Effectiveness of a specialist weight management programme in the UK National Health Service: prospective study of 1838 patients.

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Effectiveness of a specialist weight management programme in the UK National Health Service: prospective study of 1838 patients.

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ABSTRACT

Objectives

There is limited evidence on the effectiveness of weight management programmes provided within routine health care and inconsistent use of outcome measures. Our aim was to evaluate a large National Health Service (NHS) weight management service and report absolute and proportional weight losses over 12 months.

Design

Prospective observational study.

Setting

Glasgow and Clyde Weight Management Service (GCWMS), which provides care for residents of NHS Greater Glasgow and Clyde area (population 1.2 million).

Participants

All patients who began GCWMS between 1st October 2008 and 30th September 2009.

Interventions

Structured educational lifestyle programme employing cognitive behavioural therapy, 600kcal deficit diet, physical activity advice, lower calorie diet and pharmacotherapy.

Primary and secondary outcomes measures

Baseline Observation Carried Forward (BOCF), Last Observation Carried Forward (LOCF) and changes in programme completers reported using outcomes of absolute 5kg and 5% weight losses and mean weight changes at a variety of time points.

Results

6,505 referrals were made to GCWMS, 5637 were eligible, 3460 opted in and 1916 (34%) attended a first session. 78 patients were excluded from our analysis on 1838 patients. 72.9% patients were female, mean age of all patients at baseline was 49.1 years, 43.3% lived in highly socio-economically deprived areas and mean weights and BMIs at baseline were 118.1kg and 43.3 kg/m^2, respectively. 26% lost ≥5kg by the end of Phase 1, 30% by the end of Phase 2, and 28% by the end of Phase 3 (all LOCF). Weight loss was more successful among men, particularly those ≤29 years old.

Conclusions

Routine NHS weight management services may achieve moderate weight losses although these appear to be largely from conventional lifestyle interventions rather than intensive specialist care. Weight losses should be reported using a range of outcome measure so that the effectiveness of different services can be compared.

INTRODUCTION

The prevalence of obesity, defined as a Body Mass Index of 30kg/m^2 or greater, has increased steeply over the past three decades to become a major public health concern[1-3]. Obesity raises the risk of many serious diseases, including coronary artery disease and cancers[4]. In the United Kingdom, national guidelines recommend multi-component weight management programmes involving calorie deficient diets, physical activity and behavioural components for the management of patients who are either overweight or obese[5;6]. Despite these recommendations, the provision of weight management services across the UK remains patchy and there is very limited published evidence of the effectiveness of such interventions outside of a research setting within the National Health Service (NHS).

There are a variety of different methods used when reporting weight management outcomes, with no agreed standard methodology for analysis or follow-up period, which makes comparison between programmes complicated. It is therefore difficult for health authorities to make an informed choice when commissioning weight management services. Some studies include self-reported weights[7] even though these are likely to be significantly underestimated[8]. Weight loss programmes have variable lengths so that reported weight loss outcomes may represent changes over a few weeks or over a year. Attendance is often poor but there is no consensus on whether outcomes should be reported only on programme completers, on all those who start a programme, or carried-forward from the last observation. There is also lack of agreement on which outcomes to publish with some studies reporting mean weight changes, proportional weight loss or absolute weight loss.

Only a small number of UK based weight management programmes have published 12 month outcome data and the majority of these have been within a study setting[7;9;10]. The Counterweight programme is delivered in primary care with training of primary care staff provided by a specialist team (mean baseline BMI 37 kg/m^2)[9]. The Counterweight Programme report that 31% of patients achieved >5% weight loss in those completing the programme though this attenuates to just 13.9% when all patients are included; however as this was an audit rather than a study there were no resources available to obtain measured or self-reported weights in those who dropped out[9]. The other published research is based on commercial programmes with Jebb et al[10]**Error! Bookmark not defined.** reporting 12 month weight loss outcomes from a randomised trial of WeightWatchers group sessions compared to GP care alone (mean baseline BMI 31 kg/m^2), though this study included patients outside the UK. A recent trial of primary-care based interventions concluded that those provided by the NHS were ineffective[7]. The Lighten-up Study[7]compared random allocation to a number of weight management providers including commercial, pharmacy and primary care services; where direct measurement was unavailable due to non-attendance, final weight was sought by self-report. The mean BMI in this study was 33.8kg/m^2. WeightWatchers had 46% of patients achieving >5% weight loss in Jebb et al[10] and 31% in Jolly et al[7] (the most successful of all the programmes offered in that study) using measured plus self-reported 12 month weights.

There is currently no UK based programme reporting 1 year outcomes for those patients with higher BMIs and complex co-morbidities. Our aim was therefore to report 1 year outcomes from

the NHS Greater Glasgow and Clyde Weight Management Service, a secondary care based service for patients with severe obesity and obesity-related co-morbidities, including a large number of patients from areas of high socio-economic deprivation. We previously presented the results of the first phase of this programme[11]. We have taken care to report percentage and absolute weight losses using both last and baseline observations to allow maximum comparison with other services.

METHODS

Setting

In NHS Greater Glasgow and Clyde (NHSGGC), population 1.2 million, a multi-component weight management programme, the Glasgow and Clyde Weight Management Service (GCWMS), is available to patients aged 18 years and over with complex obesity (defined as Body Mass Index (BMI) of ≥ 30 kg/m^2 with obesity related co-morbidities or BMI of ≥35 kg/m^2) referred by their general practitioner or hospital doctor. The service, based in secondary care but delivered in community based sites, aims to achieve a ≥5 kg weight loss. In the hierarchy of interventions for the treatment of obesity in NHSGGC this service sits above local authority, commercial and third sector services, on the pathway to bariatric surgery. The GCWMS model was developed in 2004 and extended throughout the Health Board area in 2008.

The intervention is a time-limited structured educational lifestyle programme employing cognitive behavioural therapy (CBT) techniques alongside a 600kcal deficit diet and physical activity advice. Phase 1 of the intervention includes nine 90 minute sessions delivered fortnightly over a 16 week period. On finishing Phase 1 patients can chose to enter Phase 2, which consists of three 1 hour sessions delivered at monthly intervals and includes a range of treatment options including further lifestyle advice, prescribed low calorie diet or pharmacotherapy (Orlistat). At the end of Phase 2, or directly from the end of Phase 1 dependent on patient choice, patients enter a weight maintenance programme (Phase 3) comprising twelve 1 hour sessions delivered at monthly intervals. Patients that fail to achieve their target weight loss can choose to repeat Phase 2 once more then enter the maintenance programme.

Definitions of completers and time-points

Patients were considered to be "completers" if they attended at least half of the sessions in any phase. Thus, in Phase 1 completers had attended 4 or more appointments; in Phase 2 they had attended 2 or more appointments; and in Phase 3 they had attended 6 or more appointments. For the time-specific outcomes, there was often not a clinic date on the exact date or week corresponding to 3, 6 or 12 months so we defined these periods as follows. For 3 months, we sought a weight at 84 days (12 weeks). If no weight was available at that time point we used a later weight up to 98 days after starting the programme, or if that was also unavailable a weight from 70 days onwards. For 6 months we sought a weight at 182 days (26 weeks). If no weight was available we used a later weight up to 210 days, or, if unavailable, a weight on or after 154 days. For 12 months, we sought a weight at 364 days, and if none was available extended the range up to 422 days, and if no weight was available extended it down to 308 or more days.

The service is funded entirely by NHSGGC Health Board. In 2009 the service employed 38.5 whole time equivalent staff including 1 service lead, 5 team leaders, 11.5 dieticians, 6.5 psychologists, 1 psychology assistant, 4.2 physiotherapists, 6.3 administrative staff and 3 technical support staff. In the year 2008/09 staff costs were estimated to be £1.25 million. Additional resources required to deliver the intervention include scales, magnetic flip charts, laptops and projectors and appropriately adapted seating, provided at an estimated cost of £20,000. There are no direct costs to patients entering the GCWMS however patients are required to cover any transportation costs to and from appointments.

Data and Statistical Methods

All referrals to the GCWMS from 1st October 2008 to 30th September 2009 were followed until they completed or left the programme. Data were censored at 1st December 2011, so that full data were available on patients who completed Phase 3, which occurred around 19 months after starting the programme. Weight change from entry to the programme to the end of Phase 1, Phase 2 and Phase 3 is described. For comparison with other published studies weight change from entry to the programme to three, six and twelve months is also described. Primary analyses were intention to treat in patients entering the weight management programme. Missing data occurs when patients fail to attend appointments or leave the programme early; reasons for non attendance are generally not known. Where data was missing the method of last observation carried forward (LOCF) was preferred though baseline observation carried forward (BOCF) is also reported. All analyses were performed using the STATA statistical software package version 11 (StataCorp, College Station, TX, USA).

Socio-economic status

As individual social, educational and economic information was not available for patients, we used the Scottish Index of Multiple Deprivation (SIMD)[12] to infer socio-economic status. This is a validated area-based measure of socioeconomic circumstances that uses individuals' postcode of residence. The SIMD does not measure individuals' socio-economic status but that of their area of residence. The SIMD ranks 6505 small geographical small areas (datazones) across Scotland, each containing approximately 750 people from most deprived (1) to least deprived (6505). These have been further categorised into quintiles where 1 is most deprived and 5 is

least deprived. The SIMD score is composed of information on seven domains: (1) income and benefits (2) employment in working age population (3) health and healthcare utilisation (4) educational attainment, skills and training (5) access to services and transport (6) recorded crime rates and (7) housing quality and overcrowding.

