences in motivations, support, and finances which are not accounted for.

Due to using convenience sampling, the thesis is limited in how well it represents different groups. Across the studies, participants were mostly white, middle-aged, and female with higher levels of income and education than the general population. There is therefore less exploration of barriers/facilitators experienced by non-white, male, and deprived cohorts. Additionally, the mean BMI across the studies was in class 1 of obesity (BMI 30-35kg/m^2) suggesting the representation of adults with higher levels of obesity was lacking. Despite these limitations, the interviews and surveys revealed themes supported by the evidence from the systematic review which included studies with participants with different socio-economic backgrounds, race, sexuality, and gender. For

example, participants noted barriers/facilitators associated with health, cost of living, facilities in their area, safety in their area, and difficulties in understanding the programme.

The use of the social ecological model to direct my research may have presented some limitations in the analysis and interpretation of the data. Since the SEM considers a wide array of factors (i.e. intrapersonal, interpersonal, environmental, and cultural) it imposed a more deductive approach than is typically found in thematic analysis (53). Most of the overarching themes (i.e. all except the programme factors) and some of the sub-themes (e.g. social support and motivation) identified in the data were derived from the model. However, many themes were still identified inductively and then grouped under the constructs of the SEM. Furthermore, as a consequence of using the social-ecological approach a vast number of themes were found. This may have inhibited the depth of some of the themes resulting in some merely acting as descriptors of facilitating or blockading factors rather than deeper insights into how the theme interacts with weight management (388). While the themes do vary in depth, many do provide dynamic insights into their role in weight management (e.g. social interplay). The clear benefit of using the SEM was it provided a guide and structure to considering influential factors of success in multiple aspects of a participant's life which is lacking in the wider literature. The mixture of breadth and depth is useful for practitioners and researchers to identify possible inhibitors of success and where changes and further research is needed.

A specific limitation in the operationalisation of the social-ecological approach in this and in other research is the focus on current factors influencing engagement/change, potentially missing important influential details from participants' histories. Arguably these are important intrapersonal factors which fit within the SEM and could possibly differentiate "successful" and "unsuccessful participants further (e.g. understanding how key life transitions influence weight management or how reasons for previous "unsuccessful" attempts at weight loss). Although some historical information could be inferred (i.e. traditions with food/alcohol), considering how factors such as weight during childhood and adolescence (389), upbringing (390) or specific life experiences

(e.g. living independently for the first time) (391), or stages (e.g. menopause) (392) impacted attitudes and relationships with weight-related behaviours could be insightful. A review by Gupta and colleagues highlighted stigmatising experiences (e.g. public embarrassment related to weight) could act as barriers or facilitators of long-term weight loss maintenance, suggesting history and reaction to these experiences continues to play an important role in future weight management (305).

The wider contextual limitation of the research was the global COVID-19 pandemic. COVID-19 meant the project had to be restructured swiftly (i.e. an online programme sourced, and ethics approvals sought again) and participants in the research were having a unique experience during their participation in the weight loss programme. Inevitably, the changes caused by COVID-19 to participants' daily lives had an impact on their motivations, and the barriers and facilitators they experienced. This may limit the generalisation of findings to a non-COVID-19 setting. In addition, the situation in the UK meant participants were experiencing distinct social and environmental restrictions which likely impacted the findings.

Despite this, the data provide insight into the barriers and facilitators participants faced during a unique point in time. This will eventually provide some historical insight into how the pandemic impacted weight management efforts in adults living with obesity in the UK. This could be useful for understanding barriers in adults who have limitations on their access to facilities or social support structures (i.e. living rurally) or if there are future pandemics in which restrictions are imposed on the public. Additionally, many of the factors identified in this work are relevant to pre-and-post-pandemic life. Many participants reported they did not feel their life had changed much since the pandemic which suggests for these participants (i.e., predominantly white and affluent) factors may be similar in a non-pandemic setting.

Furthermore, the findings from the primary data collection overlapped with those found in the systematic review including in-person programmes outside of pandemic restrictions. This suggests the factors identified are relevant outside the context of the pandemic.

7.4.2 Systematic Review

7.4.2.1 Strengths and limitations of the review process

This review had several strengths. To my knowledge, this is the first review to combine quantitative and qualitative data to identify barriers and facilitators of success during participation in behavioural weight loss programmes. The review presented a novel approach to data synthesis and to understanding a complex problem by extracting factors within the programme and the individual and including data on the wider social, cultural, and political context. To assess the strength of themes within the constructs, the review took a novel approach to assess the trustworthiness of themes by using quality assessments. The review offers an in-depth and holistic insight into what factors may help or hinder a participant's weight loss journey which can be used to improve future programmes. Additionally, the review used rigorous methods and approaches to minimise bias. The Covidence software was used to allow for 50% of title/abstract screening and 50% of the full-text screening to be done by both me and another doctoral student. The same doctoral student checked 10% of the data extraction. All the quality assessments were checked by the supervisory team. Across all screening and checking stages, any discrepancies were discussed and resolved with the supervisory team.

There were however notable limitations of this systematic review. This review only included studies published in English from 5 databases, therefore there was the potential to miss important studies for this review. Only half of the screening was done by another doctoral student independently. The data extraction was checked by another doctoral student, and this was not completed independently. It is possible that not having all studies screened and all data extraction checked could cause errors in study identification or data extraction. However, since there was high consensus on what studies should be included and on the data extraction that was checked this was deemed sufficient. All quality assessments were checked by the supervisory team but again this was checked rather than completed independently.

As mentioned above, due to the nature of the data I had to convert some of the quantitative items into a qualitative theme. Every effort was made to ensure the

themes reflected what the data were saying. For example, Tate et al. found that increased levels of autonomous motivation were significantly correlated with weight loss success rather than controlled motivation which was coded as an intrapersonal facilitator of autonomous motivation (228). Furthermore, there is a likelihood that different authors would code the identified barriers and facilitators under different social-ecological constructs. Staying with the Tate example, arguably this could have been coded as a programme construct (i.e. the programme content facilitating motivation). There are likely multiple examples of this within the review and it must be acknowledged that my background and thinking may have influenced the allocation of themes even in circumstances where it has been a direct quote of a theme or interpretation within the studies.

7.4.2.2 Strengths and limitations of the evidence

The evidence extracted for this review had several strengths and limitations. While there was a breadth of data, for most studies understanding barriers and facilitators was not their primary focus. Most studies aimed to assess the success of their intervention in achieving weight loss and it was not in their remit to break this down into barriers and facilitators of success. This might explain the high number of intrapersonal, interpersonal and programme themes and minimal environmental, cultural, and political themes, as this was the goal of the research. Notably, within the constructs of intrapersonal and interpersonal these were mostly concerned with factors related to the programme (i.e. thoughts and feelings about the programme and social interactions within the programme).

Specific limitations to the included studies were that most of the studies were conducted in the USA. This could mean the findings are not transferrable to other settings due to social and cultural differences. There was also heterogeneity in how items were assessed. While BMI and weight are reliable and widely used approaches to measure obesity there was a lack of standardisation in how studies reported their weight loss outcomes. Some studies reported baseline and end-of-programme weights, others reported % of weight loss, or grouping of % weight loss (i.e. high, or low, reaching 5% or more), and used different units of measurement. Additionally, the approach to collecting the barrier and facilitator information was heterogeneous. Some

studies reported quantitative results of factors that correlated with weight loss or participation and offered interpretation while others merely stated results. That meant some interpretation of results was at my discretion. Similarly, with the qualitative studies, some had the aim of considering barriers and facilitators of weight loss while others wanted to understand the journey, and thoughts on the programme or had very specific questions on barriers/facilitators (e.g. having a health focus) which could limit or guide the information gained from participants.

Regarding qualitative studies, the quality appraisals highlighted some limitations. Most studies were unclear in their philosophical perspective and how this related to their research methodology which could suggest studies were not rigorous in how they approached the research and had a degree of incongruence in aims and what was collected. Few studies reported how the researcher was embedded in the research culturally and theoretically and the influence of the research on the researcher and vice versa. Not considering this could be problematic for qualitative enquiries as the researchers' own experiences and thoughts could influence the data collection and interpretation. Lack of clarity on the position of the researcher makes it difficult to know the extent to which the researcher affected participants and the findings of the research studies.

Finally, the use of the quality assessments for ranking theme trustworthiness provided insight into the credibility of the barriers and facilitators identified. Those with high trustworthiness assessments indicate where the evidence for the given factor is strong. While medium and low trustworthiness factors require further exploration in future research. Markedly, most of the facilitators identified were ranked as high, while there was greater variability amongst the barrier data. This perhaps reflects the bias in the studies in the review to investigate what contributes to the success rather than what does not in weight management interventions. It may also reflect that facilitating factors are easier to extract and are more homogenous amongst participants.

Despite these limitations, the review uncovered a total of 105 factors that acted as barriers or facilitators to weight loss. This provides useful evidence to inform future programmes. The range of evidence ideally should mean a range of programme styles (e.g. 1:1, group, online, in-person) can learn from the findings

of this review. Most of the themes in this review were also ranked as having a high degree of trustworthiness suggesting the evidence itself is reliable.

7.4.3 Surveys

The findings of the surveys provide useful insight into differences between "successful" and "unsuccessful" participants at baseline and the end of the programme, across different levels of the SEM. Using online methods and accessing people through an online behavioural programme facilitated wider access and opportunity to take part in the research and may have reached some participants who would otherwise not have taken part. Additionally, the collection of data at two-time points has allowed us to identify and compare differences in findings between "successful" and "unsuccessful" participants. This enables the exploration of factors which may contribute to success. Being aware of such factors could mean additional support could be put in place for participants who are less likely to reach their goals (see section 1.6 for further discussion on how the results can be used to improve programmes). The model was also promising in identifying key ingredients for success as it explained 29% of the variance in factors contributing to success. Given the range of influential factors identified in the studies and literature in this thesis, this does highlight important variables.

Despite these strengths, there are some notable limitations of the surveys. The main limitations are the small number of participants and demographic biases (i.e. more females, higher SES), making it challenging to create a robust model of variables contributing to "successful" weight loss across different groups. While the model is informative, it should still be considered exploratory due to the low sample size and the number of variables. Secondly, this group of participants had higher levels of education and income which will impact the generalisability of these findings to those with fewer education years and lower income levels. For example, barriers related to the affordability to change the lifestyle and understanding of the programme may not have been relevant in this group.

There are two further ways in which the results of the surveys may have been skewed. Firstly, the 21% of participants who did not complete the second survey

may have dropped out of the programme meaning the findings may be skewed to those who succeeded. Secondly, it is also important to recognise how my expectations may have impacted the results. Since I designed the survey myself the focus may have reflected my own biases and expectations. To combat this potential bias, I consulted the literature and patient representatives on the content of the surveys. The surveys were also tested by the supervisory team and fellow doctoral students to check for clarity and errors.

Finally, the surveys were also of considerable length due to functionality barriers for the personal network sections (see section 1.4.4 below). This may have caused participant fatigue and attributed to poorer uptake/completion of the surveys. Although, completion rates for the baseline survey were 91% (i.e. of those sent the survey) and 79% for the end-of-programme survey, suggesting this was not a major issue.

7.4.4 Qualitative Interviews

The findings from the interviews provided unique insights into the experiences of participants taking part in an online behavioural weight loss programme. By taking a social-ecological approach, barriers and facilitators of weight loss were identified in various areas of a participant's life which provides more scope for policy, intervention development, and future research ideas depending on resources and desired goals.

A large number of interviews were conducted (48 interviews) to enable a comparison of "successful" and "unsuccessful" participants in achieving a 5% weight loss. Due to interviews being conducted midway through participation, it was unclear how many interviews would be needed to achieve representation of both groups. However, interviews were conducted until saturation was reached which resulted in a representative split of "successful" (22/48) and "unsuccessful" (26/48) participants. With the interviews being collected midway through the programme, it was possible to analyse the interviews blind (i.e. not knowing whether participants were "successful" or "unsuccessful") before grouping the results and comparing the factors emerging. This approach reduced potential biases in coding the interviews and enabled the study to compare both commonalities and differences between groups.

