

Behaviours of Successful Weight Loss Maintainers

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Behaviours of Successful Weight Loss Maintainers

Abstract

Objective: The aim of this exploratory study was to determine if there were any significant differences in the behaviours of weight loss maintainers and weight loss re-gainers within a local population in the North West of England. The behaviours of the National Weight Control Registry were examined.

Method: Thirty eight patients, 26 female and 12 male, with an average age of 55 years, who had been attending a weight management service for at least one year, agreed to participate in this study. Participants attended a 30 minute interview with a dietitian where they were asked questions regarding their diet, activity levels and television viewing. Based on their current weight, participants were assigned to either the weight loss maintainer group or weight loss re-gainer group.

Results: Of the 38 participants, 21 were weight loss maintainers with 17 being weight loss re-gainers. Independent t-test and Mann Whitney U tests were conducted. No significant differences were found between the two groups in relation to the behaviours being examined or in baseline characteristics. There was a difference in the frequency of monitoring food intake with 57% of weight loss maintainers monitoring their food intake on a daily basis whereas 53% of weight loss re-gainers reported that they never monitored their food intake. Weight loss maintainers commented that the most important factor in maintaining their weight loss was portion control.

Conclusion: There were no significant differences found in the behaviours of weight loss maintainers and weight loss re-gainers in this study population. Portion control and regular monitoring of food intake were reported as the most beneficial behaviours for long term weight maintenance.

Key words: Obesity, weight maintenance

Declaration

This work is original and has not been submitted previously in support of a Degree, qualification or other course.

Signed:

Dated:

Table of Contents

<i>Acknowledgements</i>	<i>i</i>
<i>Abstract</i>	<i>ii</i>
<i>Declaration</i>	<i>iii</i>
Chapter 1: Introduction & Literature Review	1
1.0 Introduction	2 - 6
1.1 Breakfast	6 - 8
1.2 Meal Pattern	8
1.3 Diet	9 - 10
1.4 Television Viewing	10 - 11
1.5 Self Monitoring	11 - 15
1.6 Physical Activity	15 - 17
1.7 Reasons & Purpose of Study	17 – 20
Chapter 2: Methodology	21
2.0 Sampling Method	22 - 23
2.1 Study Design	23
2.2 Procedures	23 - 28
2.3 Sampling Schematic	29
2.4 Statistical Analyses	30

Chapter 3: Results	31
3.0 Baseline Characteristics	32 - 34
3.1 Breakfast	34 - 35
3.2 Meal Pattern	35 - 36
3.3 Diet	36 - 37
3.4 Television Viewing	37- 38
3.5 Weight Monitoring	38
3.6 Food Intake Monitoring	38 - 39
3.7 Physical Activity	39 - 41
3.8 Descriptive Statistics	42
3.9 Qualitative Statistics	42 - 43
Chapter 4: Discussion	44
4.0 Discussion	45 - 46
4.1 Breakfast	46 – 47
4.2 Meal Pattern	47- 48
4.3 Diet	48 - 50
4.4 Television Viewing	50 - 51
4.5 Weight Monitoring	51- 52
4.6 Food Intake Monitoring	52- 53
4.7 Physical Activity	53 - 56
4.8 Participants Comments	56 - 57
4.9 Study Limitations	57 - 62
Chapter 5: Conclusion	63
5.0 Conclusion	64 - 65
5.1 Practical Application	65 - 66
5.2 Further Study	66 - 67

References	68
6.0 Primary References	69 – 76
6.1 Secondary References	77

Appendices **78**

A: Letter of Invite	
B: Participant Information Sheet	
C: Participant Consent Form	
D: Interview Schedule	
E: Example of Tests of Normality and Homogeneity	
F: Example of Independent T-Test	
G: Cross Tabulation and Chi Square Test	
H: Example of Mann Whitney U Test	
I: Ethical Approval – North West Research Ethics Committee – Chester	
J: R & D Approval – Warrington & Halton Hospitals	
K: Letter of support from Department Manager	
L: International Physical Activity Questionnaire – short form	

List of Tables and Charts

Table 1: Characteristics of Study Participants	33 – 34
Table 2.1: Frequency of Breakfast Consumption	35
Table 2.2: Differing Meal Patterns at Weekends	35
Table 2.3: Calorie and Fat Intakes	36
Table 2.4: Frequency of Weight Monitoring	38
Table 2.5: Frequency of Food Intake Monitoring	39
Table 2.6: Level of Physical Activity	40
Table 2.7: Time Spent Sitting	40
Table 2.8: Minutes per week engaged in moderate/vigorous activity	41
Table 3: Descriptive Statistics of the Behaviours of Weight Loss Maintainers and Weight Loss Re-gainers	42
Table 4: Participants' Comments on Weight Loss Maintenance	43
Chart 1: Frequency of Television Viewing	37

CHAPTER 1

INTRODUCTION

1.0 Introduction

The continuing obesity epidemic remains a challenge for the National Health Service. Current obesity prevalence within adults in England is estimated at 24 per cent, with a forecast that half the adult population will be obese by 2050 (Butland et al. 2008). With this increase in obesity comes an increase in other medical conditions, for example, type two diabetes, coronary artery disease and certain types of cancer. This in turn will lead to a significant increase in healthcare costs, overstressing an already stretched National Health Service.

Various methods are available to help with weight loss; low calorie and very low calorie diets, low fat and low carbohydrate diets, commercial slimming organisations, pharmacological therapies and weight loss surgery. However, weight loss is only one half of the issue of weight management. Weight loss maintenance following weight loss remains a problematic area in the treatment of obesity. Studies suggest that the majority of people who lose weight will regain 30-35 per cent of their lost weight in the year following treatment and the majority, if not all of the weight lost will be regained over the following three to five years (Wadden, Butryn & Byrne, 2004; Anderson, Konz, Frederich, & Wood, 2001; Fletcher et al. 1993).

Part of the problem with studies on weight loss maintenance is that there is no universally agreed definition for weight loss maintenance. Examples of definitions used in other studies include; 'an intentional loss of at least ten per cent of body weight and maintaining this weight for at least one year' (Wing & Hill, 2001) or 'gaining less than five per cent of body weight since

completion of a weight loss program' (Greene et al. 2006) or 'an initial weight loss that has been subsequently maintained for at least six months' (Elfhag & Rossner, 2005).

Researchers have studied various strategies for maintaining weight loss. In the review of randomized clinical trials by Warziski Turk et al. (2009) the use of weight loss medications post weight loss treatment, consuming a low fat diet, participating in regular exercise, continued contact with a weight loss therapist, problem solving therapy, inclusion of caffeine and increased protein intake were found to be beneficial for weight loss maintenance. The use of problem -solving therapy and continued telephone contact with therapists was also demonstrated by Perri et al. (2001) and Khaodhiar and Blackburn (2002) along with extended treatment time and relapse prevention training.

Dohm, Beattie, Albei and Striegel-Moore (2001) explored the contribution that exercise, coping responses, cognitive attributions and emotional experiences had on successful weight loss maintenance in a group of men and women. The authors found no difference in either the frequency or the intensity of physical activity between the weight loss maintainers and weight loss re-gainers, unlike other studies where physical activity was positively associated with weight loss maintenance (Crawford, Jeffery & French, 2000; Elfhag & Rossner, 2005; Wing & Phelan, 2005). However, the authors concluded that the most useful variable for differentiating between successful weight loss maintainers and weight loss re-gainers is the ability to cope with dietary lapse. The review paper by Elfhag and Rossner (2005) also noted

that better coping strategies were beneficial for weight loss maintenance along with several other factors. These other factors, positively associated with weight loss maintenance, were more initial weight loss, reaching a self determined goal weight, regular physical activity, having a regular meal rhythm with healthier food choices and eating breakfast, self monitoring of weight related behaviours, internal motivation to lose weight, better coping strategies and having social support. Having lower levels of internal disinhibition, that is, eating in response to emotional and cognitive cues has also been associated with weight loss maintenance (Niemeier, Phelan, Fava & Wing, 2007; Butryn, Graham Thomas & Lowe, 2009).

Behaviours identified as being helpful in maintaining long term weight loss have been described by the National Weight Control Registry. This registry was developed in the United States in 1993. It is a database of successful weight loss maintainers. The registry was developed to provide information about individuals who have been successful at losing weight and maintaining their weight loss in the long-term. To be eligible to join the registry, potential participants must have lost a minimum of 13.6 kilograms (kg) and maintained this loss for at least one year. The weight data provided is self-reported via regular questionnaires. To check if the weights reported are accurate a random sample of participants' physicians were contacted. A high correlation, 0.97, was found between reported weight and recorded weight (Hill, Wyatt, Phelan & Wing, 2005). The registry members are mostly female, 78 %, and Caucasian, 95%. They tend to be married and have some college education (Phelan, Wyatt, Hill & Wing, 2006). Approximately one half of

registry members report being overweight as a child and 75 per cent report having at least one obese parent. The registry members report losing, on average, 32kg and maintaining this loss for almost six years. An average loss of 32kg far exceeds that which other studies have reported. In standard behavioural and lifestyle interventions, the average weight loss is seven to ten kilograms, while interventions comprising very low calorie diets demonstrate an initial weight loss of 20-25kg (Wadden et al. 2004; Anderson et al. 2001). However, of this weight loss, 30-35 per cent is regained in the first year after treatment. According to Perri and Foreyt (2004) as cited in Warziski Turk et al. (2009), there is an average weight loss of 1.8kg four years after treatment.

At initial entry to the registry, participants are provided with several questionnaires in order to gather information on their weight history, weight loss strategies and behaviours and weight loss maintenance strategies and behaviours. The registry members are asked to complete questionnaires on a yearly basis so that continued weight loss maintenance can be studied, as well as factors that may predict weight loss regain. From these questionnaires, certain behaviours have been deemed helpful in maintaining long term weight loss; following a low calorie, low fat diet, less than 30 per cent energy as fat, eating regular meals including breakfast daily, having a high level of physical activity, approximately an hour a day, reduced television viewing hours, less than ten hours per week, monitoring weight on a daily basis and being mindful of diet and physical activity. The qualitative study by Byrne, Cooper and Fairburn (2003) also demonstrated similar

behaviours in successful weight loss maintainers. Their study examined three groups, weight loss maintainers, weight loss re-gainers and healthy weight individuals who had never been obese, to identify factors that differentiated those who maintained weight loss from those who re-gained the weight. Three categories of differentiating factors were identified; behavioural, cognitive and affective factors. Weight loss maintainers reported adherence to a low fat diet, participated in regular exercise and frequently monitored their weight.