RESULTS

Over the one year period October 2008 to September 2009, 6505 referrals were made to GCWMS of whom 5637 were eligible for the service, based on BMI, age, area of residence and co-morbidities. Of the 5637 eligible patients, 61% (3460) opted into the service, 58% (3249) attended for assessment, 3 were deemed ineligible at assessment because their BMI was lower than 30 kg/m^2, 38% (2153) opted to enter Phase 1, and 34% (1916) attended Phase 1 at least once. From the dataset of 1916 patients we excluded a further 4 whose initial BMI was recorded as ≤ 30 kg/m^2 and 74 who were directed to a specialised disordered eating group, leaving a final sample for analysis of 1838 patients. The majority of the 1838 patients were female (72.9%), the mean age was 49.1yrs (SD 13.5) and men were older than women (mean ages 51.9 (SD 11.96) and 48.1 (SD 13.86) years, respectively) – Table 1. Most of the patients were in the most deprived quintile (43.3%) of the Scottish Index of Multiple Deprivation with only 12.2% in the least deprived quintile. The mean initial weight at first attendance in Phase 1 was 118.1kg, range 52.6 to 244.8 kg. Men were significantly heavier than women (male and female initial weights 132 and 112.7 kg, respectively). BMI was also high; the mean BMI at first attendance in Phase 1 was 43.26 (43.34 in males and 43.23 in females). Nearly two thirds (63.1%) of patients had BMI of 40 kg/m^2 or greater (Class III obesity).

Table 1 Baseline characteristics of 1838 patients who started Phase 1 of Glasgow and Clyde Weight Management Service between October 2008 and September 2009.

		N	%
All		1838	**100**
Gender	**male**	498	**27.1**
	female	1340	**72.9**
Age	**<= 29 yrs**	192	**10.5**
	30-39	268	**14.6**
	40-49	481	**26.2**
	50-59	476	**25.9**
	60-69	320	**17.4**
	>=70	101	**5.5**
SIMD	**Most Deprived**	796	**43.3**
	2	342	**18.6**
	3	245	**13.3**
	4	224	**12.2**
	Least Deprived	225	**12.2**
	nk	6	**0.3**
Initial Weight	**50- 74 (kg)**	12	**0.7**
	75-99	395	**21.5**
	100-124	813	**44.2**
	125-149	464	**25.2**
	>=150	154	**8.4**
Initial BMI	**30-34 (kg/m$^{2)}$**	131	**7.1**
	35-39	546	**29.7**
	40-49	872	**47.4**
	>=50	289	**15.7**

The cumulative weight loss at the end of each phase is outlined in Table 2. Three-quarters (72%) of patients who started GCWMS attended at least four sessions and of these "completers" 36% had lost 5 kg or more by the end of Phase 1. Twenty-six percent of patients lost 5kg or more when last weighed in Phase 1 (LOCF) and this was similar when calculated on a Baseline Observation Carried Forward basis. By the end of Phase 2, 30% of patients who started GCWMS had lost 5kg or more when they were last weighed (LOCF). A third of patients (639/1838) who started GCWMS were deemed to have completed Phase 2 and amongst them 55% had lost 5kg or more. The relatively low completion rate in Phase 2 (35%) explains the large difference between BOCF and LOCF results. Relatively few patients attended at the end of Phase 2 and the BOCF assumes weights did not change from baseline among the majority who did not provide a final weight. However, by using the last available weight, the LOCF indicates that 11% of patients who did not have a weight recorded at the end of Phase 2 were known to have lost at least 5kg when last seen. By the end of Phase 3, 28% of patients who started GCWMS had lost 5kg or more when they were last weighed. In total 11% of patients who started GCWMS complete Phase 3 (208/1838) and amongst them 58% had lost 5kg or more. Table 2 also presents weight losses of ≥5%. For over three-quarters of patients, a 5% weight loss meant loss >5kg in weight; this resulted in fewer patients achieving the proportionate loss than the absolute loss.

Of the 1358 patients who did not lose at least 5kg in Phase 1, 461 (33.9% using LOCF) entered Phase 2 and 31 patients (6.7%, 31/461) lost further weight such that their total loss was 5kg or more since starting the programme. Of the complement of 480 patients who lost at least 5kg in

Phase 1, 339 (70.6%) progressed into Phase 2. Their mean weight change in Phase 2 was -0.75Kg, that is, they experienced an overall further weight loss.

Table 2 Cumulative weight loss at end of each phase from 1st clinic visit in phase 1. BOCF – Baseline Observation Carried Forward; LOCF – Last Observation Carried Forward. *Phase 3 completers must have completed Phase 1, and Phase 2 if they entered it.

		N	%	Mean change (kg)	Lost ≥ 5kg		Lost ≥ 5%	
Phase 1								
Completers		1322	71.9	-4.02	471	36%	377	29%
All cases	**BOCF**	1838		-2.89	471	26%	377	21%
	LOCF	1838		-3.06	480	26%	381	21%
Phase 1 + 2								
Completers		639	34.8	-6.38	349	55%	313	49%
All cases	**BOCF**	1838		-2.22	349	19%	313	17%
	LOCF	1838		-3.6	550	30%	468	25%
Phases 1+(2)+3*								
Completers		208	11.3	-8.48	121	58%	117	56%
All cases	**BOCF**	1838		-0.96	121	7%	117	6%
	LOCF	1838		-3.56	509	28%	434	24%

As Phase 2 represents the second and last of the weight-loss phases of GCWMS programme, we report determinants of weight loss by age, sex, socio-economic circumstances, initial weight and initial BMI by the end of this phase in Table 3 using the LOCF. Males were generally more successful at losing the 5kg target weight (mean losses in males and females 4.16 and 3.4 kg, respectively). Both men and women in all age groups up to 70 yrs had similar success rates of about 30%. However, patients aged 29 or under had different outcomes. Younger men had greater success and young women less success (52% males versus 22% females under 30 years achieved 5kg weight loss) although numbers of younger men were small (N=25). Deprivation did not appear to affect the proportion losing their target weight. There was no clear trend between initial weight or BMI and successful weight loss, although patients who were heaviest had the greatest proportion losing 5 kg or more (43% of men and 38% of women).

Table 3 Subgroup analyses of weight loss at end of phase 2, using LOCF method

	MALE				FEMALE			
	N	Mean weight change (kg)	% lost 5kg	% lost 5%	N	Mean weight change (kg)	% Lost 5kg	% lost 5%
All	498	-4.16	33	24	1340	-3.4	29	**26**
≤29 yrs	25	-5.17	52	24	167	-2.16	22	**20**
30-39	58	-3.19	31	16	210	-3.81	32	**27**
40-49	122	-4.75	32	26	359	-3.45	30	**25**
50-59	152	-4.16	34	26	324	-3.84	31	**28**
60-69	119	-3.69	30	24	201	-3.09	25	**23**
≥70	22	-4.93	27	23	79	-3.66	30	**38**
1. (most deprived)	204	-4.02	32	22	592	-3.23	28	**24**
2	79	-3.55	32	22	263	-3.61	32	**30**
3	65	-3.83	32	25	180	-3.54	33	**29**
4	63	-5.24	37	29	161	-2.97	22	**21**
5. (least deprived)	83	-4.61	34	28	142	-4.01	30	**28**
Init Weight 75-99 (kg)	24	-4.84	38	46	383	-2.69	21	**25**
100-124	188	-3.21	27	21	625	-3.34	28	**25**
125-149	192	-4.39	34	24	272	-4.17	36	**26**
>=150	94	-5.44	41	26	60	-5.04	48	**38**
Init BMI 30-34 ($kg/m^{2)}$	40	-3.55	30	32	91	-2.75	21	**25**
35-39	136	-3.0	24	18	410	-3.13	26	**27**
40-49	242	-4.32	35	25	630	-3.49	29	**25**
>=50	80	-5.97	43	29	209	-3.93	38	**28**

In order to allow comparison of the results of GCWMS with other services that describe weight loss at fixed time-points, we calculated weight changes at 3, 6 and 12 months (Table 4). These roughly correspond to the ends of Phases 1, 2 and 3 but are not particular end-points for the GCWMS programme. GCWMS does not aim to achieve 5 kg weight losses as early as 3 months, so the 6 and 12 month results are most meaningful. At both six and twelve months after starting at GCWMS, up to 28% of patients (LOCF) had lost 5kg or more of their initial weight. Of patients with a weight measured at around 6 months, 50% had lost 5kg or more and of those who had actual weights recorded around 12 months, 54% lost 5kg or more. However, because only 21.7% had their weights recorded at 12 months, it can only be said for certain (using BOCF) that 12% of all patients who began the programme had definitely lost 5 kg or more at this time point.

Table 4. Cumulative weight changes at specified time from 1st clinic visit for 1838 patients, Oct 08 to Sept 09. BOCF – Baseline Observation Carried Forward; LOCF – Last Observation Carried Forward.

		N	%	Mean change (kg)	Lost ≥ 5kg		Lost ≥5%	
3 Months	**Complete Cases**	1167	63.5	-3.7	369	32%	289	25%
	BOCF	1838		-2.4	369	20%	289	16%
	LOCF	1838		-2.7	399	22%	308	17%
6 Months	**Complete Cases**	701	38.1	-5.8	347	50%	310	44%
	BOCF	1838		-2.2	347	19%	310	17%
	LOCF	1838		-3.4	515	28%	433	24%
12 Months	**Complete Cases**	399	21.7	-7.2	214	54%	203	51%
	BOCF	1838		-1.6	214	12%	203	11%
	LOCF	1838		-3.6	612	28%	447	24%

DISCUSSION

NHS Glasgow and Clyde Weight Management Service achieved a 5kg weight loss in 28% of participants at 12 months when a last observation carried forward analysis is used. This equates to 24% of participants losing 5% of their body weight due to a high mean BMI of 43 in the participants at baseline. Overall men achieved greater weight loss than women despite there being far fewer men participating. Those with very high initial weight (>150kg) also did well with 48% of women and 41% of men losing 5 kg or more (38% and 26% respectively losing 5%).