Another strength of the interview data is the rigorous analysis methods used. The interviews were analysed using a framework approach. I reviewed 10% of the interviews to develop a coding framework. This framework was applied to 20% of the interviews by me and by two supervisors independently. We then had a meeting where we discussed and reviewed the framework. Following this, the framework was updated accordingly. Once all the interviews were coded, I generated a framework matrix which allowed for a comparison of the themes to be made between "successful" and "unsuccessful" participants. Any uncertainties in coding or theme labelling were discussed with the supervisory team in meetings. Importantly, when the interviews were being coded I/we were blind to whether participants were "successful" or "unsuccessful" in the programme. Success and failure were applied to participants after coding was completed and comparisons were made. This is important to ensure my expectations of barriers/facilitators of success did not influence how interviews were coded.

As with the surveys, my expectations may have had an impact on the results of the interviews. Since the interview schedule was designed by myself, my expectations and personal experiences would have had a role in what questions were asked as well as in how the analysis was done (see section 5.6). To address this potential bias, I consulted the literature and patient representatives on the content. The interviews were conducted in a semi-structured way so if participants brought up ideas which warranted further exploration this could be done. I also kept notes and a reflective journal during the interviewing stage of my project and used this to reflect on the interview schedule and the interviews themselves. This resulted in a small number of questions being rephrased (e.g. finance-related questions changed to ask about affordability), and some being added (e.g. asking about safety in the local area for PA).

Due to COVID-19, the interviews were conducted by phone. The use of phone calls for interviews arguably has pros and cons. It allowed for interviews to be scheduled around the participant's availability. There were a few cases where participants experienced connectivity issues which impacted the quality of the recordings. While all the recordings were salvageable this was time-consuming. Some participants may have found it challenging to take part in an interview

without having the reciprocal interactions that take place when speaking to someone in-person (e.g. nodding, eye contact, hand gestures). Also, without these cues, I may have missed when someone was thinking over a point or needing reassurance due to not being able to see them. However, for some participants, this approach may have been preferable. It provided a degree of anonymity because they could speak without being seen. There was also more flexibility when the interviews could be scheduled – and interviews were scheduled predominantly outside of work hours (i.e. evenings and weekends).

Finally, the timing of the interviews should be considered. All interviews were conducted from mid-November 2020 until early January 2021. As well as the differing restrictions imposed by COVID-19, this time of year has many celebrations and festivities which could have impacted results. Participants did note these festivities changed due to COVID-19 restrictions and for some this resulted in emotional turmoil due to not being able to see family and friends. It should therefore be noted that while these festivities would impact weight loss "normally", the additional changes incurred by COVID-19 could have impacted routines, well-being and socialisation during this time and ultimately affected the content of the themes identified.

7.4.5 Personal Networks

The personal networks had a range of issues affecting the ability to collect and analyse the data and compare "successful" and "unsuccessful" participants.

The survey software used was not conducive to collecting such data and may have caused participants to disengage. The goal of the surveys was to have participants nominate alters, answer questions on their characteristics then complete who knew one another. To achieve this in the survey software, the survey had to be structured so participants completed these steps one alter at a time rather than nominating all and then completing the following steps. When asked about doing the task in the survey format at the interview, participants stated it was laborious, which made them nominate fewer people to reduce time on the task. This likely accounts for the low numbers nominated in the survey. But it may also be the case that due to COVID-19 people were not socialising as

much and due to the time of year trying to minimise contact to ensure gatherings for festivities could go ahead.

Another barrier to network collection was these tasks are typically visual. Participants can usually see their network building in front of them either on paper or on a screen which can prompt more alter nominations and increase engagement with the task (160). This was not possible in the survey tool or in the interviews which were conducted over the phone. Although larger networks were collected in the interview as I was able to answer any questions and explain the task more fully. Some Interview participants were also worried about the data being relayed to authorities if they had been breaking COVID-19 rules. This was overcome in the interview by explaining it would be anonymous, but some participants still only nominated alters until they reached social restrictions numbers in their area. Previous studies have also found interviews to be more favourable in gathering personal network data but the reasons for this are challenging to determine due to small sample sizes and differences between studies (393).

The average network size collected in the surveys was 4 which is low compared to other studies collecting personal networks in adults (288,297,298,394). This could be linked to problems in recall or poor prompting or confusion over the task in this format (395). There were also numerous errors in how participants completed the survey indicating more guidance was required. For example, some participants nominated groups (e.g. colleagues) of people for each alter rather than individuals. Interview participants were asked for feedback on the approaches to collecting, and many reported the task in the survey was unclear whereas in the interview they found it to be a useful and reflective task.

Specifically, in the interviews, it became evident that participants were confused about the phrasing of some questions. Participants did not understand how they could have people in their lives who they did not admire. While this question is quite standard in personal network research, there may be cultural differences in how this is understood. This project used the question of whether they admire an alter to try and pull out who in their network participants looked up to in order to identify role models. But in this group, "admire" referred to people they looked up to, were proud of, or generally had positive feelings

about. The confide question asked participants if they would confide in their health or weight with most alters being selected as yes (unless they were children). In hindsight, this question would have benefitted from being more specific about weight loss and weight-related health concerns. Results may have differed if it had been possible with the tools to show participants their network and ask them to nominate who they would confide in or who they admired. The lack of visualisation potentially made the task laborious and difficult to understand for participants (396). Future studies would benefit from added visual aids to remind participants who they had nominated, to allow participants to select certain alters for questions and to receive the visual reward of their network being built in front of them.

Despite these limitations, the personal network data did provide some insights into the networks of people living with obesity taking part in behavioural weight loss programmes. The results showed there were no differences in the size and how connected the network was, and the demographic characteristics, presence of support, weight status, and healthy attitudes of alters between "successful" and "unsuccessful" groups. This suggests network structures and characteristics may not play as strong a role in weight loss. However, the study was likely not powered to detect these effects. In addition, the limits on personal data quality in the surveys may have impacted on findings. This warrants further exploration. Perhaps, as identified by the surveys and the interviews, a deeper exploration into the role of the household in support and healthy choices is needed. A review of the role of social support in lifestyle weight management programmes noted that most interventions do not describe the type of social support (304). This may have been an issue with the personal network data – questions left participants to interpret social support in their way rather than providing clear definitions to compare support between groups. Defining types of support received by alters may have uncovered differences between groups like the specific type of social support facilitating success in the Hartman-Boyce study described above (i.e. motivational support) (321). Similarly, a longitudinal personal network study found that types of support received from alters can change over time in amount or form (397). Possibly, certain types of support make alters more memorable to the participant, and without the appropriate name generators, critical information about networks is lost.

Furthermore, it may be difficult for participants to recall or recognise the role of others in their weight management. Other personal network studies have found when collecting information on the egos network from the ego and a proxy that the networks differ in size and structure (398). Potentially, how a participant understands the task and their network as well as how they want to portray their network could influence the results. Participants may also not recognise (and therefore not nominate) potentially meaningful and influential alters that impact their behaviour. It may therefore be beneficial for future network research to consider different ways to collect network data to gather a holistic picture (e.g. collecting network data from the ego and a proxy or collecting network data from everyone in a programme about programme interactions).

7.5 Implications for weight management interventions policy and practice, and future research

These findings provide an overview of influential factors found across the different study methods – the quantitative research uncovering "what factors" and the qualitative revealing "how/why" these factors impact success from the participants' point-of-view. With the vast range of influential factors and the heterogeneity between participants in such programmes (i.e. demographic differences, individual differences in cognition and personality, environmental structure hindering or supporting weight loss) there is no 'one-size-fits-all' solution to increasing success in such programmes.

When considering the factors found across the studies, it is important to remember the influence of each will vary among participants. As shown in the interviews and the surveys, the factors are interconnected with one another, and the influence of these interactions will vary depending on the individual. For example, for some participants higher levels of depression may impact motivation and problem-solving skills resulting in lower levels of engagement and behavioural change. While other participants may experience a high degree of social support (e.g. instrumental, and emotional), have good habits at baseline (i.e. so require fewer behavioural changes for success), and experience physiological rewards from the changes they are making (e.g. alleviation of stomach problems) and become more motivated and engage in the programme

more as a result. Arguably this poses a problem in supporting individuals to achieve their best outcomes due to potential resource limitations (e.g. the ability to provide 1:1 support and tailored advice or simply being able to address the specific barriers experienced by the participant). Ultimately, there is a need for interventions which facilitate the best conditions for success (e.g. appropriate facilities, supportive environments, social support, public health messaging, education and skill building throughout the lifespan, addressing negative associations with obesity (e.g. stigma) across the system and lifespan. The findings from this research can be used to develop ideas on how programmes can facilitate and support success.

7.5.1 Suggestions for practice

What can be manipulated and changed by programmes will largely be influenced by what is feasible to change (e.g. content, setting) and extraneous factors outside the programme's control (e.g. the obesogenic environment). A recent review by Bray and colleagues supported this notion and added that support for healthy weight needs to be continuous across the lifespan (399). Though this may be challenging from a resource perspective, programmes could consider ways to offer continual lower-level support (e.g. peer support, and online resources).

There are a variety of ways interventions have attempted to adapt programmes to harness higher success rates. For example, Jakicic and colleagues offered additional support at different stages of a programme to participants who were not reaching their goals, leading to higher levels of success in the programme (192). Such an approach would allow programmes to measure success at different stages and allocate additional resources to participants who need them. Using resources strategically in this way could support tailoring of guidance and interventions to specific individuals or smaller groups within a programme to promote success, without much greater cost (i.e. tailoring to every individual in a programme could cost more time and money than focusing on a smaller group who the current guidance is not working for).

Another, similar approach to this was highlighted in the systematic review findings where programmes grouped similar participants. This enabled

programmes to tailor their content and approach to groups who shared barriers, interests, and experiences. This approach to programmes was seen in groups who shared religious beliefs, language, ethnicity, workplace, sexuality, gender, and sporting interests.

Finally, rather than tailoring to specific groups, a wider ubiquitous approach to weight management could also address the barriers individuals face. A whole-systems approach aims to address the multifactorial drivers of obesity by addressing barriers to weight loss across the social-ecological model (i.e. environment, culture, interpersonal) (400). Such approaches may be challenging to implement due to the feasibility of addressing factors outside of the programme's control. But, as the data in this work suggests, differences between "successful" and "unsuccessful" participants lie in their ability to overcome barriers so programmes could focus on understanding these barriers across the tiers of the social-ecological model and consider strategies for managing these. Similarly, adopting programmes within a specific context of an individual's life could be a way to target specific barriers in the system. For example, introducing a weight management programme within the workplace could address workplace barriers highlighted in this work (e.g. suitable facilities for meal preparation) (180–182,401).

Despite feasibility challenges to a whole-systems approach incorporating multiple levels of the SEM, there are several real-world examples with varying levels of success. For example, in the UK, the change 4 life strategy aimed to improve weight in children, young people, and families. This approach involved multiple interventions at different levels including making parents healthy role models for their children, education in schools, social marketing campaigns and investing in open spaces to promote PA found some positive effects on health and wellbeing (402). Notably, the Amsterdam Healthy Weight Approach seems to be one of the most successful whole-systems approaches, reporting significant decreases in obesity prevalence (403–405). This approach incorporated interventions at different levels (e.g. political, environmental), different settings (e.g. home, school, neighbourhood), and within different intrapersonal domains (e.g. sleep, eating habits, PA). To do this they developed a theory of change to identify barriers, assumptions, processes for change, and desired

outcomes. Such approaches require revisions due to changing social-ecological landscapes but show promise in harnessing population-level changes. While this may be challenging for individual programmes to adopt, programmes and policies should consider this approach to create weight-friendly environments.