The behaviours of the members of the National Weight Control Registry will now be discussed in more detail.

1.1 Daily Breakfast

Eating breakfast is often cited in weight management programmes as a useful behaviour for long-term weight loss maintenance. The evidence however is contradictory. Wyatt et al. (2002) examined breakfast consumption in members of the National Weight Control Registry to establish if it was a common behaviour. The questionnaires of 1895 study subjects were analysed. Eating breakfast daily was reported by 78.3 per cent of the study participants, with almost 90 per cent eating breakfast on four days or more. The study's authors examined if there were any differences between those who ate breakfast regularly and those who did not. There were no differences between the two groups in terms of weight loss, duration of weight loss maintenance or self reported calorie intake. Those who ate breakfast regularly reported slightly higher physical activity levels. The authors concluded that as the majority of National Weight Control Registry

members reported eating breakfast on most days, it may be a behaviour that assists with long-term weight loss maintenance. The randomised clinical trial by Schlundt, Hill, Sbrocco, Pope-Cordle and Sharp (1992) also concluded that eating breakfast may help with weight loss maintenance. Based on an initial questionnaire, subjects were stratified into two groups; those who reported eating breakfast and those who did not. The subjects, of whom there were 52, were then randomly assigned to one of two experimental groups; breakfast group or no breakfast group. Both groups were assigned a calorie reduced diet which differed only in the number of meals to be eaten. At the end of the twelve week intervention and six month follow-up there were no differences between the two groups in terms of weight loss. However, those in the breakfast group reported a lower fat intake and reduced frequency of unplanned snacking, which in turn may help with weight loss maintenance in the long term.

Ma et al. (2003) used cross sectional data from the Seasonal Variation of Blood Cholesterol Study to determine if there was a relationship between eating patterns and obesity. Study participants, of which there were 499 men and women, completed 24-hour dietary recalls. Regular breakfast consumption was defined as consuming breakfast on at least 75 per cent of their 24-hour dietary recalls. The authors reported that skipping breakfast was associated with a significantly increased risk of obesity; that participants who regularly missed breakfast were four and a half times more likely to be obese than those who regularly ate breakfast. One reason for this increased

risk of obesity is that energy intakes tended to be greater on the days when participants missed breakfast.

However, this finding is not supported by Song, Chun, Obayashi, Cho and Chung (2005). In this study, the authors examined the relationship between breakfast consumption and ready to eat cereal consumption with body mass index. They found that mean energy intake was greater in female breakfast consumers than those who missed breakfast.

1.2 Consistent Meal Pattern

The aim of the study by Gorin, Phelan, Wing and Hill (2004) was to examine whether dieting consistency was necessary or beneficial for weight loss maintenance. The authors asked participants from the National Weight Control Registry whether they kept to the same dietary routine across the week and the weekend or if they were stricter with their diet during the week, relaxing it at the weekend or while on holiday. They found that the majority, 59 per cent, of those who were maintaining their weight loss reported a consistent meal pattern both during the week and at the weekend, while 45 per cent also maintained the same dietary routine while on holiday. When the authors evaluated if consistent dietary routine was related to weight loss regain after two years, they found that those registry members who maintained a consistent dietary pattern across the week were one and a half times more likely to maintain their weight loss than those who dieted more strictly on weekdays. Also, those who allowed themselves more flexibility while on holiday had a greater risk of weight loss regain.

1.3 Low calorie, low fat diet

The members of the National Weight Control Registry report consuming a low calorie, low fat diet. In the study by Klem, Wing, McGuire, Seagle and Hill (1997) 784 members reported consuming a diet of 1381 kilocalories (kcal) and 24 per cent fat. The authors recognised that as dietary intake is self reported it may be underestimated by 20-30 per cent. This means that the registry members' dietary intake is more likely to be in the region of 1800 kcal. The issue of under reporting calorie intake has also been demonstrated in other studies of the overweight and obese with levels of under reporting ranging from 20-50% (Lichtman et al., 1992; Heitmann, 1993 as cited in Shick et al, 1998).

In 2006 Phelan, Wyatt, Hill and Wing examined whether the dietary behaviours of registry members had changed between 1995 and 2003. Study participants, of which there were 2708, were divided into five groups, based on the year they joined the registry; 1995, 1997, 1999, 2001 and 2003. The average dietary intake reported was 1379 kcal, which was the same as that reported in the study by Klem et al. (1997). However, there was a significant difference in total calorie intake across the year cohorts ($p=0.04$), with intakes ranging from 1322 kcal per day in 2003 and 1407 kcal per day in 1999. The percentage of calories from fat also differed significantly, ($p=0.0001$) ranging from 23.8 per cent in 1995 to 30.4 per cent in 2001. The average percentage of calories from fat across the cohorts was 26.6 per cent. It would appear that those who joined the registry later have a higher fat intake. There was also a significant difference ($p=0.0001$) in

carbohydrate intake between registry members from 1995 and later years, with the percentage of calories from carbohydrate decreasing from 56 per cent to 49.3 per cent. This may account for the higher percentage of dietary fat in those joining the registry in the later years.

The observational study by Greene et al. (2006) also demonstrated that a lower intake of total calories and fat were significantly correlated with weight loss maintenance. In this small study, 74 volunteers were recruited from the EatRight Weight Management Program, which is an academic health centre based weight control program. Only 71 of the 74 volunteers completed the requested four day food records. From these food records, those volunteers who maintained weight loss consumed less total calories and fat than those who regained weight; 1776kcal, 33 per cent fat versus 2020kcal and 36 per cent fat.

1.4 Television Viewing

Another behaviour associated with successful weight loss maintenance is reduced television viewing. Raynor, Phelan, Hill and Wing (2006) explored television viewing among members of the National Weight Control Registry. The primary aim of the study was to determine whether television viewing was an infrequent habit among the successful weight loss maintainers. Questionnaires on television viewing, physical activity and dietary intake were collected from 1422 members at entry to the registry and one year later. The number of hours for weekly television viewing were categorised into seven categories. Low television viewers were defined as those who watched less than ten hours of television per week. At baseline, 62.3 per

cent of participants watched less than ten hours of television per week. Of these, 36.1 per cent watched less than five hours of television per week. These figures are greatly less than the average 28 hours per week that the average American spends on television viewing. At one year, increases in percentage calories from fat and sweets, and decreases in physical activity levels were reported. The increases in television viewing were significantly correlated with the increases in percentage calories from fat ($r= 0.09$, $p < 0.01$) but not with the decreases in physical activity.

Hu, Li, Colditz, Willett and Manson (2003) also found that increased television viewing was not significantly correlated with changes in physical activity in their large, prospective cohort study. However, time spent watching television was positively associated with an increased risk of obesity. Weiss, Galuska, Khan, Gillespie and Serdula (2007) examined the prevalence and predictors of weight loss regain. They used data from the National Health and Nutrition Examination Survey. The authors reported that the odds of weight regain, following substantial weight loss, were 1.5 and 2.0, for screen times, which included computer and television viewing, for individuals reporting two to three hours and four or more hours respectively.

These studies cannot demonstrate a causal relationship between television viewing and weight gain. However, reducing television viewing, which is a sedentary behaviour, may help with weight loss maintenance.

1.5 Self Monitoring

Several studies have demonstrated the importance of self-monitoring as a useful behaviour associated with successful weight loss maintenance. Self monitoring can be related to monitoring of weight, of food intake or of physical activity. Self monitoring can help individuals to identify how changes in their food or physical activity behaviour can affect their weight. It allows small weight gains to be reversed so as to prevent larger weight gains, which may be more difficult to resolve.

The study by Klem et al. (1997), examined the weight maintenance strategies of successful weight loss maintainers. A total of 784 participants were included, of which most were women. Participants were asked to complete questionnaires which provided information on demographics, weight loss and weight loss maintenance strategies, previous weight loss attempts, difficulty of achieving weight loss and weight loss maintenance and the effect of weight loss on other areas of their life. The results demonstrated that 38 per cent of the participants weighed themselves daily and nearly one third of the participants weighed themselves at least once per week. Overall, 75 per cent of the participants monitored their weight at least once per week. Regarding self monitoring of food intake and physical activity levels, 50 per cent of the participants reported recording their calorie intake or fat intake or both, demonstrating that self monitoring is an important strategy for these participants to maintain their weight loss.

The goal of the study by Butryn, Phelan, Hill and Wing (2007) was to investigate the relationship between self weighing and weight change in

members of the National Weight Control Registry. The authors also wanted to determine if baseline self weighing frequency or a change in the frequency of self weighing was related to weight loss maintenance at one year follow-up. Data was collected, via questionnaire, at baseline and one year for 2462 members. Members were asked how frequently they weighed themselves. Three categories were constructed from the replies; daily, weekly and less than weekly. At baseline 36.2 per cent of participants weighed themselves at least once per day; 42.5 per cent weighed themselves at least weekly and 21.3 per cent monitored their weight less than once per week. At one year, 17.7 per cent reported a reduction in the frequency of self weighing, which resulted in a significantly greater weight loss regain when compared to those who reported an increase in self weighing frequency ($p < 0.001$).

Similar findings were also demonstrated in the study by Linde, Jeffery, French, Pronk and Boyle (2005). In this study, Linde et al. compared data on self weighing frequencies in two distinct populations; obese individuals from a weight loss program and volunteers in a weight gain prevention study. The authors hypothesised that more frequent weighing would be associated with a lower body weight or with greater weight loss or less weight gain. The two populations did not differ in frequency of self weighing at baseline. However, at 12 and 24 months those individuals in the weight gain prevention trial reported an increase in self weighing on a daily or weekly basis. Those in the weight loss program reported an increase in the number of participants never weighing themselves. When weight change was examined in relation

to self weighing frequency, both populations demonstrated that less frequent weighing was associated with weight gain.