Due to methodological differences, comparisons with other published data are difficult. Data from commercial weight management programmes show WeightWatchers to be a successful intervention with between 31%[7] **Error! Bookmark not defined.**and 46%[10]**Error! Bookmark not defined.** of participants losing 5% of their body weight. However these data were from randomised research studies with a mean BMI of between 31.5 to 33.5 kg/m^2 resulting in a very different population of participants. There were also differences in data collection from those with missing data, with the Lighten Up study using patient self-report for final weight, a method known to result in under-reporting of weight[8]. **Error! Bookmark not defined.** It is not known why some patients drop out of weight management programmes with possible reasons ranging from lack of success and weight regain to weight loss success and the feeling they can "go it alone" and no longer need the problem; this makes the issue of missing data very difficult and explains why we and other studies get large difference in results when using baseline or last observation carried forward.

Currently, the Glasgow and Clyde Weight Management Service is based around a target of achieving a 5kg weight loss. However, given the higher BMI of participants in this specialist service, 5 kg is only 4.2% of the mean body weight, as opposed to the 5kg and 5% being interchangeable outcomes in a population whose mean weight is closer to 100kg. Given the higher initial BMI and range of co-morbidities in the GCWMS population, it could be argued that higher weight loss targets should be set. Bariatric surgery has shown health benefits for larger weight gains than those achieved by conventional weight management programmes[13] and there are new non-surgical interventions such as potential drug treatments[14;15] which promote weight losses greater than 5kg as well as the recent rival of the popularity of low energy liquid diets which have the potential for larger weight loss and also to modify obesity related comorbidities[16;17].

Interestingly our results have shown limited effectiveness for the second intensive treatment phase of the programme (Phase 2) in achieving weight loss for those who do not achieve 5kg weight loss with the lifestyle intervention in Phase 1, with only 7% who entered Phase 2 achieving the 5kg target. This raises the question of whether these expensive intensive interventions should be reserved for patients who have already shown themselves able to make changes and lose 5kg, in an attempt to get far larger, clinically meaningful weight losses. Such an approach is already used within areas of the NHS as criteria for bariatric surgery and further research should be considered in this area.

The major strength of our results are that they come from a very large NHS service specifically targeting severe and complex obesity; an area of concern due to the health care costs of such patients[18]. We have provided a comprehensive description of the outcomes using both baseline and last observation carried forward as well as linking outcomes to the programme structure and

time based observations. While there are many NHS weight management programmes across the UK, the majority are poorly evaluated or not at all, making their effectiveness difficult to ascertain. This results in a lack of evidence for the commissioning and de-commissioning of these services and does not help in building arguments for investment in such services at a time of financial constraint. There is an urgent need to define consistent analytical methods, including how missing data should be treated, and acceptable ranges when describing time points.

The major weakness in our current work is the lack of ancillary information such as baseline characteristics and changes in clinical risk factors (e.g. blood pressure, lipids, glycaemic control) or change in medications. This is due to the data being from a real-life NHS service rather than a study population, but clearly data collection could be improved for future evaluations. It would also have been advantageous to have had better data from other services to compare with our own outcomes and we hope others will publish BMI-specific outcomes in due course that will be more comparable to our treatment population.

In conclusion, this is the first publication of 12 month results of a large NHS weight management programme specifically targeted at patients with severe obesity. We have shown modest results in achieving some success with 5kg weight loss in 28% of our patients at one year but it is hard to compare these results to others programmes. There is an urgent need for standardised data collection from weight management programmes. Consideration needs to be given as to the treatment target in severely obese patients and how best to achieve this within NHS services.

ARTICLE SUMMARY

Article focus

- There is limited evidence on the effectiveness of weight management services provided within routine health services; an inconsistent range of outcome measures has been reported
- We evaluated a large weight management programme provided by the National Health Service in the UK with at least 12 months' follow-up and we reported outcomes in a variety of ways to allow comparison with other studies.

Key messages

- We studied 1,838 patients with mean BMIs of 43 kg/m^2 (obesity class III)
- 28% of patients lost at least 5kg
- There were large differences in outcomes depending on which of the commonly-used definitions was used.

Strengths and limitations of this study

- Strengths include the large study population from a non-research environment, long follow-up, objective measures of weight and comprehensive reporting methods.
- Limitations include lack of clinical risk factor data.

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Outcomes of a specialist weight management programme in the UK National Health Service: prospective study of 1838 patients.

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ABSTRACT

Objectives

There is limited evidence on the effectiveness of weight management programmes provided within routine health care and inconsistent use of outcome measures. Our aim was to evaluate a large National Health Service (NHS) weight management service and report absolute and proportional weight losses over 12 months.

Design

Prospective observational study.

Setting

Glasgow and Clyde Weight Management Service (GCWMS), which provides care for residents of NHS Greater Glasgow and Clyde area (population 1.2 million).

Participants

All patients who began GCWMS between 1st October 2008 and 30th September 2009.

Interventions

Structured educational lifestyle programme employing cognitive behavioural therapy, 600kcal deficit diet, physical activity advice, lower calorie diet and pharmacotherapy.

Primary and secondary outcomes measures

Baseline Observation Carried Forward (BOCF), Last Observation Carried Forward (LOCF) and changes in programme completers reported using outcomes of absolute 5kg and 5% weight losses and mean weight changes at a variety of time points.

Results

6,505 referrals were made to GCWMS, 5637 were eligible, 3460 opted in and 1916 (34%) attended a first session. 78 patients were excluded from our analysis on 1838 patients. 72.9% patients were female, mean age of all patients at baseline was 49.1 years, 43.3% lived in highly socio-economically deprived areas and mean weights and BMIs at baseline were 118.1kg and 43.3 kg/m^2, respectively. 26% lost ≥5kg by the end of Phase 1, 30% by the end of Phase 2, and 28% by the end of Phase 3 (all LOCF). Weight loss was more successful among men, particularly those ≤29 years old.

Conclusions

Routine NHS weight management services may achieve moderate weight losses through a comprehensive evidence based dietary, activity and behavioural approach including psychological care. Weight losses should be reported using a range of outcome measure so that the effectiveness of different services can be compared.

Strengths and limitations of this study

Strengths

- Describes a large National Health Service programme for severe and complex obesity
- Comprehensive reporting of outcomes using a variety of measures to allow comparison with other studies.

Limitations

- Lack of some baseline clinical risk factor data.
- Course completion defined using a lower threshold than some other studies.

INTRODUCTION

The prevalence of obesity, defined as a Body Mass Index of 30kg/m^2 or greater, has increased steeply over the past three decades to become a major public health concern[1-3]. Obesity raises the risk of many serious diseases, including coronary artery disease and cancers[4]. In the United Kingdom, national guidelines recommend multi-component weight management programmes involving calorie deficient diets, physical activity and behavioural components for the management of patients who are either overweight or obese[5 6]. Despite these recommendations, the provision of weight management services across the UK remains patchy and there is limited published evidence of the effectiveness of such interventions outside of a research setting within the National Health Service (NHS)[7-10].

There is a variety of different methods used when reporting weight management outcomes, with no agreed standard methodology for analysis or follow-up period, which makes comparison between programmes complicated. It is therefore difficult for health authorities to make an informed choice when commissioning weight management services. Some studies include self-reported weights[11] even though these are likely to be significantly underestimated[12]. Weight loss programmes have variable lengths so that reported weight loss outcomes may represent changes over a few weeks or over a year. It is difficult to infer if weight losses reported at 12 weeks will be sustained in the medium to long-term[7-9]. Attendance is often poor but there is no consensus on whether outcomes should be reported only on programme completers, on all those who start a programme, or carried-forward from the last observation. Programme completion has variously been defined as attendance at greater than 80%, 83% or 50% of sessions and it might be argued that because of the association between attendance and

successful weight loss, higher thresholds will selectively identify patients with greater weight losses[7 9 13]. There is also lack of agreement on which outcomes to publish with some studies reporting mean weight changes, proportional weight loss or absolute weight loss.

Only a small number of UK based weight management programmes have published 12 month outcome data and the majority of these have been within a study setting[10 11 13 14]. The Counterweight programme is delivered in primary care with training of primary care staff provided by a specialist team (mean baseline BMI 37 kg/m^2)[13]. The Counterweight Programme report that 31% of patients achieved >5% weight loss in those completing the programme though this attenuates to just 13.9% when all patients are included; however as this was an audit rather than a study there were no resources available to obtain measured or self-reported weights in those who dropped out[13]. The other published research is based on commercial programmes with Jebb et al[14]**Error! Bookmark not defined.** reporting 12 month weight loss outcomes from a randomised trial of WeightWatchers group sessions compared to GP care alone (mean baseline BMI 31 kg/m^2), though this study included patients outside the UK. A recent trial of primary-care based interventions concluded that those provided by the NHS were ineffective[11]. The Lighten Up Study[11] compared random allocation to a number of weight management providers including commercial, pharmacy and primary care services; where direct measurement was unavailable due to non-attendance, final weight was sought by self-report. The mean BMI in Lighten Up was 33.8kg/m^2. WeightWatchers had 46% of patients achieving >5% weight loss in Jebb et al[14] and 31% in Jolly et al[11] (the most successful of all the programmes offered in that study) using measured plus self-reported 12 month weights.

There is currently no UK based programme reporting 1 year outcomes for those patients with higher BMIs and complex co-morbidities. Our aim was therefore to report 1 year outcomes from the NHS Greater Glasgow and Clyde Weight Management Service, an integrated service across primary and secondary care for patients with severe obesity and obesity-related co-morbidities, including a large number of patients from areas of high socio-economic deprivation. We previously presented the results of the first phase of this programme[15]. We have reported percentage and absolute weight losses using both last and baseline observations to allow maximum comparison with other services.

METHODS

Setting

In NHS Greater Glasgow and Clyde (NHSGGC), population 1.2 million, a multi-component weight management programme, the Glasgow and Clyde Weight Management Service (GCWMS), is available to patients aged 18 years and over with complex obesity (defined as Body Mass Index (BMI) of ≥ 30 kg/m^2 with obesity related co-morbidities or BMI of ≥35 kg/m^2) referred by their general practitioner or hospital doctor. The service, which is integrated across primary and secondary care but delivered in community based sites, aims to achieve a ≥5 kg weight loss. In the hierarchy of interventions for the treatment of obesity in NHSGGC this service sits above local authority, commercial and third sector services, on the pathway to bariatric surgery. The GCWMS model was developed in 2004 and extended throughout the Health Board area in 2008.