To facilitate both successful engagement and outcomes, programmes need to consider factors within and outside of the programme itself. Though not exhaustive, key recommendations for future programmes and practice elicited from this research are listed below:

1. Setting reasonable expectations of what visible changes participants should expect at different stages. A common theme between participant groups was the presence of visible changes facilitating motivation and the absence resulting in disengagement. It is therefore imperative for programmes to consider how to manage weight loss expectations. Possible approaches could include setting modest targets, regularly reviewing progress and weight loss targets, setting incremental targets throughout the programme, and explaining about different weight loss trajectories (406,407). Other approaches may involve changing the focus from weight change to health indicators (e.g. improvements in mood or blood pressure).

2. Support participants to identify or develop intrinsic motivations for their weight loss. This research found participants who were motivated by health, preparing for future hardships, or for their children/loved ones were more successful. Future programmes should therefore support participants to identify meaningful motivations. Current evidence on the efficacy of therapeutic strategies such as motivational interviewing in weight management is mixed (408,409). However, other possible approaches may include providing education tailored to specific risks associated with the participants weight/health and how weight loss may alleviate these. Another way to support motivation may be to set realistic expectations about what visible results participants may experience and when.

3. Deliver the programme content in an accessible way. The systematic review and interviews highlighted the importance of programmes delivering materials and content in a way that participants could relate to and understand. Possible

approaches, based on this data, could include using clear and accessible (lay) language, using examples and developing guidance which is culturally meaningful to the group (e.g. incorporating beliefs, language, diet choices, and interests) (205,206,219,240), and offering different formats and times to enable participants to fit the programme into their routine (i.e. online and in-person). For in-person programmes, there should be consideration on whether the setting is appropriate (e.g. suitable flooring for exercise, venue choice) and if it is accessible through public transport (235,239).

4. Providing tailored advice and guidance. Key differences between "successful" and "unsuccessful" participants lay in their abilities to manage stressors, address barriers, and in how they understood their weight targets. Providing further assistance in behaviour change strategies could bridge these differences between groups. For example, supporting participants in identifying barriers (at different levels of the SEM) and problem solve how to address these, and to assist them in identifying prompts and reinforcing strategies for desired behaviours.

5. Fostering positive group dynamics in the programme. The systematic review highlighted the importance of belonging and camaraderie in the intervention group. Similarly, the qualitative data showed if the group was perceived as overbearing or burdensome this could act as a barrier to engaging with the programme and potentially weight loss. Possible approaches for improving group dynamics would be to promote interaction between participants to build rapport or facilitating the formation of support networks either through a "buddy" system or having emotional support discussions throughout the programme (320). The research also highlighted the importance of the staff member being the same throughout the programme and their role in promoting positive group dynamics, as well as having a positive approach (e.g. non-judgemental, showing empathy, supporting problem solving).

6. Fostering positive interpersonal relationships external to the programme. Critical differences were discovered in interpersonal interactions external to the programme between "successful" and "unsuccessful" participants. "Unsuccessful" participants reported negative reactions to their weight loss (e.g. being asked if they were unwell), being more resistant to support, and actively

avoiding people who were negative influences. Whereas "successful" participants noted being able to come up with pragmatic solutions to negative social experiences. Programmes should support participants to consider how to navigate these types of issues and source practical and realistic solutions for them (158). Another approach may be to actively include a "supporter" from their family or friendship groups who could act as a confidant or a source of accountability, and to consider ways that they can be involved (e.g. having them involved in some activities or having dedicated nights for them to come along to the programme)(220,410).

7. Considering wider societal issues which may impact interaction with the programme (e.g. stigma, policy or contextual factors). The research found that "successful" participants were more aware of the wider influences on their weight management, yet all participants ultimately held their own willpower as the main reason for their weight issues. Supporting participants to think more holistically about the challenges they face in regard to their weight management may uncover more barriers that they can address (that they may not have been aware of) and alleviate the blame culture related to weight which likely is not positive for their mental health and ultimately their wellness on the programme.

8. Utilising an approach which can identify those who are struggling and address specific barriers. The approach of a programme itself needs to incorporate strategies to support those struggling in a programme and to address barriers of particular groups. One method may be to focus interventions on a specific group (e.g. by gender, health concern, beliefs, sexuality) and tailor content to be mindful of the interests and challenges the group may face (e.g. including activities which appeal to that group such as sport, or delivering content using something meaningful to them (e.g. linking it to faith)) (206,219,240,411,412). Another approach could be to offer a stepped-care approach where participant progress is monitored throughout and those at risk of not attaining their goals or of attrition are offered additional support (192).

7.5.2 Suggestions for policy & research

Changes to interventional components for research studies will be the same as discussed above. Below are key directions for future research and policy based on the findings and limitations of this project:

1. Collect data and compare barriers and facilitators experienced between groups at multiple timepoints across weight management interventions. This research managed to collect data *during* participation and provided novel insights into differences between groups as a result. However, a limitation of the interviews is they captured a particular point in time which may have missed barriers/facilitators experienced by participants afterwards. To overcome the limitation of capturing experiences at a specific point in time or at follow-up, future research should consider ways to capture data at multiple points during an intervention (including baseline and at follow-up). More intensive approaches may include ecological momentary assessments which would allow participants to record barriers or facilitators in real-time (413–415). Less intensive approaches may include collecting qualitative or survey data regularly throughout an intervention (i.e., every 2 weeks). Moreover, comparing experiences of "successful" and "unsuccessful" participants across timepoints could support a stepped-care approach by identifying critical points when additional support is needed to address barriers between groups.

2. Explore further the role of personal networks in adherence, support, and levels of "success". The personal network data faced several barriers including the usability of the software, burden of task in the surveys, COVID-19, and the phrasing of questions. Based on feedback from participant in this study, future research should adopt a qualitative approach to collecting this data. Questions should be carefully phrased to ensure participants can understand and differentiate between alters more easily (e.g., considering types of support and the specific meaning of "admire"). Outside of COVID-19 restrictions, it would also be likely networks would include alters that participants do not feel as close to which could provide insights into the influence of "weak" ties in the network (284,416).

3. Employing a whole-systems approach to address barriers and facilitate change. This research has demonstrated that constructs across the SEM can help or hinder "success" while engaging in weight management programmes. Research needs to consider how wider influencers interact with a programme and how participants can be supported to manage these. With the limitations of this research, there is also a need for research to further investigate the role of different types of environments (e.g. urban vs rural, green and blue space) and wider SEM constructs (e.g. policy, culture). Further investigation is also required to understand how different levels of the system interact and whether how these interventions fit in the system impact "success". Potential approaches may include conducting further mixed-methods evaluations of how different parts of SEM impact "success", conducting interventions in specific settings which are easier to control and evaluate (e.g. workplaces, neighbourhoods), and for wider projects incorporating multiple interventions related to environmental use, interpersonal relationships and intrapersonal change.

Following on from recommendation 3, Table 7-1 suggests further considerations for a whole-systems approach. These ideas are derived from the data collected in this work.

Table 7-1 Considerations for a whole-systems approach to muti-faceted weight management interventions.

	Consideration	Breakdown of factors
1	Consider the infrastructure of towns to promote healthier lifestyles.	• Reduce accessibility of obesogenic foods (i.e. remove access to sweets at checkouts, reduce the number/easier access to fast food outlets and reduce the visibility of advertising). • Increase access to facilities for PA (i.e. affordable, long opening hours to fit into routines, convenient location, public transport, green space). • Improve facilities for PA (i.e. outdoor areas to have suitable street lighting and walking areas).
2	Improve food facilities in the workplace.	• Provide convenient and healthy food options. • Provide food preparation areas.
3	Consider the structure of the workday to ensure staff have time for PA and meal preparation/consumption.	• Longer lunches for PA and meal preparation (nb, Particularly in the Winter months so staff can go for walks when it's daylight). • Where possible specify lunch timings and have designated areas for meal preparation and consumption. • Considering flexible working hours.
4	Improve knowledge of healthy eating.	• Education programmes and skill development on healthy choices, cooking – fast and easy options
5	Improve the affordability of a healthy lifestyle.	• Food, PA, and programmes are affordable. • Education on how to engage in these areas in a cost-effective way.
6	Interventions tailored for specific settings.	• See workplace examples above. • Household interventions – which may include focusing on harnessing social support. • Neighbourhoods – having healthy food options and places for PA.

Overall to expand on this work, it would be useful for research to investigate the wider contextual factors which may impact success in programmes (e.g. cultural, environmental, and political factors). These are factors which could be heterogenous between populations. With the specific population and context of this work (e.g. COVID-19, mostly white, female, and high SES) there may be influential factors related to race, gender, education, and deprivation which have been missed. While it may seem counterintuitive to focus on wider factors to improve behavioural weight loss programmes, it is vital to consider members of the public participating in such programmes are always embedded within their wider context. Seeking to understand how a participant's context is related to their weight loss success and participation could uncover targetable barriers within particular groups and individuals.

8 Conclusions

The results of this thesis contribute to the existing body of literature on factors impacting success in weight management programmes. This work provides insights into the factors participants report as helping or hindering their weight loss during participation in a programme. The systematic review, qualitative interviews, surveys, and personal network analysis data facilitated the comparison of differences and similarities between "successful" and "unsuccessful" participants. "Successful" participants had higher levels of self-efficacy, motivation and social support, an internal LoC, made more behavioural changes, had lower levels of depression and anxiety, were more pragmatic in their solutions to barriers, and did not report challenging work patterns compared to "unsuccessful" participants. These comparisons allow for interventions to consider ways to improve overall and specific issues that those who are not experiencing success may be facing. Across the four studies, behavioural changes, social support, mood, motivation, control, and self-efficacy were highlighted as key contributors to success. Participants themselves emphasised ultimately their success was down to their motivation, willpower, and control. However, as noted in the discussions above, wider influences likely play a key role in how these intrapersonal and interpersonal factors impact success. Considering whole-systems strategies to address barriers at different levels of the social-ecological model will likely help address high obesity rates.

Findings from this work can be used to inform weight management services, policy, and future research. With the growing prevalence of obesity and the associated risk factors (e.g. type 2 diabetes, CVD, cancer) causing an increasing burden on the NHS (i.e. cost and time for treatment) interventions must be developed to enhance chances of success and increase the likelihood of long-term healthful behaviours.