Wing, Tate, Gorin, Raynor and Fava (2006) examined the use of a self regulation program for weight loss maintenance in study participants who had already lost at least ten percent of their baseline weight. The participants were randomly assigned to one of three groups to determine if both, average weight loss regain and the proportion of participants regaining 2.3kg or more could be reduced. The study groups were a face-to face intervention group; an internet intervention group and a control group. Over eighteen months the intervention groups met weekly for the first month and then monthly for the remainder of the study. They reported their weight weekly. If weight increased between 1.4-2.2kg, the participants were instructed to use problem solving skills to lose the weight regained. Where 2.3kg or more were regained, participants recommenced active weight loss efforts. The mean absolute weight gain was 2.5kg for the face-to-face intervention group which was significantly less than that gained by the control group, 4.9kg ($p = 0.05$). Both of the intervention groups had significantly fewer participants who regained 2.3kg or more. The intervention groups also rated more highly the importance of self weighing and monitoring of food intake and exercise than the control group.

In 2008, Phelan et al. compared weight control strategies during the winter holidays among members of the National Weight Control Registry and healthy weight individuals with no history of obesity. They found that the members of the National Weight Control Registry reported greater attention

to their weight, eating and exercise habits via self monitoring when compared to those of a healthy weight. Decreases in self monitoring were related to greater weight gain.

The study by Baker and Kirschenbaum (1998) reported similar findings. This study's 38 participants were asked to record their daily food and calorie intake over three holiday weeks; Thanksgiving, Christmas and New Years Eve, and the seven weeks in between. The participants were divided into four self monitoring consistency groups. Only the highly consistent monitors lost weight, while the least consistent monitors gained weight.

1.6 Physical Activity

In the study by Klem et al. (1997) members of the National Weight Control Registry reported high levels of physical activity, expending, on average, 2,827 kilocalories per week. The purpose of the study by Catenacci et al. (2008) was to update the information from Klem et al. (1997) on the physical activity levels of registry members and to compare the physical activity levels of more recent members (2001-2004) with earlier enrollees (1993-1996). A total of 3,683 members participated in the study. Members of the registry reported expending an average of 2,621 kilocalories per week on physical activity, with men expending significantly more kilocalories than women ($p < 0.001$). Walking tended to be the most common activity engaged in. The majority, 75 per cent, of registry members reported expending more than 1000 kilocalories per week in physical activity, of which 35 per cent expended in excess of 3000 kilocalories per week. However, a small percentage, 25 per cent, reported expending less than 1000 kilocalories per

week. Those members who reported expending higher levels of physical activity, more than 3,500 kilocalories per week, were maintaining a greater weight loss, on average 4.2kg less than those reporting low levels of physical activity. When the two groups, early entrants and later entrants, were compared, early entrants reported higher levels of physical activity but not significantly so. The average energy expenditure of registry members in physical activity translates to 60-75 minutes of daily moderate intensity activity.

Similar findings were described in the study by Jakicic, Marcus, Lang and Janney (2008). They examined the effect of various intensities and durations of exercise on weight loss and fitness in overweight women. The study participants were randomised into four intervention groups over a 24 month period; vigorous intensity, high duration; moderate intensity, high duration; vigorous intensity, moderate duration; and moderate intensity, moderate duration. The women were also prescribed a calorie restricted diet based on their initial weight. Weight loss was greatest at six months, 9.3 per cent of initial weight, as was the calorie expenditure from physical activity. However at 24 months, the sustained weight loss had reduced to five percent along with a reduction in calorie expenditure from physical activity. The authors reported that the intensity of exercise did not influence weight outcomes. Those participants who maintained a loss of ten percent of initial body weight were engaged in physical activity on average for 275 minutes per week, 55 minutes per day for five days.

The community-based study by Crawford et al. (2000) examined the prevalence, distribution and correlates of successful weight loss and weight loss maintenance over a three year period. Success at weight loss maintenance was associated with continued physical activity.

These findings are also supported by the Institute of Medicine (as cited in Saris et al. 2003) which recommends a minimum of 60 minutes of daily moderate intensity physical activity to control body weight. Saris et al. (2003) also reported on the International Association for the Study of Obesity 1st Stock Conference and consensus statement. This consensus statement recommends that formerly obese individuals may require a minimum of 60-90 minutes of moderate intensity physical activity on most days to maintain weight loss. Jakicic et al. (2001) put forward the position of the American College of Sports Medicine in relation to appropriate intervention strategies for weight loss and prevention of weight regain. The American College of Sports Medicine recommends more than 200 minutes of moderate intensity exercise per week for long-term weight loss. These recommended amounts of physical activity are greater than the United Kingdom public health recommendation of 30 minutes of moderate intensity physical activity on at least five days of the week. However, the National Institute for Health and Clinical Excellence guidance on obesity (2006) recommends an increase in activity to 45 - 60 minutes per day of moderate intensity physical activity to prevent obesity and 60 – 90 minutes per day for those who have been obese to prevent weight regain.

1.7 Reasons & Purpose of Study

From the above it can be seen that there is no universally accepted definition of weight loss maintenance and no agreed strategy to maintain weight loss, but there are various behaviours and skills that may be beneficial for weight loss maintenance. The critique article by Ikeda et al. (2005), described the National Weight Control Registry as misleading the public and health professionals in believing that long-term maintenance of weight loss was possible. Adopting the behaviours of the National Weight Control Registry members however may be useful for those trying to maintain weight loss. However it must be noted that the registry members are not representative of the general population, as they are mostly female, 78 per cent, Caucasian, 95 per cent and 82 per cent have a college education (Phelan, Wyatt, Hill & Wing, 2006). Registry members have also achieved on average far greater weight loss than that reported in other studies; 32kg versus 7-10kg. This means that the results of studies within the National Weight Control Registry cannot be generalised to the general population. According to Flegal, Carroll, Ogden and Curtin (2010) over 60 per cent of the United States population falls into the categories of overweight or obese. The National Weight Control Registry has approximately 6000 members which is a very small sample size when compared to this percentage of overweight and obese in the United States population.

Another criticism of the National Weight Control Registry is the use of self reported data. This data is open to bias as studies have demonstrated that both the overweight and obese tend to under report their dietary intake and

over report their physical activity levels (Rennie, Coward & Jebb, 2006; Schoeller, 1995, as cited in Bond, Phelan, Leahey, Hill & Wing, 2009).

The aim of the current exploratory study is to determine if there are any significant differences in the behaviours of weight loss maintainers and weight loss re-gainers within a local population in the North West of England. The purpose of this is to gain data and insight into why some people maintain their weight loss while others regain it. While the data provided by the National Weight Control Registry gives information on a specific population in the United States, there is a lack of knowledge around weight maintenance generally in the United Kingdom and it is hoped that this exploratory study will provide data on weight maintenance for this local population. The findings will also help to inform future development of the local weight management service.

The behaviours being examined in this exploratory study are those identified by the National Weight Control Registry as being helpful for weight loss maintenance; eating daily breakfast, maintaining the same meal pattern during the week and weekend, following a low calorie, low fat diet, frequent monitoring of both food intake and weight, reduced television viewing and maintaining a high level of physical activity. The professional interest group for dietitians in weight management, (DOMUK), highlights the behaviours of the National Weight Control Registry in its professional guidance document 'The Dietetic Weight Management Intervention for Adults in the One to One Setting (2007). It will be useful to demonstrate if any of these behaviours are being employed by this local population to maintain their weight loss. It will

also be beneficial to discover if all of the behaviours are necessary for weight loss maintenance or if any one behaviour or combination of behaviours are used by the weight loss maintainers to maintain their weight loss.

Each of the following hypotheses will be examined;

- There is a significant difference in the frequency of breakfast consumption between weight loss maintainers and weight loss re-gainers
- There is a significant difference in the meal patterns between weight loss maintainers and weight loss re-gainers
- There is a significant difference in the calorie and fat intakes between weight loss maintainers and weight loss re-gainers
- There is a significant difference in the frequency of food intake monitoring between weight loss maintainers and weight loss re-gainers
- There is a significant difference between weight loss maintainers and weight loss re-gainers in the frequency of weight monitoring
- There is a significant difference between weight loss maintainers and weight loss re-gainers in the number of hours spent watching television
- There is a significant difference in the levels of physical activity of weight loss maintainers and weight loss re-gainers

CHAPTER 2

METHODOLOGY

2.0 Sampling Method

The Weight Management Service database was filtered to identify potential study participants. In total, 146 patients were identified as being eligible to participate in this exploratory study as they met the inclusion criteria.

The inclusion criteria were:

- that the patient was obese on commencing the weight management service
- that the patient had been attending the weight management service for at least one year
- that the patient had not undergone weight loss surgery

This sample was re-filtered to remove patients who had undergone weight loss surgery. This resulted in the removal of 13 patients, providing a potential sample of 133 participants. Two further patients were removed from the potential sample as they had left the area, leaving a final potential sample of 131 participants.

Once identified, the 131 potential participants were sorted into two categories based on their last recorded weight; weight loss maintainers and weight loss re-gainers. As there is no universally agreed definition of weight loss maintenance, this exploratory study used the definition by Greene et al. (2006). Weight loss maintainers were defined as patients who had maintained a loss of five percent of their initial weight. Based on their last

recorded weight, 60 patients were identified as weight loss maintainers and 71 were noted as weight loss re-gainers.

Ethical approval for the exploratory study was acquired from the North West Research Ethics Committee – Cheshire.

Consent was gained from all participants to take part in the study and to use direct quotations where necessary.

2.1 Study Design

This was a prospective study with an independent groups design. The dependent variable was weight loss maintenance, which was defined as a loss of five percent of the participant's initial body weight. The independent variables being examined were the frequency of breakfast intake, meal pattern differences between the week and the weekend, the number of hours spent watching television and the frequency that study participants monitored their weight and food intake. These variables were measured by asking study participants a series of questions about these behaviours. An interview schedule was used to ensure that all participants were asked the same questions. The other independent variables examined were calorie and fat intake and physical activity levels. Calorie and fat intake were estimated using Diet Plan 6, version P3, and physical activity levels were measured using the International Physical Activity Questionnaire – short form.