The intervention is a time-limited structured educational lifestyle programme employing cognitive behavioural therapy (CBT) techniques alongside a 600kcal deficit diet and physical activity advice. Phase 1 of the intervention includes nine 90 minute sessions delivered fortnightly over a 16 week period. On finishing Phase 1 patients can choose to enter Phase 2, which consists of three 1 hour sessions delivered at monthly intervals and includes a range of treatment options including further lifestyle advice, prescribed low calorie diet or pharmacotherapy (Orlistat). At the end of Phase 2, or directly from the end of Phase 1 dependent on patient choice, patients enter a weight maintenance programme (Phase 3) comprising twelve 1 hour sessions delivered at monthly intervals. Patients that fail to achieve their target weight loss can choose to repeat Phase

2 once more then enter the maintenance programme or if they fail to lose 5kg and have a BMI >40 kg/m^2, or BMI>35kg/m^2 with comorbidities, can opt for bariatric surgery.

Definitions of completers and time-points

Patients were considered to be "completers" if they attended about half of the sessions in any phase. Thus, in Phase 1 completers had attended 4 or more appointments; in Phase 2 they had attended 2 or more appointments; and in Phase 3 they had attended 6 or more appointments. For the time-specific outcomes, there was often not a clinic date on the exact date or week corresponding to 3, 6 or 12 months so we defined these periods as follows. For 3 months, we sought a weight at 84 days (12 weeks). If no weight was available at that time point we used a later weight up to 98 days after starting the programme, or if that was also unavailable a weight from 70 days onwards. For 6 months we sought a weight at 182 days (26 weeks). If no weight was available we used a later weight up to 210 days, or, if unavailable, a weight on or after 154 days. For 12 months, we sought a weight at 364 days, and if none was available extended the range up to 422 days, and if no weight was available extended it down to 308 or more days.

The service is funded entirely by NHSGGC Health Board. In 2009 the service employed 37.5 whole time equivalent staff including 1 service lead, 5 team leaders, 11.5 dieticians, 5.5 clinical psychologists, 1 psychology assistant, 4.2 physiotherapists, 6.3 administrative staff and 3 technical support staff. In the year 2008/09 staff costs were estimated to be £1.25 million. Additional resources required to deliver the intervention include scales, magnetic flip charts, laptops and projectors and appropriately adapted seating, provided at an estimated non-recurring

set-up cost of £20,000. There are no direct costs to patients entering the GCWMS however patients are required to cover any transportation costs to and from appointments.

Data and Statistical Methods

All referrals to the GCWMS from 1st October 2008 to 30th September 2009 were followed until they completed or left the programme. Data were censored at 1st December 2011, so that full data were available on patients who completed Phase 3, which occurred around 19 months after starting the programme. Weight change from entry to the programme to the end of Phase 1, Phase 2 and Phase 3 is described. For comparison with other published studies weight change from entry to the programme to three, six and twelve months is also described. Primary analyses were on all patients who began treatment. Missing data occurs when patients fail to attend appointments or leave the programme early; reasons for non attendance are generally not known. Where data was missing the method of last observation carried forward (LOCF) was preferred though baseline observation carried forward (BOCF) is also reported. All analyses were performed using the STATA statistical software package version 11.

Socio-economic status

As individual social, educational and economic information was not available for patients, we used the Scottish Index of Multiple Deprivation (SIMD)[16] to infer socio-economic status. This is a validated area-based measure of socioeconomic circumstances that uses individuals' postcode of residence. The SIMD does not measure individuals' socio-economic status but that

of their area of residence. The SIMD ranks 6505 small geographical small areas (datazones) across Scotland, each containing approximately 750 people from most deprived (1) to least deprived (6505). These have been further categorised into quintiles where 1 is most deprived and 5 is least deprived. The SIMD score is composed of information on seven domains: (1) income and benefits (2) employment in working age population (3) health and healthcare utilisation (4) educational attainment, skills and training (5) access to services and transport (6) recorded crime rates and (7) housing quality and overcrowding.

Ethics approval

Non-identifiable data were provided by GCWMS for the purposes of evaluating a routine NHS service. The work was therefore not considered to require ethics committee approval.

RESULTS

Over the one year period October 2008 to September 2009, 6505 referrals were made to GCWMS of whom 5637 were eligible for the service, based on BMI, age, area of residence and co-morbidities. Of the 5637 eligible patients, 61% (3460) opted into the service, 58% (3249) attended for assessment, 3 were deemed ineligible at assessment because their BMI was lower than 30 kg/m^2, 38% (2153) opted to enter Phase 1, and 34% (1916) attended Phase 1 at least once. From the dataset of 1916 patients we excluded a further 4 whose initial BMI was recorded as ≤ 30 kg/m^2 and 74 who were directed to a specialised disordered eating group (where they received different, specialised psychological interventions that are qualitatively different from the main programme), leaving a final sample for analysis of 1838 patients. The majority of the 1838 patients were female (72.9%), the mean age was 49.1yrs (SD 13.5) and men were older than women (mean ages 51.9 (SD 11.96) and 48.1 (SD 13.86) years, respectively) – Table 1. Most of the patients were in the most deprived quintile (43.3%) of the Scottish Index of Multiple Deprivation with only 12.2% in the least deprived quintile. The mean initial weight at first attendance in Phase 1 was 118.1kg, range 52.6 to 244.8 kg. BMI was also high; the mean BMI at first attendance in Phase 1 was 43.26 (43.34 in males and 43.23 in females). Nearly two thirds (63.1%) of patients had BMI of 40 kg/m^2 or greater (Class III obesity).

Table 1 Baseline characteristics of 1838 patients who started Phase 1 of Glasgow and Clyde Weight Management Service between October 2008 and September 2009.

		N	%
All		1838	**100**
Gender	**male**	498	**27.1**
	female	1340	**72.9**
Age	**<= 29 yrs**	192	**10.5**
	30-39	268	**14.6**
	40-49	481	**26.2**
	50-59	476	**25.9**
	60-69	320	**17.4**
	>=70	101	**5.5**
SIMD	**Most Deprived**	796	**43.3**
	2	342	**18.6**
	3	245	**13.3**
	4	224	**12.2**
	Least Deprived	225	**12.2**
	nk	6	**0.3**
Initial Weight	**50- 74 (kg)**	12	**0.7**
	75-99	395	**21.5**
	100-124	813	**44.2**
	125-149	464	**25.2**
	>=150	154	**8.4**
Initial BMI	**30-34 (kg/m$^{2)}$**	131	**7.1**
	35-39	546	**29.7**
	40-49	872	**47.4**
	>=50	289	**15.7**

The cumulative weight loss at the end of each phase is outlined in Table 2. Almost three-quarters (72%) of patients who started GCWMS attended at least four sessions and of these "completers" 36% had lost 5 kg or more by the end of Phase 1. Twenty-six percent of patients lost 5kg or more when last weighed in Phase 1 (LOCF) and this was similar when calculated on a Baseline Observation Carried Forward basis. By the end of Phase 2, 30% of patients who started GCWMS had lost 5kg or more when they were last weighed (LOCF). A third of patients (639/1838) who started GCWMS were deemed to have completed Phase 2 and amongst them 55% had lost 5kg or more. The relatively low completion rate to the end of Phase 2 (35%) explains the large difference between BOCF and LOCF results. Relatively few patients attended up to the end of Phase 2 and the BOCF assumes weights did not change from baseline among the majority who did not provide a final weight. However, by using the last available weight, the LOCF indicates that 11% of patients who did not have a weight recorded by the end of Phase 2 were known to have lost at least 5kg when last seen. By the end of Phase 3, 28% of patients who started GCWMS had lost 5kg or more when they were last weighed. In total 11% of patients who started GCWMS complete Phase 3 (208/1838) and amongst them 58% had lost 5kg or more. Table 2 also presents weight losses of ≥5%. For over three-quarters of patients, a 5% weight loss meant loss >5kg in weight; this resulted in fewer patients achieving the proportionate loss than the absolute loss.

Of the 1358 patients who did not lose at least 5kg in Phase 1, 461 (33.9% using LOCF) entered Phase 2. Their mean weight change in Phase 2 was -0.65 (95% confidence interval -0.9 to -0.4) kg. Of the complement of 480 patients who lost at least 5kg in Phase 1, 339 (70.6%) progressed into Phase 2. Their mean weight change in Phase 2 was -0.75 (-1.1 to -0.4) kg.

Table 2 Cumulative weight loss at end of each phase from 1st clinic visit in phase 1. BOCF – Baseline Observation Carried Forward; LOCF – Last Observation Carried Forward. *Phase 3 completers must have completed Phase 1, and Phase 2 if they entered it.

		N	%	Mean change & 95% CI (kg)		Lost ≥ 5kg		Lost ≥ 5%	
Phase 1									
Completers		1322	71.9	-4.02	(-4.3 to -3.8)	471	36%	377	29%
All cases	**BOCF**	1838		-2.89	(-3.1 to -2.7)	471	26%	377	21%
	LOCF	1838		-3.06	(-3.3 to -2.9)	480	26%	381	21%
Phase 1 + 2									
Completers		639	34.8	-6.38	(-6.9 to -5.8)	349	55%	313	49%
All cases	**BOCF**	1838		-2.22	(-2.5 to -2.0)	349	19%	313	17%
	LOCF	1838		-3.6	(-3.9 to -3.4)	550	30%	468	25%
Phases 1+(2)+3*									
Completers		208	11.3	-8.48	(-9.7 to -7.2)	121	58%	117	56%
All cases	**BOCF**	1838		-0.96	(-1.1 to -0.8)	121	7%	117	6%
	LOCF	1838		-3.56	(-3.8 to -3.3)	509	28%	434	24%

Completers attended ≥4 sessions in Phase 1, ≥2 sessions in Phase 2, and ≥6 sessions in Phase 3.

Duration of Phases: Phase 1, 16 weeks; Phase 2, 3 months (may be repeated); Phase 3, 12 months.