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Appendices

Appendix 1: Systematic review search strategy (Embase and Medline version)

#	Searches	Results	Comments
1	Obesity/ or Obesity, Morbid/ or Obesity, Abdominal/	189806 190052	
2	exp weight gain/	30134 30173	
3	Overweight/	22607 22643	
4	(overweight or over weight or overeat* or over eat*).ti,ab.	55984 56067	
5	(weight adj1 gain*).ti,ab.	56021 56080	
6	(weight adj1 loss*).ti,ab.		
7	obes*.ti,ab.	236465 236811	
8	1 or 2 or 3 or 4 or 5 or 6 or 7	346445 346901	
9	(modific* or therap* or intervention* or strateg* or program* or management or scheme* or group* or pathway*).ti,ab.	7442464 74510510	
10	(Behavioural or behavioral or group or lifestyle or psych* or therap* or support or commercial or plan or project or non surgical or non-surgical or coaching or weight watchers or weightwatchers or WW or slimming world or Jenny Craig or counseling or counselling).ab,ti.	5626448 5635647	Non surgical and non-surgical finds same number of hits (VW)
11	(weight adj1 los*).ti,ab.	72799 72885	
12	(weight adj1 reduc*).ti,ab.	11555 11567	
13	weight loss/	33914 33953	
14	Obesity/dh, pc, th	35639 35684	

15	Obesity, Morbid/pc, dh, th	1328 1329	
16	Diet Therapy/	10307 10307	
17	Diet, Fat-Restricted/	3548 3550	
18	Diet, Reducing/	10867 10872	
19	Dietetics/ed, mt	1691 1691	
20	(diet or diets or dieting).ti,ab.	297993 298330	
21	(low calorie or hypocaloric or calorie control*).ti,ab.	4200 4205	
22	(health* adj1 eating).ti,ab.	5652 5670	
23	(diet* adj2 (modific* or therapy or intervention* or strateg* or program* or management or scheme*)).ti,ab.	21812 21844	
24	(nutrition adj2 (modific* or therapy or intervention* or strateg* or program* or management or scheme*)).ti,ab.	8448 8457	
25	(weight adj3 (modific* or therapy or intervention* or strategy* or program* or management or scheme*)).ti,ab.		
26	(Success* or Los* or facilitat* or change or outcome or positive or favourable or predictor or achiev* or adhere* or compliance).ab,ti.	4491343 4496264	
27	(Fail* or drop-out or dropout or barrier* or obstacle* or attrition or challeng*).ab,ti.	1135362 1136486	
28	9 or 10	8502536 8514446	Interventions
29	11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25	418907 419381	Weight loss, diet etc
30	26 or 27	5249157 5254795	Failure or success
31	8 and 29	106922	

		107079	
32	30 and 31	50976 51051	
33	28 and 32	37100 37164	
34	((("semi-structured" or semistructured or unstructured or informal or "in-depth" or indepth or "face-to-face" or structured or guide) adj3 (interview* or discussion* or questionnaire*)) or (focus group* or qualitative or ethnograph* or fieldwork or "field work" or "key informant")).ti,ab. or interviews as topic/ or focus groups/ or narration/ or qualitative research/	302836 303307	Filter #1
35	(patient experience or process evaluation or evaluation or assessment or appraisal or success analysis or feedback or report or comment or response or reaction or comparison).mp	7613596	
36	8 and 28 and 29 and 30	37100 37164	All concepts
37	Adult/	4788568 4792425	
38	36 and 37	15696 15723	Limited to adults
39	34 and 35 and 38	417	With Filter #1
40	(interview: or experience:).mp. or qualitative.tw.	1213657 1214906	Filter#2 Broader than Filter#1
41	38 and 35 and 40	1467	With Filter r#2

Appendix 2: Joanna Briggs qualitative critical appraisal tool

JBI CRITICAL APPRAISAL CHECKLIST FOR QUALITATIVE RESEARCH

Reviewer_____Date_____

Author_____Year_____ Record Number_____

	Yes	No	Unclear	Not applicable
1. Is there congruity between the stated philosophical perspective and the research methodology?	☐	☐	☐	☐
2. Is there congruity between the research methodology and the research question or objectives?	☐	☐	☐	☐
3. Is there congruity between the research methodology and the methods used to collect data?	☐	☐	☐	☐
4. Is there congruity between the research methodology and the representation and analysis of data?	☐	☐	☐	☐
5. Is there congruity between the research methodology and the interpretation of results?	☐	☐	☐	☐
6. Is there a statement locating the researcher culturally or theoretically?	☐	☐	☐	☐
7. Is the influence of the researcher on the research, and vice- versa, addressed?	☐	☐	☐	☐
8. Are participants, and their voices, adequately represented?	☐	☐	☐	☐
9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?	☐	☐	☐	☐
10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?	☐	☐	☐	☐

Overall appraisal: Include ☐   Exclude ☐   Seek further info ☐

Comments (Including reason for exclusion)

_____

Appendix 3: Joanna Briggs quasi-experimental critical appraisal tool

JBI CRITICAL APPRAISAL CHECKLIST FOR QUASI-EXPERIMENTAL STUDIES

Reviewer_____ Date_____

Author_____Year_____ Record Number_____

	Yes	No	Unclear	Not applicable
1. Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)?	☐	☐	☐	☐
2. Were the participants included in any comparisons similar?	☐	☐	☐	☐
3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	☐	☐	☐	☐
4. Was there a control group?	☐	☐	☐	☐
5. Were there multiple measurements of the outcome both pre and post the intervention/exposure?	☐	☐	☐	☐
6. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	☐	☐	☐	☐
7. Were the outcomes of participants included in any comparisons measured in the same way?	☐	☐	☐	☐
8. Were outcomes measured in a reliable way?	☐	☐	☐	☐
9. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal:　Include ☐　Exclude ☐　Seek further info ☐

Comments (Including reason for exclusion)

_____
_____
_____

Critical Appraisal Checklist for Quasi-Experimental Studies - 3

Appendix 3: Joanna Briggs randomised controlled trails critical appraisal tool

JBI CRITICAL APPRAISAL CHECKLIST FOR RANDOMIZED CONTROLLED TRIALS

Reviewer_____ Date_____

Author_____Year_____ Record Number_____

		Yes	No	Unclear	NA
1.	Was true randomization used for assignment of participants to treatment groups?	☐	☐	☐	☐
2.	Was allocation to treatment groups concealed?	☐	☐	☐	☐
3.	Were treatment groups similar at the baseline?	☐	☐	☐	☐
4.	Were participants blind to treatment assignment?	☐	☐	☐	☐
5.	Were those delivering treatment blind to treatment assignment?	☐	☐	☐	☐
6.	Were outcomes assessors blind to treatment assignment?	☐	☐	☐	☐
7.	Were treatment groups treated identically other than the intervention of interest?	☐	☐	☐	☐
8.	Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	☐	☐	☐	☐
9.	Were participants analyzed in the groups to which they were randomized?	☐	☐	☐	☐
10.	Were outcomes measured in the same way for treatment groups?	☐	☐	☐	☐
11.	Were outcomes measured in a reliable way?	☐	☐	☐	☐
12.	Was appropriate statistical analysis used?	☐	☐	☐	☐
13.	Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?	☐	☐	☐	☐

Overall appraisal: Include   ☐   Exclude ☐   Seek further info ☐

Comments (Including reason for exclusion)

_____

_____

_____

Appendix 5: Study invitation email

Understanding the barriers to & facilitators of weight loss during participation in weight management programmes

Researchers at the University of Glasgow are trying to better understand what supports and prevents someone from reaching their weight loss goal while participating in a weight management programme. Understanding this will enable us to develop ideas on how to improve programmes to support people who may be struggling to reach their goal.

As part of this they would like people who are following the Second Nature programme to take part in an online survey. As someone just beginning the programme you are in an ideal position to give us valuable information about your experience during the programme. There will be an option to take part in an interview if you wish to do so.

This research is conducted independently of Second Nature and is part of a PhD research project. Your participation in this project will not be fed back to Second Nature.

What does the study involve?
- Completing an online survey at the start of the programme and at 3 months.
- A telephone interview around 4 weeks after you have started the programme via telephone or videocall. The interview will long around 60-90 mins and will ask you questions about your experience with Second Nature and what has affected your weight loss journey
- You will be enrolled into a prize draw for £200 in amazon or love2shop vouchers for completing the 2 surveys.
- You will receive a £20 amazon or love2shop voucher for completing the interview

Your responses to the questions will be kept completely confidential, data will be stored on secure systems and your identity will not be revealed during the analysis or write up of the findings. Second Nature will only see summary results from this project.

How do I take part?
If you would like to find out more information about taking part **please email:** Meigan Thomson (University of Glasgow - PhD Researcher)
m.thomson.3@research.gla.ac.uk giving your phone number and the best time to call (daytime/ evening etc) and we will be in touch.

Appendix 6: Survey PIS

Participant Information Sheet

Study title: Understanding the barriers and facilitators of weight loss in behavioural weight management programmes

Researcher Details	**Supervisor**
Meigan Thomson	Professor Sharon Simpson
University of Glasgow	University of Glasgow
MRC/CSO Social & Public Health Sciences Unit Sciences Unit	MRC/CSO Social & Public Health
200 Renfield Street	200 Renfield Street
Glasgow, G2 3AX	Glasgow, G2 3AX
Email: m.thomson.3@research.gla.ac.uk Sharon.Simpson@glasgow.ac.uk	Email:

You are being invited to take part in a research study. Before you decide to take part, it is important for you to understand why the research is being done and what it will involve. Please read the following information carefully and discuss it with others if you wish. Ask the researcher if there is anything that is not clear or if you would like more information. Take some time to decide whether or not you wish to take part.

Thank you for reading this.

What is the purpose of the study?

People taking part in weight management programmes often find it challenging to achieve their goals and maintain changes to their lifestyle. This study aims to discover which factors make it more challenging for some people to reach their goals when they take part in weight management programmes. This will give us a better understanding of how we can change and develop programmes to be more supportive in helping people to achieve their goals and overcome challenges. To gain a better understanding of this, we are conducting research with people who have just started the Second Nature programme. We are conducting two surveys – one at the start and one at the end of the programme. This will allow us to compare people's weight loss results with their responses in the surveys. We will also be conducting some interviews which you can opt in to after the survey or contact Meigan (details above) to take part.

Why have I been invited to take part?

We are asking you to take part because you have recently begun a weight management programme with Second Nature and indicated that you would be interested in taking part by contacting the researcher.

What is Second Nature's involvement?

Second Nature are facilitating recruitment by sending email invitations to new members. Following this, Second Nature have no further involvement in the study or the data collection and will not know whether you take part or not. Second Nature will not have access to the data.

Do I have to take part?

No, you are not obliged to take part – it is up to you to decide. If you decide to take part, you will need to complete a consent form online before beginning the survey.

What if I change my mind?

You are free to withdraw at any time without giving a reason and without this affecting your experience in the Second Nature programme. Data collected up to the point of withdrawal will be retained unless you specifically ask for it to be removed.

What will happen if I take part?

- You will complete a survey on factors which have affected your experience in the Second Nature programme at two time points: now and at 3 months. These surveys will be similar and ask questions about you (e.g. your mood, motivation) and social (e.g. how supportive people are), programme (e.g. what you like/dislike about the programme) and environmental factors (e.g. do you have access to green space for physical activity), and how they impact your weight loss journey.
- As part of the social section of the survey, you will be asked to complete questions on your social network. This section will ask you who you have spent time with, some questions about the person (e.g. relationship to you, gender) and whether the people you input know one another. All names put into this section will be replaced with numbers or pseudonyms to maintain confidentiality.
- The first survey will take approximately 25 minutes and the second survey will take approximately 20 minutes to complete
- In the survey, there will be an option to take part in an interview about your experience. These interviews will be conducted over the phone. For completing the interview, you will receive a £20 amazon or love2shop voucher.
- After you complete the survey, the researchers will send you a thank you email. When it is time for your second survey this will be emailed to you.
- <u>You will be entered into a prize draw for £200 amazon or love2shop voucher once you complete the second survey at 3 months</u>.

What are the possible benefits of taking part?

There are no direct benefits to you, but the results of the study will be used to inform future development of weight management interventions.

What are the possible disadvantages and risks of taking part?
During the survey there are no significant risks. You can choose to stop or have a break at any time.

What if there is a problem?

If you experience any problems during the research, please report this to the researcher (information above). If you have any questions regarding your weight loss aims, please speak to the health coach of your weight management programme.

What happens when the study is finished?

1. The results will be analysed and published as part of a PhD thesis. The results will also be shared in scientific journals, presentations and will be used to improve weight management services. Second Nature will be identified as the source of participant recruitment but individuals (names, places, relations) will not be identifiable. You and anyone you know will not be identifiable in any publications or presentations from this study.
2. The data will be stored securely for at least 10 years with the University of Glasgow to allow full analysis. The data will be deposited in a secure archive, such as the UK Data Archive, so that they can be used for research and teaching by people

To request a copy of the summarised results or the fully published results please contact one of the researchers named at the top of the form.

Will my participation in this study be kept confidential?

All information we collect during the research will be kept confidential and there are strict laws which safeguard your privacy at every stage. All the data will be stored securely, and any identifiable information will be removed.