2.2 Procedures

A total of 131 patients were identified as being eligible to participate in this exploratory study. The potential participants were contacted via letter asking

them if they wished to take part in the study. A participant information sheet on the study, consent form and freepost envelope were also included with the letter. The participant information sheet provided information on the study, how to take part in the study, withdraw from it and how their data would be used. As well as obtaining consent for participating in the study, consent was also gained to allow use of the participants' direct quotes, which would be anonymised. The potential participants were asked to return the consent form within two weeks if they wished to participate. Of the 131 potential participants, 45 replied to the letter of invite.

On receipt of the consent forms, the participants were contacted by phone to arrange an interview. Participants were informed that there was no reimbursement for participating in the study however car parking fees were waived. It was not possible to get in contact with three of the potential participants to arrange an interview.

Each participant had an identification number from the Weight Management Service database. This number was used for identification purposes once the participant had agreed to participate in the study to ensure confidentiality.

Those who agreed to take part in the study attended a thirty to forty minute interview with the dietitian conducting the research. Four of those who had agreed to an interview date did not attend. The study interviews were conducted at Halton General Hospital and on one occasion at Chapelfield Health Centre.

The participant's height was measured using the SECA Leicester portable height measure. Participants were asked to remove their shoes and to stand beneath the height measure with their back to the wall. Their heels, buttocks and scapulae were against the height measure. The participants were asked to stand up straight, relax their shoulders, leaving their arms loosely by their sides. The position of the participants head was checked to ensure that it was raised and horizontal. The participant was asked to breathe in and the headboard was lowered until it made contact with the skull.

Each participant's weight was taken using a Tanita body composition analyser BC 420 SMA. The participant's removed their shoes and wore minimal clothing. From the height and weight measurements, body mass index was calculated. This weight was compared with the participants' initial weight to establish if the participant was still in the weight loss maintainer group or the weight loss re-gainer group. Participants were then asked a series of questions regarding their dietary habits and television viewing habits.

A typical day dietary intake was recorded. Participants were asked to describe what they eat and drink on a typical day; including portion sizes, whether the food and drink were a low fat or full fat option, a low sugar or full sugar option. They were also asked the frequency with which they consumed high fat and high sugar foods and drinks. The definition of a low calorie diet, as defined by the Expert Panel on the Identification, Evaluation and Treatment of Overweight in Adults (1998), is a calorie intake between 1000 and 1500 calories. The Dietary Reference Value for fat intake is 35

percent of total calories, as advised by the Committee on Medical Aspects of Food Policy (1991). A low fat diet, as defined by the Expert Panel on the Identification, Evaluation and Treatment of Overweight in Adults (1998), consists of 20-30 percent of total calories from fat. The participants' calorie and fat intakes were compared with the above definitions to ascertain if they were following low calorie, low fat diets.

The International Physical Activity Questionnaire – short form was completed with the participants to ascertain their level of physical activity. This physical activity questionnaire consists of seven questions about the frequency and duration of physical activity over the past seven days. There are two questions on vigorous physical activity, two on moderate physical activity, two questions on walking and one final question on the length of time spent sitting. The answers given to each of the questions on vigorous and moderate physical activity and walking are calculated in minutes per week. The sum of these gives an indication of the total amount of weekly physical activity. For each category; vigorous and moderate physical activity, walking and the amount of time spent engaged in the activity is multiplied by an average metabolic cost (MET), to give MET-minutes per week. The MET is a unit used to estimate the metabolic cost or energy expenditure of physical activity. One MET is the energy expended by a person while sitting at rest and is set at 3.5mL of oxygen consumed per kilogram of body mass per minute (Westerterp & Plasqui, 2004 as cited by Miles 2007).

The METs, as advised by the International Physical Activity Questionnaire Research Committee, for vigorous physical activity, moderate physical activity and walking are 8.0, 4.0 and 3.3 respectively. Once the MET-

minutes per week were calculated, the participant's physical activity level was categorised as low, medium or high.

A high level of physical activity was defined as;

- seven or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum total physical activity of at least 3000 MET-minutes per week
- vigorous-intensity activity on at least three days achieving a minimum total physical activity of at least 1500 MET-minutes per week.

A medium level of physical activity was defined as;

- three or more days of vigorous-intensity activity of at least 20 minutes per day
- five or more days of moderate-intensity activity and/or walking of at least 30 minutes per day
- five or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum total physical activity of at least 600 MET-minutes per week.

Those who did not meet either of the medium or high categories of physical activity were defined as having a low level of activity. The last question on time spent sitting is an additional indicator of time spent in a sedentary activity. Some studies have suggested that daily sitting time can be used as a measure of obesity risk (Hu, Li, Colditz, Willett & Manson, 2003; Parsons, Manor & Power, 2008).

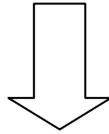
The International Physical Activity Questionnaire – short form was chosen for use in this exploratory study because its use is validated in those aged between 15 to 69 years; it has been used in another study with obese

participants (Tehard et al. 2005); it was quick to complete with participants within the time allowed for each interview and it included a question on time spent sitting.

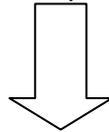
In addition to the questions above, participants were also asked questions on their marital status, ethnicity and level of education.

2.3 Sampling Schematic

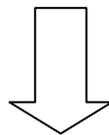
146 potential participants identified



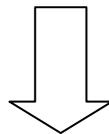
13 potential participants removed due to weight loss surgery
and 2 potential participants had left the area



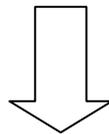
Letters of invite sent to 131 potential participants



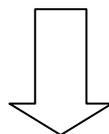
45 patients agreed to take part in exploratory study



42 participants contacted by phone and interview arranged



4 participants did not attend interview



38 participants in exploratory study

2.4 Statistical Analyses

The statistical analysis was conducted using SPSS version 17.0. The data collected which was identified as being ordinal data; breakfast habits, monitoring of weight and food intake, time spent viewing television and levels of physical activity, was analysed using a Mann Whitney U Test as this data was non- parametric. The nominal data; differences in meal pattern, was analysed using Cross Tabulation and Chi Squared Test for Difference. The ratio data; weight measured, calorie and fat intake and time spent sitting, was first assessed for normality and homogeneity before conducting the appropriate statistical analysis. The Shapiro- Wilk statistic for normality was employed as the study sample size was less than one hundred. The test of homogeneity of variance was also conducted. Where the ratio data was normally distributed, an Independent T Test for Difference was used for the analysis. A Mann Whitney U Test for difference was used for ratio data which was not normally distributed. Descriptive statistics used were mean and median. Statistical significance was assessed at the 0.05 level. The qualitative data collected was arranged into common themes.

CHAPTER 3

RESULTS

3.0 Baseline Characteristics

A total of 131 patients were identified as being eligible to participate in this exploratory study. Of these, 45 replied to the letter of invite; and 38 of these participated in the study. There were 26 female participants and 12 male participants; most, 97 per cent, of the participants were Caucasian with an average age of 55.3 ± 9.8 years. The majority, 65.8 per cent of participants were married and 55 per cent had attended school only as opposed to attending college or university. The mean initial weight and body mass index (BMI) were $122.5\text{kg} \pm 30.3\text{kg}$, and $44.2\text{kg}/\text{m}^2 \pm 9.7\text{kg}/\text{m}^2$. The mean current weight and BMI were $115.5\text{kg} \pm 29.6\text{kg}$ and $41.7\text{kg}/\text{m}^2 \pm 9.6\text{kg}/\text{m}^2$. There were no significant differences between weight loss maintainers and weight loss re-gainers regarding age, ethnicity, schooling, marital status, initial and current weight and body mass index.

Those who did not participate in the study were mostly female, 68.6per cent, with an average age of 52 years. Based on their last recorded weight, 58 per cent were deemed to be weight loss re-gainers, with 42 per cent being weight loss maintainers. Their initial weight and BMI were not significantly different to that of the participants; 120.9kg and $42.1\text{kg}/\text{m}^2$ respectively; nor was there a significant difference between participants and non-participants in relation to age.

Table 1: Characteristics of Study Participants

Characteristics	Weight Loss Maintainers N = 21	Weight Loss Re-Gainers N = 17
Gender female		
% Female	66.7	71
% Male	33.3	29
Age (yrs) mean	54.3 ± 10.9	56.5 ± 8.3
Initial Weight (kg)mean	125 ± 34.6	119.5 ± 24.6
Initial BMI (kg/m ²)mean	45.7 ± 11.7	42.4 ± 6.4
Current Weight(kg)median	102.9 (67.7-201.1)	113.7 (82.8-170)
Current BMI (kg/m ²)mean	41± 11.6	42.5 ± 6.7
% loss from initial weight (kg)	17.7	4.9
Ethnicity (% Caucasian)	95	100
Marital Status		
% Married	66.7	64.7
% Single	23.8	11.7
% Divorced	0	17.6
% Widowed	4.7	5.8
% Partner	4.7	0

Table 1: Characteristics of Study Participants/ cont.

Characteristics	Weight Loss Maintainers N = 21	Weight Loss Re-Gainers N = 17
Education		
% School only	61.9	47
% College	19	29.4
% University	19	17.6
% Not answered	0	5.8

To determine if there was a difference in the behaviours between weight loss maintainers and weight loss re-gainers, seven behaviours or habits were examined; the frequency of eating daily breakfast, maintaining the same meal pattern during the week and weekend, eating a low calorie, low fat diet, regular monitoring of weight and food intake, reduced television viewing and maintaining a high level of physical activity. Overall there was no significant difference between the groups in any of the above behaviours.

3.1 Breakfast

Participants were asked how often they consumed breakfast. Breakfast was described as the meal eaten within one hour of waking. In both groups, the majority of participants reported eating breakfast daily, with no one in the weight loss maintainer group ever missing breakfast. Two participants (11.8%) in the weight loss re-gainers group reported never eating breakfast.