As Phase 2 represents the second and last of the weight-loss phases of GCWMS programme, we report determinants of weight loss by age, sex, socio-economic circumstances, initial weight and initial BMI by the end of this phase in Table 3 using the LOCF method. Males were generally more successful at losing the 5kg target weight (mean losses in males and females 4.16 and 3.4 kg, respectively). Both men and women in all age groups from 30 to 70 yrs had similar success rates of about 30%. However, patients aged 29 or under had different outcomes. Younger men had greater success and young women less success (52% males versus 22% females under 30 years achieved 5kg weight loss) although numbers of younger men were small (N=25). Deprivation did not appear to affect the proportion losing their target weight. There was no clear trend between initial weight or BMI and successful weight loss, although patients who were heaviest had the greatest proportion losing 5 kg or more (41% of men and 48% of women).

Table 3 Subgroup analyses of weight loss at end of phase 2, using LOCF method

	MALE				FEMALE			
	N	Mean weight change & 95% CI (kg)	% lost 5kg	% lost 5%	N	Mean weight change & 95% CI (kg)	% Lost 5kg	% lost 5%
All	498	-4.16 (-4.7 to -3.6)	33	24	1340	-3.4 (-3.7 to -3.1)	29	26
≤29 yrs	25	-5.17 (-7.8 to -2.6)	52	24	167	-2.16 (-2.9 to -1.4)	22	20
30-39	58	-3.19 (-4.4 to -2.0)	31	16	210	-3.81 (-4.6 to -3.0)	32	27
40-49	122	-4.75 (-6.1 to -3.4)	32	26	359	-3.45 (-4.0 to -2.9)	30	25
50-59	152	-4.16 (-5.3 to -3.0)	34	26	324	-3.84 (-4.4 to -3.3)	31	28
60-69	119	-3.69 (-4.6 to -2.8)	30	24	201	-3.09 (-3.6 to -2.5)	25	23
≥70	22	-4.93 (-7.9 to -2.0)	27	23	79	-3.66 (-4.5 to -2.8)	30	38
1. (most deprived)	204	-4.02 (-4.9 to -3.1)	32	22	592	-3.23 (-3.6 to -2.8)	28	24
2	79	-3.55 (-4.7 to -2.4)	32	22	263	-3.61 (-4.2 to -3.0)	32	30
3	65	-3.83 (-5.3 to -2.4)	32	25	180	-3.54 (-4.2 to -2.9)	33	29
4	63	-5.24 (-7.1 to -3.3)	37	29	161	-2.97 (-3.8 to -2.1)	22	21
5. (least deprived)	83	-4.61 (-6.1 to -3.1)	34	28	142	-4.01 (-4.9 to -3.2)	30	28
Init Weight 75-99 (kg)	24	-4.84 (-6.4 to -3.2)	38	46	383	-2.69 (-3.1 to -2.3)	21	25
100-124	188	-3.21 (-3.9 to -2.6)	27	21	625	-3.34 (-3.7 to -3.0)	28	25
125-149	192	-4.39 (-5.4 to -3.4)	34	24	272	-4.17 (-4.9 to -3.4)	36	26
>=150	94	-5.44 (-7.2 to -3.7)	41	26	60	-5.04 (-7.2 to -2.9)	48	38
Init BMI 30-34 (kg/m$^{2)}$	40	-3.55 (-4.8 to -2.3)	30	32	91	-2.75 (-3.6 to -1.9)	21	25
35-39	136	-3.0 (-3.8 to -2.2)	24	18	410	-3.13 (-3.5 to -2.7)	26	27
40-49	242	-4.32 (-5.1 to -3.5)	35	25	630	-3.49 (-3.9 to -3.1)	29	25
>=50	80	-5.97 (-8.1 to -3.9)	43	29	209	-3.93 (-4.8 to -3.1)	38	28

In order to allow comparison of the results of GCWMS with other services that describe weight loss at fixed time-points, we calculated weight changes at 3, 6 and 12 months (Table 4) – although these are not recognised as end-points by GCWMS. These roughly correspond to the ends of Phases 1 and 2 while Phase 3 corresponds to a time point of between 18 and 24 months. GCWMS does not aim to achieve 5 kg weight losses as early as 3 months, so the 6 and 12 month results are most meaningful. At both six and twelve months after starting at GCWMS, 28% of patients (LOCF) had lost 5kg or more of their initial weight. Of patients with a weight measured at around 6 months, 50% had lost 5kg or more and of those who had actual weights recorded around 12 months, 54% lost 5kg or more. However, because only 21.7% had their weights recorded at 12 months, it can only be said for certain that 12% of all patients who began the programme had definitely lost 5 kg or more at this time point.

Table 4. Cumulative weight changes at specified time from 1st clinic visit for 1838 patients, Oct 08 to Sept 09. BOCF – Baseline Observation Carried Forward; LOCF – Last Observation Carried Forward.

		N	%	Mean change & 95% CI (kg)	Lost ≥ 5kg		Lost ≥5%	
3 Months	**Complete Cases**	1167	63.5	-3.7 (-3.9 to -3.5)	369	32%	289	25%
	BOCF	1838		-2.4 (-2.5 to -2.2)	369	20%	289	16%
	LOCF	1838		-2.7 (-2.9 to -2.5)	399	22%	308	17%
6 Months	**Complete Cases**	701	38.1	-5.8 (-6.3 to -5.4)	347	50%	310	44%
	BOCF	1838		-2.2 (-2.4 to -2.0)	347	19%	310	17%
	LOCF	1838		-3.4 (-3.6 to -3.2)	515	28%	433	24%
12 Months	**Complete Cases**	399	21.7	-7.2 (-8.1 to -6.3)	214	54%	203	51%
	BOCF	1838		-1.6 (-1.8 to -1.3)	214	12%	203	11%
	LOCF	1838		-3.6 (-3.9 to -3.3)	612	28%	447	24%

DISCUSSION

NHS Glasgow and Clyde Weight Management Service achieved a 5kg weight loss in 28% of participants at 12 months when a last observation carried forward analysis is used. This equates to 24% of participants losing 5% of their body weight, because the mean weight was greater than 100kg at baseline. When complete cases are considered, 54% of participants achieved at least 5kg weight loss at 12 months. Overall men achieved greater weight loss than women. Those with very high initial weight (>150kg) also did well with 48% of women and 41% of men losing 5 kg or more (38% and 26% respectively losing 5%).

Due to methodological differences, comparisons with other published data are difficult. Data from commercial weight management programmes show WeightWatchers to be a successful intervention with between 31%[11] and 51%[7] of participants losing 5kg or 5% of their body weight[8]. However these data were from randomised research studies with mean BMIs under 38 kg/m^2 compared to the GCWMS mean of 43 kg/m^2. There were also differences in data collection, with the Lighten Up study using patient self-report for final weight, a method known to result in under-reporting of weight[12]. It is not known why some patients drop out of weight management programmes however within GCWMS, patients are given a target weight loss of 5kg and then offered the option of longer term support of up to 2 years. Participants can choose to leave earlier than this with possible reasons ranging from lack of success and weight regain to weight loss success and the feeling they can "go it alone" and no longer need the service; this makes the issue of missing data very difficult and explains why we and other studies get large difference in results when using baseline or last observation carried forward. Our definition of course completion was lower than some others' have used and given that attendance is directly related to weight loss, it is likely that if we used a higher threshold for completion weight losses would have been

greater in this group. It is difficult to compare the final opt-in proportion, 62%, with that of other studies in which very different recruitment methods are used, such as widespread postal invitations, rather than the individual GP referrals from GCWMS. Retention of patients in GCWMS appears to be lower than that in some other studies but the aim of the service is not to retain all patients to the end of Phase 3 but rather to be flexible in allowing them to leave if they have succeeded in losing their target weight.

Currently, the Glasgow and Clyde Weight Management Service is based around a target of achieving a 5kg weight loss. However, given the higher BMI of participants in this specialist service, 5 kg is only 4.2% of the mean body weight, as opposed to the 5kg and 5% being interchangeable outcomes in a population whose mean weight is closer to 100kg. Given the higher initial BMI and range of co-morbidities in the GCWMS population, it could be argued that higher weight loss targets should be set. Bariatric surgery has shown health benefits for larger weight losses than those achieved by conventional weight management programmes[17] and there are new non-surgical interventions such as drug treatments[18 19] which promote weight losses greater than 5kg as well as the recent rival of the popularity of low energy liquid diets which have the potential for larger weight loss and also to modify obesity related comorbidities[20 21].

The major strength of our results are that they come from a very large NHS service specifically targeting severe and complex obesity; an area of concern due to the health care costs of such patients[22]. We have provided a comprehensive description of the outcomes using both baseline and last observation carried forward as well as linking outcomes to the programme structure and time based observations. While there are many NHS weight management programmes across the UK, the majority are poorly evaluated or not at all, making their effectiveness difficult to

ascertain. This results in a lack of evidence for the commissioning and de-commissioning of these services and does not help in building arguments for investment in such services at a time of financial constraint. There is an urgent need to define consistent analytical methods, including how missing data should be treated, and acceptable ranges when describing time points.

The major weakness in our current work is the lack of ancillary information such as baseline characteristics and changes in clinical risk factors (e.g. blood pressure, lipids, glycaemic control) or change in medications. This is due to the data being from a real-life NHS service rather than a study population, but clearly data collection could be improved for future evaluations. Where BMI-specific weight changes have been reported elsewhere in the UK, there is some evidence that patients with greater baseline weights were more likely to lose weight[7] although Ahern reported a weight gain in patients with Class III obesity (BMI $\geq$40 kg/m^2). Our definition of course completion was lower than some others' have used and given that attendance is directly related to weight loss, it is likely that if we used a higher threshold for completion weight losses would have been greater in this group.