What will happen to my data?
1- Survey data will be stored on secure password-protected servers at the University of Glasgow

2- All survey data will be stored for at least 10 years at the University of Glasgow.

3- Contact information will be stored until the end of follow-up at the University of Glasgow.

4- Starting and 3-month weights received via the survey will be used to allow for comparison between amount of weight lost during the time period and results in the surveys

Who is organising and funding the research?
The study is part of a PhD project funded by the Medical Research Council.

Who has reviewed this research?
This project has been considered and approved by the College of Social Sciences Research Ethics Committee

To pursue any complaint about the conduct of the research: contact the College of Social Sciences Ethics Officer, Dr Muir Houston, email: Muir.Houston@glasgow.ac.uk

_____End of Participant Information Sheet_____

Appendix 7: Survey consent form

Consent Form

Title of Project: **Understanding the barriers and facilitators of weight loss in behavioural weight management programmes**

Name of Researcher: Meigan Thomson   Email: m.thomson.3@research.gla.ac.uk
Supervisor: Professor Sharon Simpson   Email: Sharon.Simpson@glasgow.ac.uk

Basic consent clauses

Please tick as appropriate

Yes ☐   No ☐   I confirm that I have read and understood the Participant Information Sheet for the above study and have had the opportunity to ask questions.

Yes ☐   No ☐   I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.

Confidentiality/anonymity clauses

Yes ☐   No ☐   I understand that any personal or information that could identify me in the survey or social data collection will be replaced with pseudonyms.

Where dependent relationship exists

Yes ☐   No ☐   I acknowledge that there will be no effect on my experience in the weight management programme arising from my participation or non-participation in this research.

Clauses relating to data usage and storage

Yes ☐   No ☐   I consent to the use of anonymised information from this study to be stored for at least 10 years at the University of Glasgow.

Yes ☐   No ☐   I understand the data from the survey, with any personal or identifiable information removed, will be deposited in a secure archive so that they can be used for research and teaching purposes

I agree that:

Yes ☐ No ☐   All names and other material likely to identify individuals will be anonymised.

Yes ☐ No ☐   The material will be treated as confidential and kept in secure storage at all times.

Yes ☐ No ☐   The material will be retained in secure storage for use in future academic research

Yes ☐ No ☐   The material may be used in future publications, both print and online.

Yes ☐ No ☐   I waive my copyright to any data collected as part of this project.

Yes ☐ No ☐   Other authenticated researchers will have access to this data only if they agree to preserve the confidentiality of the information as requested in this form.

Refer to Privacy Notice in relation to processing of personal data.

Yes ☐ No ☐   I acknowledge the provision of a Privacy Notice in relation to this research project.

Yes ☐ No ☐   I consent to the University processing my personal data for the purposes detailed in the privacy notice.

Consent clause, tick box format

I agree to take part in this research study   ☐

I do not agree to take part in this research study   ☐

……………… End of consent form ……………

Appendix 8: Survey privacy notice

Privacy Notice for: Understanding the barriers and facilitators of weight loss in behavioural weight management programmes - Surveys

Your Personal Data

***The University of Glasgow** will be what's known as the 'Data Controller' of your personal data processed in relation to your responses and contact details received in the survey. This privacy notice will explain how The University of Glasgow will process your personal data.*

Why we need it

We are collecting your basic personal data such as name, emailed address and telephone number so we can contact you for other parts of the study (i.e. the next survey or if you opt into an interview). The survey will collect information on different aspects of your life related to your weight loss journey, this will include the collection of data on: personal information (such as income, postcode, gender, age), your weight history, your environment, the programme you are participating in, your thoughts and motivations and who you have spent time with. We are gathering this information to better understand what factors may support or prevent weight loss. We can use this information to try and improve programmes to be more supportive of those at risk of not reaching their goals. We will only collect data that we need in order to in order to address the research question.

Legal basis for processing your data

We must have a legal basis for processing all personal data. In this instance, the legal basis is public task and scientific research – please ensure to select that you have read this notice in the consent form please ensure to select that you have read this notice in the consent form. For personal data, the lawful basis is that processing is necessary for the performance of a task carried out in the public interest (Article 6 1.(e) of the GDPR) and for special category data, the processing is necessary for scientific research (Article 9 2.(j) of the GDPR).

What we do with it and who we share it with
- *All the personal data you submit is processed by staff at the University of Glasgow in the United Kingdom.*
- Any names or nicknames you provide in the social section with be replaced with pseudonyms or numbers to protect your identity
- Your contact information will be stored on the University of Glasgow's secured computer systems in a password-protected folder. This will only be accessible to the University of Glasgow staff working on the project and only to contact you in relation to the project.

How long do we keep it for

Your contact data will be retained by the University until the follow-up in the study is completed. If you request to be sent a copy of the study results we will hold your contact details until this is sent. After this time, personal data will be securely deleted. Data from the survey will be retained by the University for 10 years in a pseudonymised format (with any identifiable names or places replaced) to allow for full analysis. After 10 years, the data will be securely uploaded to a data archive for research and education purposes. All identifiable information will be removed.

What are your [rights](#)?*

As a participant in the study, you have the right to request access, correction or deletion of your personal contact data. You have the right to withdraw from the study at any time, without providing reason. We will retain the survey data we have collected up to time of withdrawal for analysis, unless you specifically request for this to be removed.

You can request access to the information we process about you at any time. If at any point you believe that the information we process relating to you is incorrect, you can request to see this information and may in some instances request to have it restricted, corrected or, erased. You may also have the right to object to the processing of data and the right to data portability.

If you wish to exercise any of these rights, please submit your request via the [webform](#) or contact dp@gla.ac.uk.

*Please note that the ability to exercise these rights will vary and depend on the legal basis on which the processing is being carried out.

Complaints

If you wish to raise a complaint on how we have handled your personal data, you can contact the University Data Protection Officer who will investigate the matter.

Our Data Protection Officer can be contacted at dataprotectionofficer@glasgow.ac.uk

If you are not satisfied with our response or believe we are not processing your personal data in accordance with the law, you can complain to the Information Commissioner's Office (ICO) https://ico.org.uk/

Participant Information Sheet

Study title: Understanding the barriers and facilitators of weight loss in behavioural weight management programmes

Researcher Details	**Supervisor**
Meigan Thomson	Professor Sharon Simpson
University of Glasgow	University of Glasgow
MRC/CSO Social & Public Health Sciences Unit	MRC/CSO Social & Public Health Sciences Unit
200 Renfield Street	200 Renfield Street
Glasgow, G2 3AX	Glasgow, G2 3AX
Email: m.thomson.3@research.gla.ac.uk	Email: Sharon.Simpson@glasgow.ac.uk

You are being invited to take part in a research study. Before you decide to take part, it is important for you to understand why the research is being done and what it will involve. Please read the following information carefully and discuss it with others if you wish. Ask the researcher if there is anything that is not clear or if you would like more information. Take some time to decide whether or not you wish to take part.

Thank you for reading this.

What is the purpose of the study?

People taking part in weight management programmes often find it challenging to achieve their goals and maintain changes to their lifestyle. This study aims to discover which factors make it more challenging for some people to reach their goals when they take part in weight management programmes. This will give us a better understanding of how we can change and develop programmes to be more supportive in helping people achieve their goals and overcome challenges. To gain a better understanding of this we are interviewing people who are 3-5 weeks into the Second Nature programme.

Why have I been invited to take part?

We are asking you to take part because you have recently begun a weight management programme with Second Nature and indicated that you would be interested in taking part, either through our survey or by contacting the researcher.

What is Second Nature's involvement?

Second Nature are facilitating recruitment by sending email invitations to new members. Following this, Second Nature have no further involvement in the study or the data collection and will not know whether you take part or not. Second Nature will not have access to the data.

Do I have to take part?

No, you are not obliged to take part – it is up to you to decide. If you decide to take part, you will need to read over the consent form before the interview. If you can sign it, please email it back to the researcher, if you cannot we will take audio consent at the start of the interview. This will be audio recorded on an encrypted recorder and stored separately from the interview data on the University of Glasgow's secured computer systems.

What if I change my mind?

You are free to withdraw at any time without giving a reason, without this affecting your experience in the Second Nature programme. Data collected up to the point of withdrawal will be retained unless you specifically ask for it to be removed.

What will happen if I take part?

- You will be contacted by one of our researchers to book a convenient time for the interview. Interviews will take place over the phone.
- It is estimated the interviews will take approximately 1-1.5 hours. The researcher will use a voice recorder to record the interview.
- The interview aims to learn about your personal experience of the weight loss programme and how it and other factors in your life have impacted you reaching your goals (e.g. getting enough support from family and friends or having access to healthy options such as fresh fruits and vegetables and green spaces) .
- There will be a short exercise exploring how the influence of your friends, family and others in your social network may impact your weight loss. This will involve answering questions on who you have spent time with, received support from and confided in and their relationship to you during your time at Second Nature.
- Following the interview, the recordings will be sent securely to be transcribed by a company which has been approved by the University of Glasgow and who have agreed to keep your information private. Each recording will be given a unique participant ID number and any identifiable information stated in the interview (i.e. place names or friend/family names) will be removed. Audio recordings and transcripts will be stored securely on the University of Glasgow computer systems.
- You will receive a £20 amazon or love2shop voucher your time.

What are the possible benefits of taking part?

There are no direct benefits to you, but the results of the study will be used to inform future development of weight management interventions.

What are the possible disadvantages and risks of taking part?

During the interview there are no significant risks. You can choose to stop or have a break at any time.

What if there is a problem?

If you experience any problems during the research, please report this to the researcher or supervisor (information above). If you have any questions regarding your weight loss aims, please speak to the health coach of your weight management program. If you have any health concerns, please consult with your GP or a healthcare professional.

What happens when the study is finished?

1. The results will be analysed and published as part of a PhD thesis. The results will also be shared in scientific journals, presentations and will be used to improve weight management services. Second Nature will be identified as the source of participant recruitment, but individuals (names, places, relations) will not be identifiable. You and anyone you know will not be identifiable in any publications or presentations from this study. Any quotations used from the study will be anonymised so you will not be identifiable.
2. The data will be stored securely for at least 10 years with the University of Glasgow to allow full analysis. Audio recordings will be destroyed once the study has reached completion. The transcripts with personal or identifiable information removed will be deposited in a secure archive, such as the UK Data Archive, so that they can be used for research and teaching by people who agree to keep your information private.

To request a copy of the summarised results or the fully published results please contact one of the researchers named at the top of the form.

Will my participation in this study be kept confidential?

All information we collect during the research will be kept confidential and there are strict laws which safeguard your privacy at every stage. All the data will be stored securely, and any identifiable information will be removed.

Please note that confidentiality will be maintained as far as it possible, unless during our conversation I hear anything which makes me worried that someone might be in danger of harm, I might have to inform relevant agencies of this.

What will happen to my data?

1- Interview will be audio recorded.

2- Audio recording will be securely transferred to a trusted company to be transcribed.

3- Audio recordings and transcripts will be stored on the university secured computer.

4- Any personal or information that could identify you or people you know will be removed or changed in the transcripts.

5- Contact information will be stored until the end of follow-up at the University of Glasgow.

6 - Audio recordings will be stored until the end of the study at the University of Glasgow.

7-Full transcripts will be stored for at least 10 years at the University of Glasgow.

8- The transcripts with personal or identifiable information removed will be deposited in a secure archive so that they can be used for research and teaching.

9- Starting and 3-month weights will be received from you via the survey you have completed to allow for comparison between amount of weight lost during the study and what issues are discussed in the interviews. If you did not complete the questionnaire, the researcher will note your weight at interview and email/telephone you for your 3-month weight.

Who is organising and funding the research?
The study is part of a PhD project funded by the Medical Research Council.