Table 2.1: Frequency of Breakfast Consumption

Group	Daily	4-6 Days	1-3 Days	Never
Weight Loss maintainers	80.9%	14.3%	4.8%	0
Weight Loss Re-gainers	64.7%	17.6%	5.9%	11.8%

The hypothesis that there is a significant difference in the frequency of breakfast consumption between weight loss maintainers and weight loss re-gainers has been rejected.

3.2 Meal Pattern

Participants were asked if their meal pattern differed between the week and the weekend. The majority of weight loss maintainers and weight loss re-gainers reported a difference in meal pattern at the weekends. Reasons cited for this were 'getting up later, so have brunch instead of breakfast' and differing shift patterns.

Table 2.2: Table demonstrating differing meal pattern at weekends

Different Meal Pattern	Weight Loss Maintainers	Weight Loss Re-gainers
Yes %	60	52.2
No %	40	47.8

The hypothesis that there is a significant difference in the meal patterns between weight loss maintainers and weight loss re-gainers has been rejected.

3.3 Low calorie, low fat diet

Each participant was asked to describe a typical day's dietary intake and how frequently they consumed high fat snacks. There was no significant difference in the reported calorie intake between weight loss maintainers and weight loss re-gainers; however, weight loss re-gainers, on average reported a lower calorie intake. Both groups reported the same fat intake.

Table 2.3: Table demonstrating Calorie and Fat intake

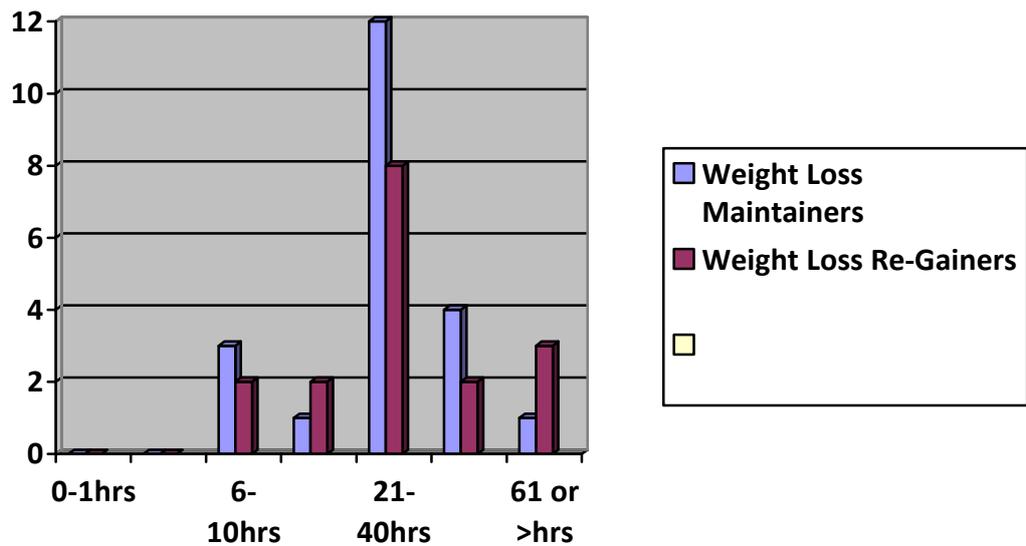
Group	Weight Loss Maintainers	Weight Loss Re-gainers
Mean Calorie Intake	1794	1658
Minimum Calorie Intake	1035	894
Maximum Calorie Intake	2633	2772
Mean Fat Intake (g)	70.2	70.8
Minimum Fat Intake (g)	22	30.9
Maximum Fat Intake (g)	135	109.2

The hypothesis that there is a significant difference in the calorie and fat intakes between weight loss maintainers and weight loss re-gainers has been rejected.

3.4 Television Viewing

Each participant was asked how many hours per week they spent watching television. The majority of participants in both groups reported spending anywhere between twenty-one and forty hours per week watching television. More of the weight loss re-gainers reported watching in excess of sixty-one hours per week compared with the weight loss maintainers.

Chart 1: Frequency of Television viewing (hours per week)



The hypothesis that there is a significant difference between weight loss maintainers and weight loss re-gainers in the number of hours spent watching television has been rejected.

3.5 Weight Monitoring

When asked how frequently participants checked their weight, the median result was monthly. However most, 42.8 per cent, of the participants in the weight loss maintainers reported monitoring their weight on a weekly basis compared with 23.5 per cent of weight loss re-gainers.

Table 2.4: Frequency of Weight Monitoring

Group	Daily	Weekly	Monthly	Never
Weight Loss maintainers	4.8%	42.8%	28.6%	23.8%
Weight Loss Re-gainers	5.9%	23.5%	41.2%	29.4%

The hypothesis that there is a significant difference between weight loss maintainers and weight loss re-gainers in the frequency of weight monitoring has been rejected.

3.6 Food Intake Monitoring

Study participants were asked how often they monitored their food intake.

While there was no significant difference between the two groups, there was a difference. The majority, 57 per cent of those in the weight loss maintainers group reported monitoring their food intake on a daily basis compared with only 23.5 per cent of those in the weight loss re-gainers group. The majority, 52.9 per cent, of those in the weight loss re-gainers

group reported that they never monitored their food intake compared with 33.3 per cent of weight loss maintainers.

Table 2.5: Frequency of Food Intake Monitoring

Group	Daily	Weekly	Monthly	Never
Weight Loss maintainers	57.1%	4.8%	4.8%	33.3%
Weight Loss Re-gainers	23.5%	5.9%	17.7%	52.9%

The hypothesis that there is a significant difference in the frequency of food intake monitoring between weight loss maintainers and weight loss re-gainers has been rejected.

3.7 Physical Activity

Participants completed the International Physical Activity Questionnaire – short form to ascertain their level of physical activity. While there was no significant difference between the two groups, the majority of those in both the weight loss maintainers group and weight loss re-gainers group reported a low level of physical activity, 47.6 per cent and 47 per cent respectively. Only 28.6 per cent of those in the weight loss maintainers group reported engaging in high levels of physical activity.

Table 2.6: Level of Physical Activity

Group	Low	Medium	High
Weight Loss maintainers	47.6%	23.8%	28.6%
Weight Loss Re-gainers	47%	41.2%	11.8%

The hypothesis that there is a significant difference in the levels of physical activity of weight loss maintainers and weight loss re-gainers has been rejected.

The final question on the International Physical Activity Questionnaire – short form asked participants to estimate the amount of time they spent sitting on a weekday. There was no significant difference between the two groups in the number of hours spent sitting.

Table 2.7: Time spent sitting (hours)

Group	Weight Loss Maintainers	Weight Loss Re-gainers
Median hours sitting	8	9
Minimum hours sitting	3	5
Maximum hours sitting	17	16

The sum of the number of minutes engaged in moderate and/or vigorous physical activities were divided across seven days to allow some comparison with the results of the National Weight Control Registry. The median minutes spent by weight loss maintainers and weight loss re-gainers in moderate/vigorous physical activity were seventeen minutes and zero minutes respectively.

Table 2.8: Minutes per week engaged in moderate/vigorous physical activity

Group	Weight Loss Maintainers	Weight Loss Re-gainers
Median minutes in moderate activity	17	0
Minimum minutes in moderate activity	0	0
Maximum minutes in moderate activity	205	58

3.8 Descriptive Statistics

Table 3: Descriptive Statistics of the Behaviours of Weight Loss Maintainers and Weight Loss Re-Gainers

Behaviours	Weight Loss Maintainers	Weight Loss Re-Gainers
Breakfast (median)	Daily	Daily
Differing Meal pattern (No)	40%	47.8%
Calorie intake (mean kcals)	1794	1658
Fat intake (grams)	70.2	70.8
Television watching (Hrs)	21-40	21-40
Weight monitoring (median)	Monthly	Monthly
Food intake monitoring (median)	Daily	Never
Physical activity level (median)	Medium	Medium

3.9 Qualitative Statistics

Those participants who had been successful in maintaining five percent or more of their weight were asked if they had any advice or comments on how they were managing to keep the weight off. Sixteen of the twenty-one weight

loss maintainers responded to this question. The majority, 43.7 per cent, of the respondents reported that portion control was the most important factor in maintaining their weight loss.

Table 4: Table of Participants Comments on Weight Loss Maintenance

Theme	Number of Respondents (percentage) N = 16
Portion Control	7 (43.7%)
Monitoring of food intake	6 (37.5%)
Choosing healthier options	4 (25%)
Having a motivating reason for weight loss/maintenance	3 (18.7%)
Regular exercise	2 (12.5%)
Eating breakfast daily	2 (12.5%)
Having support	2 (12.5%)
Improved cooking methods	2 (12.5%)
Questions self if tempted to snack 'Do I really need this?'	2 (12.5%)
Keeping to a regular meal pattern	1 (6.25%)
Monitoring of weight	1 (6.25%)

CHAPTER 4

DISCUSSION

4.0 Discussion

The aim of this exploratory study was to determine if there were any significant differences in the behaviours of weight loss maintainers and weight loss re-gainers attending a local weight management service within the North West of England. The purpose of this was to gain data and insight into why some people maintain their weight loss while others regain it, and to use this information to inform future development of the local weight management service.

The evidence around successful weight loss maintenance strategies is lacking. Several studies have demonstrated a variety of behaviours and habits that may be beneficial for long-term weight loss maintenance, which include long term therapist contact, the use of problem solving skills, the development of coping strategies, the use of weight loss medication and those behaviours described by the National Weight Control Registry.

For this exploratory study seven hypotheses were examined to determine if there were significant differences in the behaviours of the weight loss maintainers and the weight loss re-gainers. The behaviours or habits examined were those which the National Weight Control Registry has reported as being helpful in maintaining long-term weight loss. These behaviours are eating breakfast daily, keeping to a regular meal pattern both during the week and the weekend; eating a low calorie, low fat diet, reduced television viewing, regular monitoring of weight and food intake and engaging in a high level of physical activity.

It was also hoped that this exploratory study would identify if all of these behaviours were necessary for weight loss maintenance or if any one behaviour or combination of behaviours were more important or common in those who had maintained their weight loss.

While the overall results of this exploratory study demonstrated that there were no significant differences between the behaviours of weight loss maintainers and weight loss re-gainers in this local population there were some differences. Both study groups were mostly female, married and similar in age however at baseline assessment those who were maintaining their weight loss were heavier than those in the weight loss re-gainers group.