In conclusion, this is the first publication of 12 month results of a large NHS weight management programme specifically targeted at patients with severe obesity. We have shown modest results in achieving some success with a 5kg or greater weight loss in 28% of our patients at one year but it is hard to compare these results to others programmes. There is an urgent need for standardised data collection from weight management programmes. Consideration needs to be given as to the treatment target in severely obese patients and how best to achieve this within NHS services.

Competing Interests

None

Contributorship

MG carried out extraction, cleaning and interpretation of data.
GA carried out all statistical analyses.
JL, GA and DSM drafted the manuscript; MG and LF commented on a late draft.
All authors designed the study and approved the final draft of the manuscript.

Data sharing

The Glasgow and Clyde Weight Management Service database includes additional variables that have not been extracted or analysed as part of this work. Applications for a list of variables should be sent in the first instance to the corresponding author.

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~~Effectiveness~~

Outcomes of a specialist weight management programme in the UK National Health Service: prospective study of 1838 patients.

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ABSTRACT

Objectives

There is limited evidence on the effectiveness of weight management programmes provided within routine health care and inconsistent use of outcome measures. Our aim was to evaluate a large National Health Service (NHS) weight management service and report absolute and proportional weight losses over 12 months.

Design

Prospective observational study.

Setting

Glasgow and Clyde Weight Management Service (GCWMS), which provides care for residents of NHS Greater Glasgow and Clyde area (population 1.2 million).

Participants

All patients who began GCWMS between 1st October 2008 and 30th September 2009.

Interventions

Structured educational lifestyle programme employing cognitive behavioural therapy, 600kcal deficit diet, physical activity advice, lower calorie diet and pharmacotherapy.

Primary and secondary outcomes measures

Baseline Observation Carried Forward (BOCF), Last Observation Carried Forward (LOCF) and changes in programme completers reported using outcomes of absolute 5kg and 5% weight losses and mean weight changes at a variety of time points.

Results

6,505 referrals were made to GCWMS, 5637 were eligible, 3460 opted in and 1916 (34%) attended a first session. 78 patients were excluded from our analysis on 1838 patients. 72.9% patients were female, mean age of all patients at baseline was 49.1 years, 43.3% lived in highly socio-economically deprived areas and mean weights and BMIs at baseline were 118.1kg and 43.3 kg/m^2, respectively. 26% lost ≥5kg by the end of Phase 1, 30% by the end of Phase 2, and 28% by the end of Phase 3 (all LOCF). Weight loss was more successful among men, particularly those ≤29 years old.

Conclusions

Routine NHS weight management services may achieve moderate weight losses ~~although these appear to be largely from conventional lifestyle interventions rather than intensive specialist~~through a comprehensive evidence based dietary, activity and behavioural approach including psychological care. Weight losses should be reported using a range of outcome measure so that the effectiveness of different services can be compared.

Strengths and limitations of this study

Strengths

- Describes a large National Health Service programme for severe and complex obesity
- Comprehensive reporting of outcomes using a variety of measures to allow comparison with other studies.

Limitations

- Lack of some baseline clinical risk factor data.
- Course completion defined using a lower threshold than some other studies.

INTRODUCTION

The prevalence of obesity, defined as a Body Mass Index of 30kg/m^2 or greater, has increased steeply over the past three decades to become a major public health concern~~[1-3]~~[1-3]. Obesity raises the risk of many serious diseases, including coronary artery disease and cancers~~[4]~~[4]. In the United Kingdom, national guidelines recommend multi-component weight management programmes involving calorie deficient diets, physical activity and behavioural components for the management of patients who are either overweight or obese~~[5,6]~~[5 6]. Despite these recommendations, the provision of weight management services across the UK remains patchy and there is ~~very~~ limited published evidence of the effectiveness of such interventions outside of a research setting within the National Health Service (NHS~~).~~)[7-10].

There ~~are~~is a variety of different methods used when reporting weight management outcomes, with no agreed standard methodology for analysis or follow-up period, which makes comparison between programmes complicated. It is therefore difficult for health authorities to make an informed choice when commissioning weight management services. Some studies include self-reported weights~~[7]~~[11] even though these are likely to be significantly underestimated~~[8]~~[12]. Weight loss programmes have variable lengths so that reported weight loss outcomes may represent changes over a few weeks or over a year. It is difficult to infer if weight losses reported at 12 weeks will be sustained in the medium to long-term[7-9]. Attendance is often poor but there is no consensus on whether outcomes should be reported only on programme completers, on all those who start a programme, or carried-forward from the last observation. Programme completion has variously been defined as attendance at greater than 80%, 83% or

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50% of sessions and it might be argued that because of the association between attendance and successful weight loss, higher thresholds will selectively identify patients with greater weight losses[7 9 13]. There is also lack of agreement on which outcomes to publish with some studies reporting mean weight changes, proportional weight loss or absolute weight loss.

Only a small number of UK based weight management programmes have published 12 month outcome data and the majority of these have been within a study setting[7;9;10][10 11 13 14]. The Counterweight programme is delivered in primary care with training of primary care staff provided by a specialist team (mean baseline BMI 37 kg/m^2)[9][13]. The Counterweight Programme report that 31% of patients achieved >5% weight loss in those completing the programme though this attenuates to just 13.9% when all patients are included; however as this was an audit rather than a study there were no resources available to obtain measured or self-reported weights in those who dropped out[9][13]. The other published research is based on commercial programmes with Jebb et al[10][14]Error! Bookmark not defined. reporting 12 month weight loss outcomes from a randomised trial of WeightWatchers group sessions compared to GP care alone (mean baseline BMI 31 kg/m^2), though this study included patients outside the UK. A recent trial of primary-care based interventions concluded that those provided by the NHS were ineffective[7][11]. The Lighten ~~up~~ Up Study[7][11] compared random allocation to a number of weight management providers including commercial, pharmacy and primary care services; where direct measurement was unavailable due to non-attendance, final weight was sought by self-report. The mean BMI in ~~this study~~Lighten Up was 33.8kg/m^2. WeightWatchers had 46% of patients achieving >5% weight loss in Jebb et al[10][14] and 31% in Jolly et al[7][11] (the most

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successful of all the programmes offered in that study) using measured plus self-reported 12 month weights.

There is currently no UK based programme reporting 1 year outcomes for those patients with higher BMIs and complex co-morbidities. Our aim was therefore to report 1 year outcomes from the NHS Greater Glasgow and Clyde Weight Management Service, ~~a~~an integrated service across primary and secondary care ~~based service~~ for patients with severe obesity and obesity-related co-morbidities, including a large number of patients from areas of high socio-economic deprivation. We previously presented the results of the first phase of this programme[11] [15]. We have ~~taken care to report~~reported percentage and absolute weight losses using both last and baseline observations to allow maximum comparison with other services.

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METHODS

Setting

In NHS Greater Glasgow and Clyde (NHSGGC), population 1.2 million, a multi-component weight management programme, the Glasgow and Clyde Weight Management Service (GCWMS), is available to patients aged 18 years and over with complex obesity (defined as Body Mass Index (BMI) of ≥ 30 kg/m^2 with obesity related co-morbidities or BMI of ≥35 kg/m^2) referred by their general practitioner or hospital doctor. The service, ~~based in~~which is integrated across primary and secondary care but delivered in community based sites, aims to achieve a ≥5 kg weight loss. In the hierarchy of interventions for the treatment of obesity in NHSGGC this service sits above local authority, commercial and third sector services, on the pathway to bariatric surgery. The GCWMS model was developed in 2004 and extended throughout the Health Board area in 2008.

The intervention is a time-limited structured educational lifestyle programme employing cognitive behavioural therapy (CBT) techniques alongside a 600kcal deficit diet and physical activity advice. Phase 1 of the intervention includes nine 90 minute sessions delivered fortnightly over a 16 week period. On finishing Phase 1 patients can ~~chose~~choose to enter Phase 2, which consists of three 1 hour sessions delivered at monthly intervals and includes a range of treatment options including further lifestyle advice, prescribed low calorie diet or pharmacotherapy (Orlistat). At the end of Phase 2, or directly from the end of Phase 1 dependent on patient choice, patients enter a weight maintenance programme (Phase 3) comprising twelve 1 hour sessions delivered at monthly intervals. Patients that fail to achieve their target weight loss can choose to repeat Phase 2 once more then enter the maintenance programme~~.~~ or if they fail to lose

5kg and have a BMI >40 kg/m^2, or BMI>35kg/m^2 with comorbidities, can opt for bariatric surgery.

Definitions of completers and time-points

Patients were considered to be "completers" if they attended ~~at least~~about half of the sessions in any phase. Thus, in Phase 1 completers had attended 4 or more appointments; in Phase 2 they had attended 2 or more appointments; and in Phase 3 they had attended 6 or more appointments. For the time-specific outcomes, there was often not a clinic date on the exact date or week corresponding to 3, 6 or 12 months so we defined these periods as follows. For 3 months, we sought a weight at 84 days (12 weeks). If no weight was available at that time point we used a later weight up to 98 days after starting the programme, or if that was also unavailable a weight from 70 days onwards. For 6 months we sought a weight at 182 days (26 weeks). If no weight was available we used a later weight up to 210 days, or, if unavailable, a weight on or after 154 days. For 12 months, we sought a weight at 364 days, and if none was available extended the range up to 422 days, and if no weight was available extended it down to 308 or more days.

The service is funded entirely by NHSGGC Health Board. In 2009 the service employed ~~38~~37.5 whole time equivalent staff including 1 service lead, 5 team leaders, 11.5 dieticians, ~~6.~~5.5 clinical psychologists, 1 psychology assistant, 4.2 physiotherapists, 6.3 administrative staff and 3 technical support staff. In the year 2008/09 staff costs were estimated to be £1.25 million. Additional resources required to deliver the intervention include scales, magnetic flip charts, laptops and projectors and appropriately adapted seating, provided at an estimated non-recurring

set-up cost of £20,000. There are no direct costs to patients entering the GCWMS however patients are required to cover any transportation costs to and from appointments.