Who has reviewed this research?
This project has been considered and approved by the College Research Ethics Committee

To pursue any complaint about the conduct of the research: contact the College of Social Sciences Ethics Officer, Dr Muir Houston, email: Muir.Houston@glasgow.ac.uk

_____End of Participant Information Sheet_____

Appendix 10: Interview consent form

Consent Form

Title of Project: **Understanding the barriers and facilitators of weight loss in behavioural weight management programmes**

Name of Researcher: Meigan Thomson   Email: m.thomson.3@research.gla.ac.uk
Supervisor: Professor Sharon Simpson   Email: Sharon.Simpson@glasgow.ac.uk

Basic consent clauses

Please tick as appropriate

Yes ☐ No ☐   I confirm that I have read and understood the Participant Information Sheet for the above study and have had the opportunity to ask questions.

Yes ☐ No ☐   I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.

Consent on method clause

Yes ☐ No ☐   I consent to interviews being audio-recorded

Yes ☐ No ☐   I understand my audio recordings will be sent securely to be transcribed by a company which has been approved by the University of Glasgow and who have agreed to keep my information private

Confidentiality/anonymity clauses

Yes ☐ No ☐   I understand that any personal or information that could identify me will be removed or changed in the transcripts.

Yes ☐ No ☐   I give permission for the publication of direct quotes in academic thesis, journal articles and in presentations. I understand these will quotes will be anonymised as far as possible by removing identifiable information such as names and places.

Where dependent relationship exists

Yes ☐ No ☐   I acknowledge that there will be no effect on my experience in the weight management programme arising from my participation or non-participation in this research.

Clauses relating to data usage and storage

Yes ☐ No ☐   I understand the audio recordings will be stored securely by the University of Glasgow

Yes ☐ No ☐   I consent to the use of anonymised information from this study to be stored for at least 10 years at the University of Glasgow.

Yes ☐ No ☐   I understand the transcripts with personal or identifiable information removed will be deposited in a secure archive so that they can be used for research and teaching purposes

I agree that:

Yes ☐ No ☐   All names and other material likely to identify individuals will be anonymised.

Yes ☐ No ☐   The material will be treated as confidential and kept in secure storage at all times.

Yes ☐ No ☐   The material will be retained in secure storage for use in future academic research

Yes ☐ No ☐   The material may be used in future publications, both print and online.

Yes ☐ No ☐   I waive my copyright to any data collected as part of this project.

Yes ☐ No ☐   Other authenticated researchers will have access to this data only if they agree to preserve the confidentiality of the information as requested in this form.

Yes ☐ No ☐   Other authenticated researchers may use my words in publications, reports, web pages, and other research outputs, only if they agree to preserve the confidentiality of the information as requested in this form

Refer to Privacy Notice in relation to processing of personal data.

Yes ☐ No ☐   I acknowledge the provision of a Privacy Notice in relation to this research project.

Yes ☐ No ☐   I consent to the University processing my personal data for the purposes detailed in the privacy notice.

Consent clause, tick box format

I agree to take part in this research study ☐

I do not agree to take part in this research study ☐

Please select the sections below to add your name and the date. If you do not have an electronic signature, please type your name.

Name of participant	**Signature**	Click or tap to enter a date.
Name of researcher	*Signature*	Click or tap to enter a date.

……………… End of consent form ……………

Appendix 11: Interview privacy notice

Privacy Notice for: Understanding the barriers and facilitators of weight loss in behavioural weight management programmes - Interview

Your Personal Data

The University of Glasgow *will be what's known as the 'Data Controller' of your personal data processed in relation to your responses and contact details for the interview. This privacy notice will explain how The University of Glasgow will process your personal data.*

Why we need it

We are collecting your basic personal data such as name, emailed address and telephone number so we can contact you to arrange and complete the interview and to collect your 3 month weight (either through the next survey or via email if you are only doing the interviews). The interview will involve answering questions on different aspects of your weight loss journey and this will include the collection of data on: your weight history, your environment, the programme you are participating in, your thoughts and motivations and who you have spent time with. We are gathering this information to better understand what factors may support or prevent weight loss. We can use this information to try and improve programmes to be more supportive of those at risk of not reaching their goals. We will only collect data that we need in order to address the research questions.

Legal basis for processing your data

We must have a legal basis for processing all personal data. In this instance, the legal basis is public task and scientific research – please ensure to select that you have read this notice in the consent form.

For personal data, the lawful basis is that processing is necessary for the performance of a task carried out in the public interest (Article 6 1.(e) of the GDPR) and for special category data, the processing is necessary for scientific research (Article 9 2.(j) of the GDPR).

What we do with it and who we share it with

- *All interview data will be recorded using an encrypted audio recorder. We will record you consent and store this separately from the interview recording in a password-protected folder on the secure University of Glasgow computer systems.*
- *The interview recording will be sent through a secure file transfer to a transcription company who hold a confidentiality agreement with the University for transcription. All audio recordings will be labelled by a unique participant ID and your personal details will not be shared with the*

company. All the personal data you submit is processed by staff at the University of Glasgow in the United Kingdom.

- If you state any places or names in your interview this will be replaced with a pseudonym (another name or a number) to maintain confidentiality.

How long do we keep it for

Your contact data will be retained by the University until the follow-up in the study is completed. If you request to be sent a copy of the study results, we will hold your contact details until this is sent. After this time, personal data will be securely deleted. Your data will be retained by the University for 10 years. After this time, the audio data files will be securely deleted. The transcriptions will be deposited securely into a data repository to be used for future research and education purposes. All names and places which may identify you will be removed

What are your [rights](#)?*

As a participant in the study, you have the right to request access, correction, or deletion of your personal contact data. You have the right to withdraw from the study at any time, without providing reason. We will retain the interview data we have collected up to time of withdrawal for analysis unless you specifically request for this to be removed.

You can request access to the information we process about you at any time. If at any point you believe that the information we process relating to you is incorrect, you can request to see this information and may in some instances request to have it restricted, corrected or, erased. You may also have the right to object to the processing of data and the right to data portability.

If you wish to exercise any of these rights, please submit your request via the [webform](#) or contact dp@gla.ac.uk.

*Please note that the ability to exercise these rights will vary and depend on the legal basis on which the processing is being carried out.

Complaints

If you wish to raise a complaint on how we have handled your personal data, you can contact the University Data Protection Officer who will investigate the matter.

Our Data Protection Officer can be contacted at dataprotectionofficer@glasgow.ac.uk

If you are not satisfied with our response or believe we are not processing your personal data in accordance with the law, you can complain to the Information Commissioner's Office (ICO) https://ico.org.uk/

Appendix 12: Scoring of survey scales

Scale	Scoring methods
Weight locus of control scale (262)	This is a 4-item measure. The response scale for the items is a 6-point Likert scale (strongly disagree to strongly agree), with scores ranging from 4 to 24. Two of the items are worded in the internal direction and two are worded in the external direction. The measure is scored in the external direction, with the two internal items reversed coded, so that lower scores indicate internality and higher scores indicate externality
WEL-SF for eating self-efficacy (263)	This is an 8-item measure. The response scale for the items is a 10-point Likert scale (NOT at all confident to VERY confident). Higher scores indicate a higher level of eating self-efficacy
Exercise self-efficacy scale (task & scheduling subscales) (264)	This consisted of 6 items. The response scale for the items is a 10-point Likert scale (NOT at all confident to VERY confident). Higher scores indicate a higher level of exercise self-efficacy.
GAD2 (265)	This was a 2-item measure of general anxiety. The response scale for the items is a 4-point Likert scale of frequency (Not at all to Nearly every day). Higher scores indicate higher levels of anxiety.
PHQ2 (266)	This was a 2-item measure of depression. The response scale for the items is a 4-point Likert scale of frequency (Not at all to Nearly every day). Higher scores indicate higher levels of depression.

Appendix 13 Interview Schedule

Interview Guide

"Thank you for agreeing to come take part in the interview today. We are hoping these interviews will help us understand the experience people have when they take part in weight management programmes and how different factors impact this. The interview will involve questions about different aspects of your life and history related to your weight loss journey such as your environment, social life and how you feel about the programme and weight loss. If there are any questions you do not want to answer, let me know and we can move on. Does this sound okay?"

Background Questions

Preface:
"To begin, I was hoping to ask you about your history and your weight loss journey. We know there are multiple causes of weight gain such as access to green spaces and healthy foods, social pressures, health and mood or stress, so I'd like to begin with your personal experience."

1. When did you first start to struggle with your weight?	*Follow-Up Questions* What factors do you think led to your initial weight gain? *Prompts* Did you have any problems with your weight in childhood? Do any of your parents of family members struggle with their weight? How did you become aware that you were overweight – at what age? Did others tell you and how did they broach the subject? Did it become a self-fulfilling prophecy?
2. Have you tried to lose weight in the past?	*Follow-Up Questions* Did you do this on your own or with friends or professional help? What factors contributed to whether this was successful? What led to your weight regain?

Programme-Specific Questions
Preface:
Now, I would like to ask you some questions specifically about Second Nature. The reasons you started at Second Nature and your goals.

3. What led you to want to begin your weight loss journey with Second Nature?	*Prompts* *How did you hear about it?*

4. **What do you think about the online format of Second Nature?**	*Prompts* Is it easy to use?
5. **What do you think of the group sessions?**	*Prompts* *What do you like or dislike about them?* *Do you feel part of the group?* *Follow-Up Questions* *Would you change anything about them?*
6. **What do you think of the health coach?**	Prompts Do you find them helpful? *Follow-Up Questions* Is there anything you would change about how you interact with the coach?
7. **What are your goals while attending Second Nature?**	*Follow-Up Questions* Do you use the dashboard to monitor your goals? How did you make these goals? Have they changed since starting?
8. **What do you like or dislike about Second Nature?** 9. **Is there anything you would change about the programme?** 10. **Is there anything else you would like to add about how Second Nature has affected your weight loss journey?**	

Preface:
Now, I would like to move on to factors which may impact whether you reach your goals or how you engage while participating in Second Nature. I will ask you questions about yourself, your environment and who you socialise with

Individual Questions
Preface:
Sometimes our own motivations, beliefs and enjoyment can impact whether we reach our health goals.

9. **What motivates you to lose weight?**	*Prompts* Are you motivated by your health or appearance or by others around you?

10. **What do you do to try and lead a healthier lifestyle?**	*Prompts* Are there new things or things you do differently since starting at Second Nature? Have you picked up any new habits? Has the way you think about your diet and/or physical activity changed?
11. **How do you react to negative experiences during your weight loss journey? E.g. having a set back or not losing the weight you expect**	*Prompts* How do you feel if you do not reach your goals or have a set back? Is there anything you do in reaction?
12. **What factors make it hard to lose weight or achieve your Second Nature goals?**	*Follow-Up Questions* *Do you enjoy having a healthy diet and exercising? – what do you like/dislike?* *What do you think would make it easier to lose weight?* *How much control do you feel that you have over your weight loss?*
13. **How does dieting and physical activity affect your mood?**	*Follow-Up Questions* Does it affect your stress or anxiety levels?

Environment Questions

Preface: "Sometimes certain situations or where we live can make it easier to make healthier choices. With the COVID-19 situation we may find our environment or accessibility to certain food has been changed."

14. **How are you currently affected by the COVID-19 situation regarding your weight loss?**	*Follow-Up Questions* *What restrictions are currently in place where you live?* *Are you having to social distance or self-isolate?* *Are you able to leave your house to shop?* *Do you find the restrictions affect your mood or motivation?*
15. **There have been some findings that people living with obesity have worse outcomes with COVID-19 – Has this affected you in any way?**	*Follow-Up Questions* Has this affected how you interact with your environment or other people? How has this affected your mood or motivation?