4.1 Breakfast

In both the weight loss maintainer and the weight loss re-gainer groups, the majority, 73.4 per cent, of study participants reported eating breakfast daily. However, all participants in the weight loss maintainer group reported eating breakfast on at least one day of the week compared with some participants in the weight loss re-gainer group who reported never eating breakfast.

The evidence around the importance of eating breakfast for weight loss maintenance is contradictory. Both eating breakfast and skipping breakfast have been shown to help with weight loss maintenance. The National Weight Control Registry regard eating breakfast as a helpful behaviour in aiding weight loss maintenance as 78.3 per cent of registry members reported eating daily breakfast (Wyatt et al. 2002). No causal relationship however has been demonstrated. This differs from the outcome of the study

by Song, Chun, Obayashi, Cho and Chung (2005). These authors concluded that the mean energy intake was greater in female breakfast consumers than in those who missed breakfast. Eating breakfast may help with weight loss maintenance in the long-term as it may reduce the frequency of unplanned snacking, as discussed in the randomised clinical trial by Schlundt, Hill, Sbrocco, Pope-Cordle and Sharp (1992).

When asked about how they were maintaining their weight loss, only two of the weight loss maintainers in this exploratory study cited eating daily breakfast as a helpful habit for weight loss maintenance. As the majority of both weight loss maintainers and weight loss re-gainers are eating breakfast daily, it may be seen as a beneficial behaviour for long-term weight loss maintenance in this study population.

4.2 Meal Pattern

When asked if their meal pattern differed at the weekend compared with the week, the majority of both the weight loss maintainers and the weight loss re-gainers reported that their meal pattern changed at weekends. This change was attributed to sleeping in longer, resulting in a brunch type meal being eaten rather than breakfast, so participants consumed two meals per day instead of their usual three meals. Some participants reported that a later breakfast led to snacking on high fat or high sugar foods during the day rather than eating a lunch time meal. These results differ from those of the study by Wing and Phelan (2005). Most of their study participants, 59 per cent, reported that their eating pattern was the same on weekdays and weekends. Only one weight loss maintainer reported that keeping to a

regular meal pattern during the week and the weekend was helpful to weight loss maintenance. As the majority, 60 per cent, of weight loss maintainers reported a change in meal pattern, maybe having a regular meal pattern the majority of the time is beneficial but not necessary all of the time to aid weight maintenance. Allowing this change or flexibility in eating pattern may also help with adhering to long term dietary change as the eating pattern fits into ones daily life.

4.3 Diet

To assess whether following a low calorie, low fat diet was important for weight loss maintenance, study participants were asked to describe what they ate and drank on a typical day. The weight loss maintainers reported an average intake of 1794 calories per day compared with 1658 calories per day reported by the weight loss re-gainers. There is a reasonable difference in calorie intake between the two groups and it would be expected that those regaining weight would report a lower calorie intake. Some studies (Lichtman et al., 1992; Heitmann, 1993 as cited in Shick et al, 1998) have demonstrated that under reporting of calorie intake is very common in both the overweight and the obese, and that the level of under reporting can range from 20-50 per cent.

The average intake reported in the study on the National Weight Control Registry by Klem, Wing, McGuire, Seagle and Hill (1997) was 1381 kilocalories and 24 per cent fat. As the authors assumed an underestimation of food intake of 20-30 per cent, this brought the figure to 1800 kilocalories. Applying this same principle to this exploratory study's results, the weight

loss maintainers food intake increased from 1794 kilocalories to 2332 kilocalories and the weight loss re-gainers daily kilocalorie intake increased from 1658 kilocalories to 2155 kilocalories. The calorie intakes from participants in this exploratory study are also greater than the calorie intakes consumed by the weight loss maintainers in the EatRight Weight Management Program (Greene et al. 2006).

The definition of a low calorie diet, as defined by the Expert Panel on the Identification, Evaluation and Treatment of Overweight in Adults (1998), is a calorie intake between 1000 and 1500 calories. As can be seen, neither the weight loss maintainers nor the weight loss re-gainers reported consuming a low calorie diet.

Regarding fat intake, there was no difference between the weight loss maintainers and the weight loss re-gainers in the amount of fat they consumed, with both groups reporting a mean fat intake of 70 grams. These intakes correspond to a dietary percentage fat intake of 35.2 per cent for weight loss maintainers and 38.4 per cent for weight loss re-gainers which is greater than the average fat intake of 26.6 per cent reported by the National Weight Control Registry (Phelan, Wyatt, Hill & Wing, 2006), and the 33 per cent fat intake consumed by the weight loss maintainers in the EatRight Weight Management Program (Greene et al. 2006).

The Dietary Reference Value for fat intake is 35 per cent of total calories (Committee On Medical Aspects of Food Policy Report, 1991). From the results above, it can be seen that, on average, the weight loss maintainers are adhering to dietary guidelines whereas those in the weight loss re-

gainers group are consuming fat in excess of that recommended. There was a large difference in the minimum and maximum reported fat intakes of the weight loss maintainers and weight loss re-gainers, with reported maximum fat intakes of 135g and 109g respectively, which corresponded to dietary percentage fat intakes of 68 per cent and 59 per cent respectively. These maximum fat intakes are almost twice that recommended by the Committee on Medical Aspects of Food Policy (1991). A low fat diet, as defined by the Expert Panel on the Identification, Evaluation and Treatment of Overweight in Adults (1998), consists of 20-30 percent of total calories from fat. It is clear from the results above that those maintaining their weight loss in this exploratory study are not adhering to a low fat diet. When asked how they were maintaining their weight loss, only four of the weight loss maintainers reported that making healthier choices was helping them with their weight loss maintenance.

However, while both the calorie and fat intakes of the weight loss maintainers are not by definition a low calorie diet or a low fat diet, their energy intakes are lower than what they require as they are not re-gaining their lost weight. This implies that a low calorie, low fat diet is not necessary for long term weight loss maintenance in this study population.

4.4 Television Viewing

Again, as previously shown above, there were no significant differences between the weight loss maintainers and the weight loss re-gainers in relation to the number of hours spent watching television with a median of 21-40 hours of viewing per week in both groups. It is not possible to know if

one group was closer to 21 hours of viewing than the other as the exact number of television viewing hours was not recorded. Both of the groups within this exploratory study spent more time watching television than that reported by the majority of participants in the study by Raynor, Phelan, Hill and Wing (2006) on the National Weight Control Registry, where 62 per cent of participants reported watching ten hours or less of television. The average American spends 28 hours per week watching television, which may still be less than that watched by the participants in this exploratory study. Only 14 per cent of weight loss maintainers and 11.7 per cent of weight loss re-gainers reported watching between six and ten hours of television. No one reported watching any less than six hours of television.

Increased television viewing may encourage weight re-gain as it is a sedentary activity and can be associated with an increased intake of high fat and high sugar foods, as reported in the study by Raynor, Phelan, Hill and Wing (2006). None of the weight loss maintainers in this exploratory study cited reduced television viewing as a behaviour helping them to maintain their weight loss. As seen from this study's results, there was no difference in television viewing between the two study groups. This would suggest that reduced television viewing is not a necessary behaviour for weight loss maintenance in this study population.

4.5 Weight Monitoring

Self monitoring of weight, physical activity levels and food intake has been demonstrated by several studies to be beneficial in helping to maintain long-term weight loss (Klem et al., 1997; Butryn, Phelan, Hill and Wing, 2007;

Linde, Jeffery, French, Pronk and Boyle, 2005; Wing, Tate, Gorin, Raynor and Fava, 2006; Phelan et al., 2008; Baker and Kirschenbaum, 1998). Self monitoring can identify when weight is being regained, activity levels reducing or calorie intake increasing which can allow the person to take action sooner to remedy the 'risky' behaviour. Both the weight loss maintainers and the weight loss re-gainers in this exploratory study reported monitoring their weight on a monthly basis. However, the majority, 43 per cent, of those in the weight loss maintainers group reported checking their weight on a weekly basis compared with only 24 per cent of those in the weight loss re-gainers group. This compares well with those in the National Weight Control Registry, where the majority of registry members reported checking their weight on a weekly basis (Klem et al. 1997). There were equal numbers of weight loss maintainers and weight loss re-gainers who reported that they never monitored their weight. Only one participant in the weight loss maintainer group reported that monitoring their weight was a habit that helped them to maintain their weight loss. As the majority of those in the weight loss maintainers group monitored their weight on a weekly basis, this behaviour may be deemed beneficial for long-term weight maintenance in this study population.

4.6 Food Intake Monitoring

In relation to self monitoring of food intake, while again there was no significant difference between the weight loss maintainers and the weight loss re-gainers, there was a difference. The majority, 57 per cent, of those in the weight loss maintainers group reported monitoring their food intake on a

daily basis whereas the majority, 53 per cent, of the weight loss re-gainers reported that they never monitored their food intake. The weight loss maintainers reported that they monitored their food intake either by recording their dietary intake or by being mindful of their portions at meal times and by questioning themselves if they were hungry and needed to snack. It was interesting to see that the majority of those maintaining their weight loss tended to monitor their dietary intake either daily, 57 per cent, or not at all, 33 per cent. This compares well with the study by Klem et al. (1997). In that study 50 per cent of National Weight Control Registry members reported monitoring their calorie and or their fat intake. When asked for comments on how they were maintaining their weight loss, six of the weight loss maintainers in this exploratory study reported that monitoring their food intake was important in helping them to maintain their weight loss. From this exploratory study results, the behaviour of monitoring dietary intake would appear to be helpful for weight loss maintenance.

4.7 Physical Activity

In examining the behaviour of engaging in high levels of physical activity, the findings of this exploratory study were surprising. Many studies have demonstrated the importance of regular physical activity in maintaining weight loss (Klem et al. 1997; Catenacci et al. 2008; Jakicic, Marcus, Lang and Janney 2008; Crawford et al. 2000). In this exploratory study, no significant difference was found between the weight loss maintainers and the weight loss re-gainers in relation to their levels of physical activity. The majority of both weight loss maintainers and weight loss re-gainers reported

engaging in low levels of physical activity, 48 per cent and 47 per cent respectively. Only 29 per cent of the weight loss maintainers reported engaging in high levels of physical activity, compared with 12 per cent of those in the weight loss re-gainers group. A high level of physical activity was defined as seven or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum total physical activity of at least 3000 MET-minutes per week.