Data and Statistical Methods

All referrals to the GCWMS from 1st October 2008 to 30th September 2009 were followed until they completed or left the programme. Data were censored at 1st December 2011, so that full data were available on patients who completed Phase 3, which occurred around 19 months after starting the programme. Weight change from entry to the programme to the end of Phase 1, Phase 2 and Phase 3 is described. For comparison with other published studies weight change from entry to the programme to three, six and twelve months is also described. Primary analyses were ~~intention to treat in~~on all patients ~~entering the weight management programme.~~ who began treatment. Missing data occurs when patients fail to attend appointments or leave the programme early; reasons for non attendance are generally not known. Where data was missing the method of last observation carried forward (LOCF) was preferred though baseline observation carried forward (BOCF) is also reported. All analyses were performed using the STATA statistical software package version 11 ~~(StataCorp, College Station, TX, USA).~~.

Socio-economic status

As individual social, educational and economic information was not available for patients, we used the Scottish Index of Multiple Deprivation (SIMD)[12] [16] to infer socio-economic status. This is a validated area-based measure of socioeconomic circumstances that uses individuals'

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postcode of residence. The SIMD does not measure individuals' socio-economic status but that of their area of residence. The SIMD ranks 6505 small geographical small areas (datazones) across Scotland, each containing approximately 750 people from most deprived (1) to least deprived (6505). These have been further categorised into quintiles where 1 is most deprived and 5 is least deprived. The SIMD score is composed of information on seven domains: (1) income and benefits (2) employment in working age population (3) health and healthcare utilisation (4) educational attainment, skills and training (5) access to services and transport (6) recorded crime rates and (7) housing quality and overcrowding.

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Ethics approval

Non-identifiable data were provided by GCWMS for the purposes of evaluating a routine NHS service. The work was therefore not considered to require ethics committee approval.

RESULTS

Over the one year period October 2008 to September 2009, 6505 referrals were made to GCWMS of whom 5637 were eligible for the service, based on BMI, age, area of residence and co-morbidities. Of the 5637 eligible patients, 61% (3460) opted into the service, 58% (3249) attended for assessment, 3 were deemed ineligible at assessment because their BMI was lower than 30 kg/m^2, 38% (2153) opted to enter Phase 1, and 34% (1916) attended Phase 1 at least once. From the dataset of 1916 patients we excluded a further 4 whose initial BMI was recorded as ≤ 30 kg/m^2 and 74 who were directed to a specialised disordered eating group~~,~~ (where they received different, specialised psychological interventions that are qualitatively different from the main programme), leaving a final sample for analysis of 1838 patients. The majority of the 1838 patients were female (72.9%), the mean age was 49.1yrs (SD 13.5) and men were older than women (mean ages 51.9 (SD 11.96) and 48.1 (SD 13.86) years, respectively) – Table 1~~Table 1~~. Most of the patients were in the most deprived quintile (43.3%) of the Scottish Index of Multiple Deprivation with only 12.2% in the least deprived quintile. The mean initial weight at first attendance in Phase 1 was 118.1kg, range 52.6 to 244.8 kg. ~~Men were significantly heavier than women (male and female initial weights 132 and 112.7 kg, respectively).~~ BMI was also high; the mean BMI at first attendance in Phase 1 was 43.26 (43.34 in males and 43.23 in females). Nearly two thirds (63.1%) of patients had BMI of 40 kg/m^2 or greater (Class III obesity).

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Table 1 Baseline characteristics of 1838 patients who started Phase 1 of Glasgow and Clyde Weight Management Service between October 2008 and September 2009.

		N	%
All		1838	100
Gender	male	498	27.1
	female	1340	72.9
Age	<= 29 yrs	192	10.5
	30-39	268	14.6
	40-49	481	26.2
	50-59	476	25.9
	60-69	320	17.4
	>=70	101	5.5
SIMD	Most Deprived	796	43.3
	2	342	18.6
	3	245	13.3
	4	224	12.2
	Least Deprived	225	12.2
	nk	6	0.3
Initial Weight	50- 74 (kg)	12	0.7
	75-99	395	21.5
	100-124	813	44.2
	125-149	464	25.2
	>=150	154	8.4
Initial BMI	30-34 (kg/m^2)	131	7.1
	35-39	546	29.7
	40-49	872	47.4
	>=50	289	15.7

The cumulative weight loss at the end of each phase is outlined in Table 2~~Table 2~~. ~~Three~~Almost three-quarters (72%) of patients who started GCWMS attended at least four sessions and of these "completers" 36% had lost 5 kg or more by the end of Phase 1. Twenty-six percent of patients lost 5kg or more when last weighed in Phase 1 (LOCF) and this was similar when calculated on a Baseline Observation Carried Forward basis. By the end of Phase 2, 30% of patients who started GCWMS had lost 5kg or more when they were last weighed (LOCF). A third of patients (639/1838) who started GCWMS were deemed to have completed Phase 2 and amongst them 55% had lost 5kg or more. The relatively low completion rate ~~in~~to the end of Phase 2 (35%) explains the large difference between BOCF and LOCF results. Relatively few patients attended ~~at~~up to the end of Phase 2 and the BOCF assumes weights did not change from baseline among the majority who did not provide a final weight. However, by using the last available weight, the LOCF indicates that 11% of patients who did not have a weight recorded ~~at~~by the end of Phase 2 were known to have lost at least 5kg when last seen. By the end of Phase 3, 28% of patients who started GCWMS had lost 5kg or more when they were last weighed. In total 11% of patients who started GCWMS complete Phase 3 (208/1838) and amongst them 58% had lost 5kg or more. Table 2~~Table 2~~ also presents weight losses of ≥5%. For over three-quarters of patients, a 5% weight loss meant loss >5kg in weight; this resulted in fewer patients achieving the proportionate loss than the absolute loss.

Of the 1358 patients who did not lose at least 5kg in Phase 1, 461 (33.9% using LOCF) entered Phase 2~~ and 31 patients (6.7%, 31/461) lost further weight such that their total loss was 5kg or more since starting the programme.~~. Their mean weight change in Phase 2 was -0.65 (95% confidence interval -0.9 to -0.4) kg. Of the complement of 480 patients who lost at least 5kg in

Phase 1, 339 (70.6%) progressed into Phase 2. Their mean weight change in Phase 2 was -0.~~75Kg, that is, they experienced an overall further weight loss.~~ 75 (-1.1 to -0.4) kg.

Table 2 Cumulative weight loss at end of each phase from 1st clinic visit in phase 1. BOCF – Baseline Observation Carried Forward; LOCF – Last Observation Carried Forward. *Phase 3 completers must have completed Phase 1, and Phase 2 if they entered it.

		N	%	Mean change & 95% CI (kg)	Lost ≥ 5kg		Lost ≥ 5%	
Phase 1								
Completers		1322	71.9	-4.02 (-4.3 to -3.8)	471	36%	377	29%
All cases	**BOCF**	1838		-2.89 (-3.1 to -2.7)	471	26%	377	21%
	LOCF	1838		-3.06 (-3.3 to -2.9)	480	26%	381	21%
Phase 1 + 2								
Completers		639	34.8	-6.38 (-6.9 to -5.8)	349	55%	313	49%
All cases	**BOCF**	1838		-2.22 (-2.5 to -2.0)	349	19%	313	17%
	LOCF	1838		-3.6 (-3.9 to -3.4)	550	30%	468	25%
Phases 1+(2)+3*								
Completers		208	11.3	-8.48 (-9.7 to -7.2)	121	58%	117	56%
All cases	**BOCF**	1838		-0.96 (-1.1 to -0.8)	121	7%	117	6%
	LOCF	1838		-3.56 (-3.8 to -3.3)	509	28%	434	24%

Completers attended ≥4 sessions in Phase 1, ≥2 sessions in Phase 2, and ≥6 sessions in Phase 3.

Duration of Phases: Phase 1, 16 weeks; Phase 2, 3 months (may be repeated); Phase 3, 12 months.

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As Phase 2 represents the second and last of the weight-loss phases of GCWMS programme, we report determinants of weight loss by age, sex, socio-economic circumstances, initial weight and initial BMI by the end of this phase in Table 3~~Table 3~~ using the LOCF method. Males were generally more successful at losing the 5kg target weight (mean losses in males and females 4.16 and 3.4 kg, respectively). Both men and women in all age groups ~~up~~from 30 to 70 yrs had similar success rates of about 30%. However, patients aged 29 or under had different outcomes. Younger men had greater success and young women less success (52% males versus 22% females under 30 years achieved 5kg weight loss) although numbers of younger men were small (N=25). Deprivation did not appear to affect the proportion losing their target weight. There was no clear trend between initial weight or BMI and successful weight loss, although patients who were heaviest had the greatest proportion losing 5 kg or more (~~43~~41% of men and ~~38~~48% of women).