16. How much has your typical routine or activities changed because of the COVID-19 restrictions?	*Prompts* *Has it affected your work?* *Do you have more childcare responsibilities?* *Follow-Up Questions* *Do you think this has helped or hindered your weight loss journey so far?*
17. Is there anything else you would like to add about how COVID-19 has impacted your weight loss journey so far?	
18. Is there anything in your household which makes it hard to lose weight?	*Follow-Up Questions* *Who makes the meals?* *Who does the grocery shopping?*
19. How affordable do you think a healthy lifestyle is?	*e.g. the programme, healthy diet*
20. Do you feel like your local area makes it easier or more difficult to lead a healthier lifestyle?	*Prompts* *Is there a lot of fast-food in your area?* *Are there places where you can exercise?* *Do you feel comfortable or able to go outside?* *Is there green space near you?* *Is there advertising for healthy lifestyles or unhealthy lifestyles?*
21. Does your workplace make it easier or more difficult to lead a healthier lifestyle?	*Prompts* *Do people at work eat healthily?* *Are there places to walk?* *Do you have celebrations or activities that may impact a healthy lifestyle? E.g. cake culture, team step counts*
22. Is there anything else you would like to add about how your environment, either at home, at work or access to certain places, has affected your weight loss journey so far?	

Social Questions
Preface:
A lot of what we do and the choices we make are influenced by the people we spend time with. This can be people at home, work, or those we spend time within our spare time.

23. Has the COVID-19 measures changed who and/or how you socialise with people?	*Prompts* *In what ways?* *Do you contact people more or less frequently now?* *Do you think this has impacted your weight loss journey?*
24. How supportive do you think the people in your life are of any changes you are trying to make to your lifestyle?	*Prompts* *Is there anyone who supports you by giving you advice or going to classes with you?* *Does anyone make is difficult to make healthy choices?* *How supportive are the people in your household?*

Preface: *Sometimes there are activities, behaviours, or attitudes which those around us accept as normal. We refer to these as social norms. An example of one of these could be treating yourself to a dessert when you go out for a meal" or making an unhealthy choice to celebrate an occasion.*	*Prompts* What is the norm or typical attitude towards diet and exercise in your area or with the people you spend time with?
25. Have you had any experiences of social norms or other people attitudes making it easier or more difficult to make healthier choices?	
26. Do you think the people in your life have helped or hindered your weight loss journey so far?	Prompts Have you had to change who you spend time with? If so, for what reasons?

Preface: "I am now going to complete a task on my laptop with you. I will read each question aloud. We are now going to create your social network. Your social network is who you typically spend time with, confide in or seek support from. You will be asked a range of questions about who you have interacted with since beginning at Second Nature. You will also be asked about how you know them and what they are like. We understand this will be different from normal, but this can include who you socialise with online via Second Nature or social media."

"You will be asked to name who you have interacted with since starting at Second Nature. You will be asked to name people in different situations who you have interacted with. You can name someone in multiple situations"

"Give people names which you will recognise and find easy to tell distinguish from others with the same name. Feel free to use initials, nicknames or first names. After the interview I will replace all names with a number"

27. Since beginning Second Nature, who have you spent time with?	a. At Home b. At Work c. Online or via text d. Elsewhere (e.g. GP)	Name Generation
Sometimes, when we are trying to eat healthier or be more active, we may spend less time or avoid spending time with people we would usually spend time with. This may be because they are a bad influence (e.g. suggest a takeaway) or unsupportive or the changes we are trying to make. **28. Please tell us the names of who you have tried to spend less time with or reduce contact with over the last 2 weeks.** *Follow up:* **What are the reasons you have tried to avoid or spend less time with this person?** o Encourages me to cheat (e.g. eat unhealthily) o They are critical or unsupportive		

o I do not want them to know I am trying to lose weight o Other (input answer)		
	Now I am going to ask you questions about each person you have nominated. If you realise you have forgotten someone, let me know and we can add them in. Remember we are only talking about people you have spent time or interacted with since starting at Second Nature.	Alter Characteristics
	29. What is this person's gender? 30. What is their relationship to you? 31. Approximately, how long have you known this person? 32. Approximately, how old is this person? 33. How often are you in contact with this person? 34. Do you admire or look up to this person? 35. Would you go to this person for advice or confide in about your weight or health? 36. Are they underweight, a healthy weight or overweight? 37. Are they trying to lose weight?	
Finally, we would like to know who in your network knows each other well enough to spend time together or have a conversation without you being present. I will state two people's names and let me know if they could interact without you present. **End of Social Network Section.** **Before we continue to the next questions, is it okay if I ask you a couple of questions about the task we just completed?** 38. **Do you think this is reflective of who you would usually spend time with or is it different from normal?**		Alter-Alter Ties

39. **Is there anything else you would like to add about your weight loss journey before we end the interview?**

Turn off recorder & ask current weight.

Appendix 14 Data management plan

0. Proposal name
Understanding the barriers and facilitators of weight loss in behavioural weight loss programme
1. Description of the data

1.1   Type of study

This study will collect information on barriers and facilitators of weight loss in adults taking part in an online behavioural weight loss programme: Second Nature. This is a mixed methods study collecting both quantitative survey data, qualitative interview data and social network data as part of a PhD project.

1.2   Types of data

- Quantitative data from online surveys

- Qualitative data from interviews

- Social network data collected via the survey and interview (Social network data is information on who a person has interacted with and spent time with, information on each person and whether they know each other – it isn't an analysis of online social networks)

- Database of contact information

- Audio and electronic consent forms

1.3   Format and scale of the data

Survey data: There will be two surveys – one at the start of the weight loss programme and one at the end. The first survey has approximately 55 questions and the seconds has approximately 40 questions. Surveys 1 and 2 will ask questions on the persons current weight, environment, social life, their thoughts on the programme and about themselves (i.e. mood, motivation scales) and contact information to progress in the study or be enrolled in the prize draw. Survey 1 also asks demographic questions and questions on their weight history. The survey will be distributed through Second Nature until we reach approximately 100 completions. The survey software will be the online survey tool for research which the university has a license for (https://www.onlinesurveys.ac.uk/)

Qualitative: Data from up to 50 interviewed participants. Recordings taken on encrypted devices and in MP3 format. Transcripts in MS Word Format. NVivo project file. Word files containing field notes, data summaries, key themes, and quotations.

Social Network Data: Collected as part of the survey and interview. Data collected in the survey will be in the usual survey format. Participants in the interviews will be asked set questions by the researcher to collect information about their social network. This data will be typed directly into an excel file. Participants will be encouraged to discuss the questions with the researcher as they complete the task. This discussion will be audio recorded on an encrypted device and in MP3 format as part of the interviews. Transcripts in MS Word Format. NVivo project file. The quantitative network data will be exported in .csv format to R for analysis.

2. Data collection / generation

2.1 Methodologies for data collection / generation

How the data will be collected/generated and which community data standards (if any) will be used at this stage.

Consent forms: consent for the survey items will be taken online at the start of the questionnaire. This will be stored on the survey tool. Consent for the interviews will be either through an electronic signature (or if someone has the facility to print, sign and scan the form back) or over the telephone.

Surveys: Baseline data and social network data will be collected through an online survey developed in the university. Login details for the survey tool for research tool account will only be given to researchers using the data. Each participant will be labelled by their a unique ID number. Once all outcomes are collected (final weights at the end of their participation in the programme) the data will be anonymised.

Social Network Data: The social network data collected during interviews will be stored in an excel file and analysed using R. The data collected in the survey will be imported into R for analysis also.

Qualitative: Interviews will be recorded using a portable digital recorder that has a PIN enabled to restrict access and with file encryption set up in the folder where the data will be held. The sound file will be saved in MP3 format. Each sounds file will be named with an anonymised identifier and transcribed into a word document corresponding to that name. Transcripts will be anonymised, with identifiable information being removed, and imported as sources into NVivo. Transcripts will be coded in NVivo and thematic frameworks generated.

Other data: There will be a participant log which will keep track of what stage participants are in on the study. This log will also hold their contact information to arrange interviews, email vouchers and send the second survey. This will be stored separately in the secured project drive on SPHSU systems from project data and used as a key for participant ID numbers.

Once participants have completed the programme, their final weights will either be collected in the second survey or via email/telephone (for participants only doing the interviews). This will be used to categorise participants as either successful in attaining a 5% weight loss or unsuccessful. Once categorised emergent themes from the interviews and social network data (e.g. size, levels of support and influence) will be analysed to create profiles of barriers/facilitators people face who are successful/unsuccessful in such programmes.

2.2 Data quality and standards

Surveys: The surveys have been reviewed by the research team and lay persons for clarity. The survey items are based off other surveys and validated scales.

Social network data: The data collected at the time of the interview will be directly typed into an excel file. For quality control purposes, these will be checked by listening to relevant section of the audio recordings. This allows for answers to be recorded quickly and in a format, which is easily imported into R. Questions will be made so they have simple response options (e.g. number inputs, drop down multiple choice).

Interviews: The interview guide will be piloted and then used for the main interviews. Each interview will be transcribed by a trusted agency. The researcher will check the transcription. In NVivo, an iterative process of creating codes and categories will be undertaken until the coding scheme has been fixed and applied across all transcripts.

3. Data management, documentation, and curation

3.1 Managing, storing, and curating data.

Participant contact information gathered via the survey will be stored on the survey software. Potential participants will have the opportunity to take part in either the

surveys, interview, or both. Participants who take part in the interview only will have their contact information stored in an excel file stored on the Q project drive folder, as this won't have been collected in the survey. All contact information will be stored in an excel file next to the participant's ID number. This will be used as a key and stored on the servers in the SPHSU.

Survey data: *The online survey tool for research will be used to develop and collect the survey data. The participant information sheet and consent forms will be at the start of the survey. Data on the online survey tool is stored online in the UK, is GDPR compliant and is* certified to ISO 27001 standard*. This will be accessible to study researchers via password. Any data downloads will be on the Unit server on the T project drive folder accessible only to those with access to the folder (i.e. members of the research team based in the SPHSU). A file stored on the Q drive will hold the only link between the participant contact information and the unique identifier. Survey data will be downloaded in a .csv format*

Interview data: mp3 files will be stored in a folder on the T project drive for at least 10 years. Transcriptions, anonymised as in section2.1 above, will be stored on the T project drive until the end of the study when they will be formally archived. Social network data will be downloaded as a .csv file and stored on the T project drive.
Any paper records such as printouts of transcripts will be stored in a locked cabinet when not in use.
Back ups
All data on the project drives will be backed up daily in line with Unit back up procedures.

3.2 Metadata standards and data documentation

Survey data: the data will be labelled: variable labels will include the question numbers, question text and missing values labelled. Metadata will be exported from the online survey tool for research as a .csv file.

Qualitative & Social Network Data: Interview data: the metadata associated with each data file will be as follows: participant code, date of interview, time/duration of interview, filename of interview, confirmation that consent has been obtained, filename of transcribed data, weight outcomes. Social network data: Metadata will be saved as an excel file. Data will be labelled: variable labels will include question numbers, text, and missing values.

Copies of the interview schedule, survey (base line and end of programme) and social network questions (survey and interview) will be stored.

3.3 Data preservation strategy and standards

Where possible and where consents allow (the consent form will ask for consent to share data but will not be a condition of participation), the research data will be archived for at least 10 years then put into a repository such as the University of Glasgow Enlighten: Research Data Repository or the UK data service. The format of the data at the time of archiving will be as advised by the repository as that being best for long term preservation.

Since only anonymised data with consent to share will be formally archived, all other research-related materials will be retained in the care of the Unit for the same period and subject to a retention schedule. This is for the purposes of proving research integrity, should it be necessary.
Paper materials such as interviewer notes will be scanned and stored in the T project drive. Electronic files such as data without consent to share, original audio files, participant contact information, that cannot be formally archived will be retained in archived project folders in T:\ completed projects on the SPHSU servers or databases with access restricted to the principal investigator.

Printouts of transcripts which may be used as a tool during the transcription quality control and analysis will not be retained long term.