These results do not compare well with the results of other studies. Klem et al. (1997) reported that members of the National Weight Control Registry expended an average of 2,827 kilocalories per week in physical activity. When Catenacci et al. (2008) updated this information their study reported that registry members engaged in 60-75 minutes of moderate intensity physical activity per day. The study by Jakicic, Marcus, Lang and Janney (2008) demonstrated that ten per cent weight loss maintenance required weight maintainers to engage in physical activity for 55 minutes per day. The Institute of Medicine (2002) and the consensus statement from the International Association for the Study of Obesity (2003) both recommend between 60-90 minutes of moderate intensity physical activity per day to maintain weight loss. For some, 16 per cent of the exploratory participants, engaging in physical activity is not possible due to their medical conditions, mostly heart conditions and arthritis. In both the weight loss maintainer and the weight loss re-gainer groups there were three such participants. These participants reported spending between twelve and seventeen hours per day sitting down.

Dohm, Beattie, Albei and Striegel-Moore (2001) also found no difference in exercise frequency or exercise intensity between weight loss maintainers and weight loss re-gainers who participated in their study. While the study by Catenacci et al. (2008) demonstrated that 75 per cent of National Weight Control Registry members expended more than 1000 kilocalories per week in activity, they also reported that 25 per cent of registry members expended less than 1000 kilocalories per week in physical activity, demonstrating that some registry members can maintain their weight loss without engaging in high levels of physical activity.

It was not possible to do a direct comparison on physical activity with the results of studies on the National Weight Control Registry as different physical activity questionnaires were used; International Physical Activity Questionnaire – short form and Paffenberger Physical Activity Questionnaire. Participants in this exploratory study estimated their time spent engaged in vigorous and moderate physical activities and time spent walking. The International Physical Activity Questionnaire has its own scoring formula to ascertain whether a participant has a low, medium or high level of physical activity. To allow some comparison with the results of the National Weight Control Registry studies and with other physical activity recommendations, which report time spent engaged in moderate intensity physical activity, the minutes reported, by both weight loss maintainers and weight loss re-gainers, engaged in moderate and /or vigorous physical activities were added and the total sum divided across seven days. This gave a median result for weight loss maintainers of 17 minutes per day spent in moderate

intensity physical activity, which is greatly less than that reported by members of the National Weight Control Registry and less than the 60-90 minutes per day recommended by the Institute of Medicine (2002), the International Association for the Study of Obesity (2003) and the American College of Sports Medicine (2001).

The time spent by the exploratory study participants in moderate intensity physical activities may be higher as walking can be a moderate intensity activity. However, the International Physical Activity Questionnaire does not ask for a description of walking speed, so the question on walking covers those who go for a stroll as well as those who are walking at a fast pace. Of the weight loss maintainers, of which there were six participants, deemed by the International Physical Activity Questionnaire as having a high level of physical activity, four of them met the recommended 60-90 minutes of moderate intensity activity per day. Within the weight loss re-gainers, only two participants were deemed to be engaging in high levels of physical activity but neither of these met the above recommended activity levels. Only two of the weight loss maintainers cited regular activity as being an important factor in their weight maintenance. The results from this exploratory study demonstrate that engaging in high levels of physical activity is not necessary for weight loss maintenance within this study population.

4.8 Participants' Comments

When asked about how they were maintaining their weight loss, the weight loss maintainers cited portion control as the most important factor followed by monitoring of food intake. This was also reflected in the study by Greene

et al. (2006) where serving sizes were found to be greater in those re-gaining weight compared with those maintaining it.

The importance of monitoring food intake has already been cited by several studies as being a useful behaviour for weight loss maintenance however portion control is not one of the seven behaviours mentioned by the National Weight Control Registry as being important for weight loss maintenance. All participants of this exploratory study were provided with and encouraged to follow a portion control plan as part of the local Weight Management Service. Portion control allows the study participants to continue to enjoy all the foods they like as long as they adhere to their portion plans. The portion plans are based on the Eatwell Plate, ensuring that the study participants get a balance of all of the five food groups. It allows an individually calculated number of calories to be used for high fat, high sugar 'treat' foods and alcohol, if the participant chooses to use these additional calories for these types of food. This maybe why the weight loss maintainers did not report following a low fat diet, as the percentage of dietary fat recommended by the Committee on Medical Aspects of Food Policy (1991) is 35 per cent of total calories.

4.9 Study Limitations

There were several limitations to this exploratory study. Firstly, there were only a small number of study participants, thirty eight in total. With such a small study sample, it is important not to draw conclusions from the results as the sample size is not large enough to demonstrate any significant differences between the two study groups. More than half of the exploratory

study participants fell into the weight loss maintainers group, (55 per cent). Based on the rates of weight re-gain cited in studies on weight loss maintenance, it was expected that there would have been more weight loss re-gainers in the study sample than weight loss maintainers. Of the 93 potential participants who did not take part in the study, 58 per cent, based on their last recorded weight, were defined as weight loss re-gainers, compared with 42 per cent being weight loss maintainers. However, for precisely that reason of weight regain; this may be why other potential participants did not take part in the study.

Although the behaviours examined in this exploratory study were taken from the National Weight Control Registry, it was not the aim of this study to conduct a direct comparison with the National Weight Control Registry. It was, however, useful to examine if the behaviours identified by the National Weight Control Registry as being beneficial for long term weight loss maintenance are being employed by this study population and if there were similarities between the National Weight Control Registry members and this study population. The exploratory study participants were mostly female and Caucasian with an average age of 55.3 years. The participants tended to be married and had attended school only rather than college or university. On examining baseline characteristics, the exploratory study participants are only similar to those of the National Weight Control Registry in terms of gender, ethnicity and marital status. They differ in the areas of age, education and body mass index. The average age on entry to the Registry is 46.8 years and most, 82 per cent, of the National Weight Control Registry

members have received some college education. The average maximum lifetime body mass index of registry members is 35kg/m^2 compared with the average initial body mass index of 45.7kg/m^2 and 42.4kg/m^2 for weight loss maintainers and weight loss re-gainers respectively. The exploratory participants are also from a small locality within the North West of England. From these baseline characteristics, the exploratory study participants cannot be compared with the registry members nor can the results of this exploratory study be generalised to the rest of the population of the United Kingdom or even the remainder of the North West.

All the data collected by researchers on the National Weight Control Registry is self reported data, with questionnaires sent out annually to members. In this exploratory study, all the study data collected, apart from the participant's weight and height, were also self reported and therefore subjective; studies (Lichtman et al., 1992; Heitmann, 1993 as cited in Shick et al, 1998) have demonstrated that the overweight and obese under report calorie intake and over report physical activity expenditure. The International Physical Activity Questionnaire, short version, was used in this pilot study to estimate the level of study participant's physical activity while participants reported their dietary intake from a typical day in order to ascertain their calorie and fat intake. Unfortunately it was not possible to replicate the same questionnaires used in the studies on the National Weight Control Registry, Block Food Frequency Questionnaire to assess dietary intake and Paffenbarger physical activity questionnaire as permission was not given to use them.

The International Physical Activity Questionnaire, short form was chosen instead, as it has been used in another study with obese subjects, it was quick and easy to complete and it has been validated for use with adults aged 15 to 69 years. There were, however four study participants over the age of 69. Future research may use more objective means of establishing study participants dietary intake and energy expenditure rather than relying on study participants self reported data. The use of questionnaires that have been validated in an obese population of a wider age group should also be used.

Another limitation of this exploratory study and other studies on weight loss maintenance is the lack of a universally accepted definition of weight loss maintenance. This lack of definition makes it difficult to compare results. To gain entry to the National Weight Control Registry, entrants must have maintained a weight loss of at least ten percent. For the purpose of this exploratory study weight maintenance was defined as a weight loss of at least five percent of initial body weight, as defined by Greene et al. (2006). This definition was chosen to ensure an equal number of weight loss maintainers and weight loss re-gainers as had the ten percent definition been chosen, there would have only been six participants in the weight loss maintainers group based on their last recorded weight before participating in the exploratory study. It can be seen from the results that the number of participants in the weight loss maintainer group was greater than that of the weight loss re-gainer group; 21 and 17 respectively.

It may have been more beneficial when questioning about television viewing to have ascertained an exact number of hours spent watching television and then group the answers rather than providing the study participants with time ranges. The median hours for watching television for both weight loss maintainers and weight loss re-gainers was between 21 and 40 hours. It is not known if either group was closer to 21 hours or 40 hours, to determine if reduced television viewing time helps with long term weight maintenance.

Another limitation of this study was the use of the dietary analysis package as this was missing some of the foods reported by the study participants. In these cases, the closest food or meal to the one reported by the study participant was selected.

A positive aspect of this exploratory study was that the weight, height and body mass index were ascertained during the study interview and not self reported by participants. This allowed participants to be reliably assigned as either a weight loss maintainer or a weight loss re-gainer based on an accurate weight.

There may be many reasons why some people manage to maintain their weight loss while others re-gain it. Studies have demonstrated various habits and behaviours that may be beneficial for long-term weight maintenance; continued contact with weight loss therapists; problem solving therapy, development of coping strategies and use of weight loss medication; along with those behaviours demonstrated by the National Weight Control Registry members. A final limitation of this exploratory study was that these other behaviours were not examined. The weight loss maintainers were not

significantly different from the weight loss re-gainers, nor were the weight loss maintainers adhering to all seven behaviours of the National Weight Control Registry deemed beneficial for weight loss maintenance. However, it may be that those participants maintaining their weight loss have better coping strategies for managing relapse and difficult situations in their life, and this is why they are successful at maintaining their weight loss.