Table 3 Subgroup analyses of weight loss at end of phase 2, using LOCF method

	MALE					FEMALE				
	N	Mean weight change & 95% CI (kg)	% lost 5kg	% lost 5%		N	Mean weight change & 95% CI (kg)	% Lost 5kg	%
All	498	-4.16 (-4.7 to -3.6)	33	24		1340	-3.4 (-3.7 to -3.1)	29	
≤29 yrs	25	-5.17 (-7.8 to -2.6)	52	24		167	-2.16 (-2.9 to -1.4)	22	
30-39	58	-3.19 (-4.4 to -2.0)	31	16		210	-3.81 (-4.6 to -3.0)	32	
40-49	122	-4.75 (-6.1 to -3.4)	32	26		359	-3.45 (-4.0 to -2.9)	30	
50-59	152	-4.16 (-5.3 to -3.0)	34	26		324	-3.84 (-4.4 to -3.3)	31	
60-69	119	-3.69 (-4.6 to -2.8)	30	24		201	-3.09 (-3.6 to -2.5)	25	
≥70	22	-4.93 (-7.9 to -2.0)	27	23		79	-3.66 (-4.5 to -2.8)	30	
1. (most deprived)	204	-4.02 (-4.9 to -3.1)	32	22		592	-3.23 (-3.6 to -2.8)	28	
2	79	-3.55 (-4.7 to -2.4)	32	22		263	-3.61 (-4.2 to -3.0)	32	
3	65	-3.83 (-5.3 to -2.4)	32	25		180	-3.54 (-4.2 to -2.9)	33	
4	63	-5.24 (-7.1 to -3.3)	37	29		161	-2.97 (-3.8 to -2.1)	22	
5. (least deprived)	83	-4.61 (-6.1 to -3.1)	34	28		142	-4.01 (-4.9 to -3.2)	30	
Init Weight 75-99 (kg)	24	-4.84 (-6.4 to -3.2)	38	46		383	-2.69 (-3.1 to -2.3)	21	
100-124	188	-3.21 (-3.9 to -2.6)	27	21		625	-3.34 (-3.7 to -3.0)	28	
125-149	192	-4.39 (-5.4 to -3.4)	34	24		272	-4.17 (-4.9 to -3.4)	36	
>=150	94	-5.44 (-7.2 to -3.7)	41	26		60	-5.04 (-7.2 to -2.9)	48	
Init BMI 30-34 (kg/m^2)	40	-3.55 (-4.8 to -2.3)	30	32		91	-2.75 (-3.6 to -1.9)	21	
35-39	136	-3.0 (-3.8 to -2.2)	24	18		410	-3.13 (-3.5 to -2.7)	26	
40-49	242	-4.32 (-5.1 to -3.5)	35	25		630	-3.49 (-3.9 to -3.1)	29	
>=50	80	-5.97 (-8.1 to -3.9)	43	29		209	-3.93 (-4.8 to -3.1)	38	

In order to allow comparison of the results of GCWMS with other services that describe weight loss at fixed time-points, we calculated weight changes at 3, 6 and 12 months (Table 4~~).~~) – although these are not recognised as end-points by GCWMS. These roughly correspond to the ends of Phases 1~~, 2~~ and 2 while Phase 3 ~~but are not particular end-points for the GCWMS programme.~~corresponds to a time point of between 18 and 24 months. GCWMS does not aim to achieve 5 kg weight losses as early as 3 months, so the 6 and 12 month results are most meaningful. At both six and twelve months after starting at GCWMS, ~~up to~~ 28% of patients (LOCF) had lost 5kg or more of their initial weight. Of patients with a weight measured at around 6 months, 50% had lost 5kg or more and of those who had actual weights recorded around 12 months, 54% lost 5kg or more. However, because only 21.7% had their weights recorded at 12 months, it can only be said for certain ~~(using BOCF)~~ that 12% of all patients who began the programme had definitely lost 5 kg or more at this time point.

Table 4. Cumulative weight changes at specified time from 1st clinic visit for 1838 patients, Oct 08 to Sept 09. BOCF – Baseline Observation Carried Forward; LOCF – Last Observation Carried Forward.

		N	%	Mean change & 95% CI (kg)	Lost ≥ 5kg		Lost ≥5%	
3 Months	Complete Cases	1167	63.5	-3.7 (-3.9 to -3.5)	369	32%	289	25%
	BOCF	1838		-2.4 (-2.5 to -2.2)	369	20%	289	16%
	LOCF	1838		-2.7 (-2.9 to -2.5)	399	22%	308	17%
6 Months	Complete Cases	701	38.1	-5.8 (-6.3 to -5.4)	347	50%	310	44%
	BOCF	1838		-2.2 (-2.4 to -2.0)	347	19%	310	17%
	LOCF	1838		-3.4 (-3.6 to -3.2)	515	28%	433	24%
12 Months	Complete Cases	399	21.7	-7.2 (-8.1 to -6.3)	214	54%	203	51%
	BOCF	1838		-1.6 (-1.8 to -1.3)	214	12%	203	11%
	LOCF	1838		-3.6 (-3.9 to -3.3)	612	28%	447	24%

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DISCUSSION

NHS Glasgow and Clyde Weight Management Service achieved a 5kg weight loss in 28% of participants at 12 months when a last observation carried forward analysis is used. This equates to 24% of participants losing 5% of their body weight ~~due to a high~~ , because the mean ~~BMI~~weight was greater than 100kg at baseline. When complete cases are considered, 54% of ~~43 in the~~ participants ~~at baseline.~~achieved at least 5kg weight loss at 12 months. Overall men achieved greater weight loss than women ~~despite there being far fewer men participating~~. Those with very high initial weight (>150kg) also did well with 48% of women and 41% of men losing 5 kg or more ~~-~~(38% and 26% respectively losing 5%).

Due to methodological differences, comparisons with other published data are difficult. Data from commercial weight management programmes show WeightWatchers to be a successful intervention with between 31%[7] [11] ~~and 46%~~ and 51%[7] of participants losing 5kg or 5% of their body weight[10] [8] ~~of participants losing 5% of their body weight.~~ However these data were from randomised research studies with ~~a~~ mean ~~BMI of between 31.5 to 33.5~~BMIs under 38 kg/m^2 ~~resulting in a very different population of participants.~~ compared to the GCWMS mean of 43 kg/m^2. There were also differences in data collection ~~from those with missing data~~, with the Lighten Up study using patient self-report for final weight, a method known to result in under-reporting of weight[8] [12]. ~~-~~ It is not known why some patients drop out of weight management programmes however within GCWMS, patients are given a target weight loss of 5kg and then offered the option of longer term support of up to 2 years. Participants can choose to leave earlier than this with possible reasons ranging from lack of success and weight regain to weight loss success and the feeling they can "go it alone" and no longer need the ~~problem~~service; this makes the issue of missing data very difficult and explains why we and other studies get large

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difference in results when using baseline or last observation carried forward. Our definition of course completion was lower than some others' have used and given that attendance is directly related to weight loss, it is likely that if we used a higher threshold for completion weight losses would have been greater in this group. It is difficult to compare the final opt-in proportion, 62%, with that of other studies in which very different recruitment methods are used, such as widespread postal invitations, rather than the individual GP referrals from GCWMS. Retention of patients in GCWMS appears to be lower than that in some other studies but the aim of the service is not to retain all patients to the end of Phase 3 but rather to be flexible in allowing them to leave if they have succeeded in losing their target weight.

Currently, the Glasgow and Clyde Weight Management Service is based around a target of achieving a 5kg weight loss. However, given the higher BMI of participants in this specialist service, 5 kg is only 4.2% of the mean body weight, as opposed to the 5kg and 5% being interchangeable outcomes in a population whose mean weight is closer to 100kg. Given the higher initial BMI and range of co-morbidities in the GCWMS population, it could be argued that higher weight loss targets should be set. Bariatric surgery has shown health benefits for larger weight ~~gains~~losses than those achieved by conventional weight management programmes[13] [17] and there are new non-surgical interventions such as ~~potential~~ drug treatments[14;15] [18 19] which promote weight losses greater than 5kg as well as the recent rival of the popularity of low energy liquid diets which have the potential for larger weight loss and also to modify obesity related comorbidities[16;17] [20 21].

~~Interestingly our results have shown limited effectiveness for the second intensive treatment phase of the programme (Phase 2) in achieving weight loss for those who do not achieve 5kg weight loss with the lifestyle intervention in Phase 1, with only 7% who entered Phase 2~~

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~~achieving the 5kg target. This raises the question of whether these expensive intensive interventions should be reserved for patients who have already shown themselves able to make changes and lose 5kg, in an attempt to get far larger, clinically meaningful weight losses. Such an approach is already used within areas of the NHS as criteria for bariatric surgery and further research should be considered in this area.~~

The major strength of our results are that they come from a very large NHS service specifically targeting severe and complex obesity; an area of concern due to the health care costs of such patients[18][22]. We have provided a comprehensive description of the outcomes using both baseline and last observation carried forward as well as linking outcomes to the programme structure and time based observations. While there are many NHS weight management programmes across the UK, the majority are poorly evaluated or not at all, making their effectiveness difficult to ascertain. This results in a lack of evidence for the commissioning and de-commissioning of these services and does not help in building arguments for investment in such services at a time of financial constraint. There is an urgent need to define consistent analytical methods, including how missing data should be treated, and acceptable ranges when describing time points.

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The major weakness in our current work is the lack of ancillary information such as baseline characteristics and changes in clinical risk factors (e.g. blood pressure, lipids, glycaemic control) or change in medications. This is due to the data being from a real-life NHS service rather than a study population, but clearly data collection could be improved for future evaluations. ~~It would also have been advantageous to have had better data from other services to compare with our own outcomes and we hope others will publish BMI-specific outcomes in due course that will be more comparable to our treatment population.~~ Where BMI-specific weight changes have been

reported elsewhere in the UK, there is some evidence that patients with greater baseline weights were more likely to lose weight[7] although Ahern reported a weight gain in patients with Class III obesity (BMI ≥40 kg/m^2). Our definition of course completion was lower than some others' have used and given that attendance is directly related to weight loss, it is likely that if we used a higher threshold for completion weight losses would have been greater in this group.

In conclusion, this is the first publication of 12 month results of a large NHS weight management programme specifically targeted at patients with severe obesity. We have shown modest results in achieving some success with a 5kg or greater weight loss in 28% of our patients at one year but it is hard to compare these results to others programmes. There is an urgent need for standardised data collection from weight management programmes. Consideration needs to be given as to the treatment target in severely obese patients and how best to achieve this within NHS services.

ARTICLE SUMMARY

Article focus

- There is limited evidence on the effectiveness of weight management services provided within routine health services; an inconsistent range of outcome measures has been reported
- We evaluated a large weight management programme provided by the National Health Service in the UK with at least 12 months' follow-up and we reported outcomes in a variety of ways to allow comparison with other studies.

Key messages

- We studied 1,838 patients with mean BMIs of 43 kg/m^2 (obesity class III)
- 28% of patients lost at least 5kg
- There were large differences in outcomes depending on which of the commonly-used definitions was used.

Strengths and limitations of this study

- Strengths include the large study population from a non-research environment, long follow-up, objective measures of weight and comprehensive reporting methods.
- Limitations include lack of clinical risk factor data.

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