4. Data security and confidentiality of potentially disclosive information

4.1 Formal information/data security standards

The MRC-SPHSU unit works to ISO 27001, 27002 for information technology security, though it does not have formal certification. The Unit does an annual internal audit of IT security processes. In particular: access to the building is restricted by electronic keys, all network servers are protected with strong passwords and a firewall, screens are locked after 5 minutes of inactivity, workstations and portable devices are encrypted, we have our own cloud computing for secure transfer of data. All members of the Unit have signed a confidentiality agreement and have undergone training in data protection and a compulsory online course in Information Security. Staff involved in research have done Good Clinical Practice Training.

Specific policies applying to the data are described in the GUI-DM-001_Guidance on the Management of Research Data *and associated standard operating procedures and we abide by the University of Glasgow data protection policy.*
https://www.gla.ac.uk/myglasgow/dpfoioffice/policiesandprocedures/dpa-policy/

4.2 Main risks to data security

MRC guidance on the [Confidentiality and data security](link) is provided (please see page 24 of the PDF file generated by selecting the above or adjacent [link]).
Identification of individual study members is the main security risk but every step is taken to reduce this risk: information that could be used to identify individuals is removed from the main data files, and are not shared externally. Such data include date of birth, full postcode, and uncoded verbatim data. When data are shared with external collaborators, the data requested are checked for possible statistical disclosure risk.

Our own cloud is used along with encryption using 7 zip and password protection for any transfer of data. This includes transfer of audio files and transcripts between us and a transcribing company with which we have an agreement and whose staff have signed a confidentiality agreement.

5. Data sharing and access

The research data will be archived in the UK data service with an entry in the University of Glasgow Enlighten: Research Data Repository**.**

5.1 Suitability for sharing

Consent to share data for research and teaching purposes will be requested from participants and data for which consent is obtained will be available for sharing with genuine researchers.

5.2 Discovery by potential users of the research data

- *The research data will be discoverable through the University of Glasgow Enlighten: Research data repository and the UK data archive.*

5.3 Governance of access

Access to the survey data will be available through the and the UK data archive. Qualitative data access will require approval of the students lead supervisor and will require a strict licence that includes a confidentiality agreement.

5.4 The study team's exclusive use of the data

The data will be archived and available for sharing but will be embargoed until the end of the publication of the main papers and the submission/completion of the PhD thesis.

Until then, the study team will have exclusive use of the data. This will be for up to 2 years after the data collection has finished.

5.5   Restrictions or delays to sharing, with planned actions to limit such restrictions

The quantitative/social network data will have identifiable information removed.

The interview data will have personal information removed or replaced (e.g. place names, names of organisations will be substituted for more general terms and specific dates with months or years). The lead supervisor will retain control over who will access the data and ensure they sign a confidentiality agreement.

Where participants have refused to share data, their records will not be shared.

5.6   Regulation of responsibilities of users

External users must abide to user agreements and confirm to SPHSU data sharing policy contained in the GUI-DM-001_Guidance on the Management of Research Data

6.   Responsibilities

The PhD Researcher: Meigan Thomson- overall responsibility of data management, security, metadata creation and quality assurance of data.

Supervisors: Professor Sharon Simpson (Lead), Dr Jennifer Logue, Dr Anne Martin & Dr Emily Long – study wide data management, data security & quality and assurance of data.

Unit IT Systems Manager: Crawford Neilson – unit systems, security and IT support.

7. Relevant institutional, departmental or study policies on data sharing and data security

Please complete, where such policies are (i) relevant to your study, and (ii) are in the public domain, e.g. accessible through the internet.

Add any others that are relevant

Policy	URL or Reference
SPHSU Guidance on the Management of Research Data (local SPHSU link)	G:\SPHSU SOP LIBRARY\4. Data Management\001 GUI Management of Research Data\GUI - DM- 001_Guidance on Managing Research Data_V 3.0_15022019.pdf
MRC Information Security Policy	https://www.mrc.ac.uk/documents/pdf/mrc-information-security-policy/
University of Glasgow Data Protection Policy	https://www.gla.ac.uk/myglasgow/dpfoioffice/policiesandprocedures/dpa-policy/

8. Author of this Data Management Plan (Name) and, if different to that of the Principal Investigator, their telephone & email contact details

Meigan Thomson

PhD Researcher

m.thomson.3@research.gla.ac.uk

Appendix 15: Egonets collected from interviews

Weight Status of Alter
- Health Weight
- Overweight
- Underweight

Status: Complete

Success: Fail

Egoid: 1

Weight Status of Alter
- Health Weight
- Overweight

Status: Complete

Success: Success

Egoid: 2

Weight Status of Alter
- Health Weight
- Overweight

Status: Complete

Success: Success

Egoid: 3

Weight Status of Alter
- Health Weight
- Overweight

Status: Incomplete

Success: Fail

Egoid: 4

Weight Status of Alter
- Health Weight
- Overweight
- Underweight

Status: Complete

Success: Success

Egoid: 5

Weight Status of Alter
- Health Weight
- Overweight

Status: Complete

Success: Success

Egoid: 6

Weight Status of Alter
- Health Weight
- Overweight
- Underweight

Status: Incomplete

Success: Fail

Egoid: 7

Weight Status of Alter
- Health Weight
- Overweight

Status: LOST CONTACT

Success: Success

Egoid: 8

Weight Status of Alter
- Health Weight (yellow)
- Overweight (red)

Status: Complete

Success: Fail

Egoid: 9

Weight Status of Alter
- Health Weight (yellow)
- Overweight (orange)
- Underweight (red)

Status: LOST CONTACT

Success: Fail

Egoid: 10

Weight Status of Alter
- Health Weight (yellow)
- Overweight (orange)
- Underweight (red)

Status: Incomplete

Success: Fail

Egoid: 11

Weight Status of Alter
- Health Weight (yellow)
- Overweight (red)

Status: Complete

Success: Success

Egoid: 12

Weight Status of Alter
- Health Weight
- Overweight
- Underweight

Friend Parent Friend
Sibling
Sibling
Friend
Friend
Friend
0
Spouse/Partner
Family

Status: Incomplete

Success: Fail

Egoid: 13

Weight Status of Alter
- Health Weight
- Overweight

Other Other Other
Other Other
Spouse/Partner
Child Other
Family Sibling
Other Parent
Parent
Friend
Friend
Friend
0

Status: Complete

Success: Success

Egoid: 14

Weight Status of Alter
- Health Weight
- Overweight
- Underweight

Colleague
Colleague
Colleague
Other Other
Family
Child
Parent Parent Other
Spouse/Partner Child
Friend
Family
Other
0

Status: Complete

Success: Success

Egoid: 15

Weight Status of Alter
- Health Weight
- Overweight
- Underweight

Colleague
Colleague
Friend
Family
Sibling
Colleague
Child
Child
Colleague
Family
Colleague
Family Family
0

Status: Incomplete

Success: Fail

Egoid: 16

Weight Status of Alter
- ☐ Health Weight
- ☐ Overweight
- ☐ Underweight

Status: Incomplete

Success: Fail

Egoid: 17

Weight Status of Alter
- ☐ Health Weight
- ☐ Overweight

Status: Incomplete

Success: Fail

Egoid: 18

Weight Status of Alter
- ☐ Health Weight
- ☐ Overweight

Status: Complete

Success: Fail

Egoid: 19

Weight Status of Alter
- ☐ Health Weight
- ☐ Overweight

Status: Incomplete

Success: Success

Egoid: 20

Weight Status of Alter
- ☐ Health Weight
- ☐ Overweight
- ☐ Underweight

Status: LOST CONTACT

Success: Fail

Egoid: 21

Weight Status of Alter
- ☐ Health Weight
- ☐ Overweight
- ☐ Underweight

Status: Complete

Success: Fail

Egoid: 22

Weight Status of Alter
- ☐ Health Weight
- ☐ Overweight
- ☐ Underweight

Status: Complete

Success: Success

Egoid: 23

Weight Status of Alter
- ☐ Health Weight
- ☐ Overweight
- ☐ Underweight

Status: Incomplete

Success: Fail

Egoid: 24

Weight Status of Alter
- ☐ Health Weight
- ☐ Overweight

Status: Complete

Success: Success

Egoid: 25

Weight Status of Alter
- ☐ Health Weight
- ☐ Overweight

Status: Complete

Success: Success

Egoid: 26

Weight Status of Alter
- ☐ Health Weight
- ☐ Overweight

Status: Incomplete

Success: Fail

Egoid: 27

Weight Status of Alter
- ☐ Health Weight
- ☐ Overweight

Status: Complete

Success: Success

Egoid: 28

Weight Status of Alter
- ☐ Health Weight (yellow)
- ☐ Overweight (orange)
- ☐ Underweight (red)

Status: Complete

Success: Success

Egoid: 29

Weight Status of Alter
- ☐ Health Weight (yellow)
- ☐ Overweight (red)

Status: Incomplete

Success: Fail

Egoid: 30

Weight Status of Alter
- ☐ Health Weight (yellow)
- ☐ Overweight (red)

Status: Complete

Success: Fail

Egoid: 31

Weight Status of Alter
- ☐ Health Weight (red)

Status: Incomplete

Success: Fail

Egoid: 32

Weight Status of Alter
- □ Health Weight (yellow)
- ■ Overweight (red)

Other, Other, Other, Other, Other, Friend, Other, Friend, Friend, Family, Friend, Friend, Sibling, Friend, Friend, Friend, Friend

Status: Complete

Success: Success

Egoid: 33

Weight Status of Alter
- □ Health Weight (yellow)
- ■ Overweight (red)

Colleague, Friend, Colleague, Child, Friend, Spouse/Partner, Parent, Parent, Family, Friend

Status: Incomplete

Success: Fail

Egoid: 34

Weight Status of Alter
- □ Health Weight (yellow)
- ■ Overweight (orange)
- ■ Underweight (red)

Colleague, Colleague, Colleague, Friend, Friend, Friend, Friend, Spouse/Partner, Friend, Friend, Parent

Status: Complete

Success: Fail

Egoid: 35

Weight Status of Alter
- □ Health Weight (yellow)
- ■ Overweight (red)

Family, Family, Sibling, Spouse/Partner, Child, Child, Friend, Colleague

Status: Complete

Success: Success

Egoid: 36

Weight Status of Alter
- Health Weight
- Overweight
- Underweight

Status: Complete

Success: Success

Egoid: 37

Weight Status of Alter
- Health Weight
- Overweight
- Underweight

Status: Complete

Success: Success

Egoid: 38

Weight Status of Alter
- Health Weight
- Overweight
- Underweight

Status: Incomplete

Success: Success

Egoid: 39

Weight Status of Alter
- Health Weight
- Overweight

Status: Incomplete

Success: Success

Egoid: 40

Weight Status of Alter
- Health Weight (yellow)
- Overweight (red)

Status: Complete
Success: Fail
Egoid: 41

Weight Status of Alter
- Health Weight (yellow)
- Overweight (red)

Status: Complete
Success: Fail
Egoid: 42

Weight Status of Alter
- Health Weight (yellow)
- Overweight (orange)
- Underweight (red)

Status: Complete
Success: Success
Egoid: 43

Weight Status of Alter
- Health Weight (yellow)
- Overweight (red)

Status: Incomplete
Success: Fail
Egoid: 44

Weight Status of Alter
- ☐ Health Weight
- ☐ Overweight
- ☐ Underweight

Parent
Child
Friend
Child
Friend
Spouse/Partner
0
Friend
Colleague
Colleague
Colleague

Status: Incomplete

Success: Fail

Egoid: 45

Weight Status of Alter
- ☐ Health Weight
- ☐ Overweight

Friend
Friend
Child
Friend
Child
Parent
Other
Spouse/Partner
Friend
Friend
Sibling
Sibling
Family
Other
Family
Family
Colleague

Status: Complete

Success: Success

Egoid: 46