CHAPTER 5

Conclusion, Practical Implications & Further Study

5.0 Conclusion

Obesity levels continue to rise, bringing with them a whole host of medical conditions which are putting additional strains on an already over stretched National Health Service. Weight management is composed of two distinct phases; weight loss and weight loss maintenance. Many studies have been conducted on weight loss, with evidence supporting various means to achieve weight loss, however, the evidence available on weight loss maintenance is lacking. As there is currently no world-wide agreed definition of weight loss maintenance or agreed strategies on how to maintain weight loss, this makes it difficult to create recognised guidelines on how best to achieve and measure success within a weight management service.

This exploratory study concluded that there were no significant differences in the behaviours of weight loss maintainers and weight loss re-gainers. For this small study population adhering to all of the behaviours of the National Weight Control Registry was not necessary for weight loss maintenance.

The behaviours of the Registry reported by the majority of study participants as being adhered to were eating breakfast daily and engaging in regular self monitoring of weight and food intake. The additional comments from those participants who were maintaining their weight loss highlighted that portion control and regular monitoring of food intake were important for them in maintaining their weight loss and this may warrant further study.

The results of this exploratory study cannot be generalised to the general population, however it may be useful to promote the habits of daily breakfast,

regular self monitoring and portion control to others wishing to maintain their weight loss.

Long term weight loss maintenance requires sustained effort. Those regaining weight may have been unable to keep up the dietary and lifestyle habits they had employed to help them to lose weight initially. The environment we live in encourages us to eat high fat, high sugar foods in large portions and to avoid energy expenditure. Those who are maintaining their weight loss have developed skills and habits that work for them in their environment.

5.1 Practical Application

As a practicing dietitian in a weight management service, the purpose of this study was to gain insight as to why some of the patients attending the weight management service were maintaining their weight loss while others were regaining it. The professional interest group for dietitians in weight management, (DOMUK), highlights the behaviours of the National Weight Control Registry in its professional guidance document 'The Dietetic Weight Management Intervention for Adults in the One to One Setting (2007). However, there is no evidence to show that these behaviours are applicable to patients in the United Kingdom.

Having conducted this exploratory study, it can be seen that some of the behaviours of the National Weight Control Registry may be helpful to some patients in maintaining their weight loss but are not essential to follow. The one behaviour that may be of most benefit is that of monitoring food intake.

While the difference between the weight loss maintainers and weight loss re-gainers was not significant, the majority of those maintaining their weight reported monitoring their food intake on a daily basis compared with the majority of the weight loss re-gainers who reported never monitoring their food intake. This habit or behaviour also follows nicely with the comments from weight loss maintainers who cited portion control as the most important factor in helping them to maintain their weight. Those who were following a portion plan or keeping an eye on their portions tended to record their food intake.

The advice I would share with other practicing dietitians is to focus their practice on working with patients on portion control, to strongly encourage self monitoring of food intake and weight and to encourage daily breakfast.

5.2 Further Study

As this was a small exploratory study, the findings cannot be generalised to the general population. To gain further insight into the behaviours that are beneficial to long term weight loss maintenance, a larger study would be needed. Additionally, if this larger study was to be conducted in various regions across the United Kingdom, and included a wider range of age groups, more male participants and participants from different ethnic groups, it would provide more meaningful results. Other studies have demonstrated various habits and behaviours that may be beneficial for long-term weight loss maintenance; continued contact with therapists; problem solving therapy, development of coping strategies and use of weight loss medication; along with those behaviours demonstrated by the National Weight Control

Registry members. Future studies on weight loss maintenance in the United Kingdom should also examine these behaviours and not just those recommended by the National Weight Control Registry.

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APPENDICES

Appendix A – Letter of Invite

Appendix B – Participant Information Sheet

Warrington and Halton Hospitals

NHS Foundation Trust

Participant information sheet

Behaviours of Successful Weight Loss Maintainers

You are being invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Thank you for reading this.

What is the purpose of the study?

The purpose of this study is to find out why some people lose weight and maintain this loss while other people regain weight. The results of the study will be used to improve the weight management service so that we can better help people to lose weight and keep it off.

Why have I been chosen?

You have been chosen because you have been attending the Weight Management Service for at least one year.

Do I have to take part?

It is up to you to decide whether or not to take part. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason. A decision to withdraw at any time, or a decision not to take part, will not affect the standard of care you receive in any way.

What will happen to me if I take part?

A dietitian from Halton Hospital will contact you to invite you to attend an appointment. At this appointment, the dietitian will ask you some questions and check your weight. The appointment will last 30-40 minutes. You will not be identifiable in the final report.

What are the possible disadvantages and risks of taking part?

There are no disadvantages or risks foreseen in taking part in the study.

What are the possible benefits of taking part?

By taking part, you will be contributing to the development of the Weight Management Service which will hopefully benefit patients in the future.

What if something goes wrong?

If you wish to complain or have any concerns about any aspect of the way you have been approached or treated during the course of this study, please contact the Chief Executive, Warrington & Halton Hospitals NHS Foundation Trust, Warrington Hospital, Lovely Lane, Warrington, WA5 1QG.

Will my taking part in the study be kept confidential?

All information which is collected about you during the course of the research will be kept strictly confidential so that only the researcher carrying out the research will have access to such information.

What will happen to the results of the research study?

The results will be written up into a report for my Masters degree at the University of Chester. It is hoped that the findings may be used to improve the Weight Management Service. Individuals who participate will not be identified in any subsequent report or publication.

Who is organising and funding the research?

I am organising and carrying out the study. There is no funding for the study.

Who may I contact for further information?

If you would like more information about the research before you decide whether or not you would be willing to take part, please contact:

Eileen Gunessee, Advanced Community Dietitian, Dietetic Department, Halton Hospital, Hospital Way, Runcorn, WA7 2DA

Telephone number: 01928 753074

Thank you for your interest in this research.

Appendix D – Interview Schedule

Interview Schedule

Participant Number:

Date:

Gender: Male

Female

Group:

Ethnicity:

Marital Status:

Education:

Initial Weight: kg

Initial BMI: kg/m²

Current Weight: kg

Current BMI: kg/m²

Q1: How many days of the week do you eat breakfast?

Daily

4-6 days

1-3 days

never

Comments:

Q2: Does your meal pattern differ at weekends?

Yes

No

If yes, explain how

Q3: Can you talk me through what you ate and drank yesterday?

Q4: How often do you eat any of the following?

Fried food/take away meals/sweets/chocolate/crisps/ice cream/cream/pastry/pies/biscuits/cakes

Everyday

4-6 days

1-3 days

Occasionally

Never

Q5: How many hours per week do you spend watching television?

0-1 hour 2-5 hours 6-10 hours 11-20 hours
21 – 40 hours 41- 60 hours 61 or more hours

Comments:

Q6: How often do you check your weight?

Daily Weekly Monthly Never

Comments

Q7: How often do you monitor your food intake?

Daily Weekly Monthly Never

Comments

Q8: IPAQ Questionnaire- short form: Attached

Q9: If the participant is maintaining their weight, any additional comments on how they are achieving it

Appendix E – Example of Tests of Normality and Homogeneity on Ratio Data

Tests of Normality

Group		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Calories	maintainer	.129	21	.200 [*]	.932	21	.150
	gainer	.147	17	.200 [*]	.950	17	.451
Fat	maintainer	.097	21	.200 [*]	.952	21	.369
	gainer	.136	17	.200 [*]	.896	17	.059

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Calories	Based on Mean	.237	1	36	.629
	Based on Median	.227	1	36	.637
	Based on Median and with adjusted df	.227	1	36.000	.637
	Based on trimmed mean	.240	1	36	.627
Fat	Based on Mean	.000	1	36	.985
	Based on Median	.003	1	36	.955
	Based on Median and with adjusted df	.003	1	30.408	.955
	Based on trimmed mean	.001	1	36	.970

Appendix F – Example of Independent T-Test on Ratio Data

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Calories	Equal variances assumed	.237	.629	.824	36	.416	136.4286	165.6297	-199.4839	472.3411
	Equal variances not assumed			.831	35.373	.411	136.4286	164.1273	-196.6421	469.4992
Fat	Equal variances assumed	.000	.985	-.061	36	.952	-.6196	10.1554	-21.2156	19.9764
	Equal variances not assumed			-.062	35.555	.951	-.6196	10.0404	-20.9914	19.7522

Group Statistics

Group		N	Mean	Std. Deviation	Std. Error Mean
Calories	maintainer	21	1794.429	526.1629	114.8181
	gainer	17	1658.000	483.5574	117.2799
Fat	maintainer	21	70.233	32.5340	7.0995
	gainer	17	70.853	29.2733	7.0998

Appendix G - Cross Tabulation and Chi Square on Nominal Data

Group * Differing meal pattern Crosstabulation

			Differing meal pattern		
			yes	no	Total
Group	maintainer	Count	9	12	21
		% within Group	42.9%	57.1%	100.0%
		% within Differing meal pattern	60.0%	52.2%	55.3%
		% of Total	23.7%	31.6%	55.3%
	gainer	Count	6	11	17
		% within Group	35.3%	64.7%	100.0%
		% within Differing meal pattern	40.0%	47.8%	44.7%
		% of Total	15.8%	28.9%	44.7%
Total		Count	15	23	38
		% within Group	39.5%	60.5%	100.0%
		% within Differing meal pattern	100.0%	100.0%	100.0%
		% of Total	39.5%	60.5%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.225 ^a	1	.635		
Continuity Correction ^b	.020	1	.888		
Likelihood Ratio	.226	1	.635		
Fisher's Exact Test				.744	.445
Linear-by-Linear Association	.219	1	.640		
N of Valid Cases	38				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.71.

b. Computed only for a 2x2 table

Appendix H – Example of Mann Whitney U Test on Ordinal Data

Test Statistics^b

	Breakfast	Television viewing	Weight check	Monitoring food intake	IPAQ
Mann-Whitney U	145.500	169.500	151.000	122.500	163.500
Wilcoxon W	376.500	400.500	382.000	353.500	316.500
Z	-1.255	-.287	-.850	-1.783	-.477
Asymp. Sig. (2-tailed)	.210	.774	.395	.075	.634
Exact Sig. [2*(1-tailed Sig.)]	.337 ^a	.794 ^a	.432 ^a	.101 ^a	.663 ^a

a. Not corrected for ties.

b. Grouping Variable: Group