

A mixed method evaluation of adult tier 2 lifestyle weight management service provision across a county in Northern England

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Abstract

Adult obesity in the UK remains a public health priority. Current guidance recommends local areas provide multicomponent interventions to treat adults with overweight and obesity however, there is currently a dearth of published evidence on the evaluation of these programmes. This study reports on a mixed method evaluation of seven tier 2 weight management programmes¹ funded by a local authority in the North of England through their public health grant. Data collected from over 2000 participants demonstrated that the proportion of participants achieving 5% initial body weight loss was comparable to that reported in recent UK weight management trials. Two services exceeded national criteria of 30% of participants achieving 5% initial body weight loss at 12 weeks, although long term data was limited. Greater weight loss was also observed in participants aged 35-44 and those without co-morbidities. This study provides important learning points for improvements in real world weight management services, these include: standardised data collection and management tools; staff training and communication requirements; the importance of programmes that are joined up to wider support services; and the importance of providing ongoing peer and provider support, continuous monitoring and feedback, and physical activities tailored to user needs.

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¹ A lifestyle multicomponent weight management programme for the treatment of adults with overweight and obesity (but not severe obesity, or obesity with severe co-morbidities).

What is already known:

- Only half of adult weight management interventions in the UK are evaluated, and most of these locally commissioned evaluations are not published which limits the sharing of real world evidence.
- Adult weight management is challenging, particularly with regard to access for socially disadvantaged groups.
- There is a dearth of information as to whether efficacy and effectiveness of interventions observed in research trials is replicated in practice (real world evidence), particularly for long term management.

What this study adds:

- This study demonstrates that real world weight management services can achieve results that are comparable to research trial evidence, although success varies depending on the delivery model used, and evidence for long term impact is limited due a lack of long term service provision and data collection.
- This study confirms that inequalities exist in terms of uptake of local services for lower socio-economic status groups, but also for men, younger adults, and black and minority ethnic communities.
- This study provides useful learning points for improvements in real world weight management services; 1) a requirement for standardised data collection and management tools, staff training, and communication strategies, 2) programmes should be tailored to local needs and joined up to the wider support services, 3) programmes should provide ongoing peer support, continuous monitoring and feedback, and physical activities tailored to user needs.

Background

Obesity is a global public health concern¹, with serious associated co-morbidities^{2,3}, which can result in premature death⁴, disability⁵ and reduced quality of life⁶. Obesity also contributes to health inequalities with higher prevalence linked to low socio-economic status and certain ethnic groups⁷. Currently in England over 41% of adults are overweight and a quarter have obesity⁸, costing the National Health Service over £6 billion per year. If left unchecked, obesity is predicted to affect 60% of men and 50% of women by 2050, resulting in escalating costs to health care and wider economy⁹. Reversing the upward trend in obesity is a stated government commitment¹⁰.

Current National Institute for Health and Clinical Excellence (NICE) guidance¹¹ recommends managing obesity through multicomponent lifestyle interventions which provide dietary, physical activity and behaviour change support. These are delivered as part of a tiered pathway consisting of: tier 1: universal services; tier 2: multicomponent lifestyle interventions; tier 3: specialist weight management services; and tier 4: bariatric surgery¹¹. The majority of tier 2 adult services in England are commissioned by local authorities, who deliver mostly 12-week group sessions.¹² Whilst there is evidence to suggest that a tier 2 approach is effective in the short term, there remains a lack of evidence on longer term clinical and cost effectiveness¹³. Thus providing some explanation as to why no nation has successfully tackled obesity¹⁴, and emphasises the importance of local programme evaluation.

In 2012-2014, 67.1% of adults in North Yorkshire had overweight or obesity¹⁵. To address excess weight across the county, North Yorkshire County Council (NYCC) funded (through their public health grant), each of their seven districts (A-G) to pilot the delivery of an accessible tier 2 lifestyle weight management programme. The aim of these programmes was to support adults residents (aged 18 or over) with a BMI of 25 or over (without comorbidities or managed comorbidities) to lose weight and sustain their weight loss

through a 12 week multicomponent programme, provided as an integral part of the local weight management care pathway. The service did not include adults with a BMI of 35 and more with significant unmanaged comorbidities or those who had received bariatric surgery within the 2 years of referral.

The aim of this study was to conduct a robust mixed method, process and outcome evaluation of this programme following the standard evaluation framework for weight management interventions¹⁶.

Methods

A mixed methods approach was undertaken using a retrospective pre-post design, to assess data collected between August 2014 to February 2016. Ethical approval was obtained from Teesside University School of Health and Social Care Research Ethics and Governance committee, and information governance approval was obtained from NYCC.

Data collection and analysis

Participant outcome data

The following participant outcome data was collected from each service by NYCC: participant demographics; source of referral; weight at baseline, weight post-intervention and follow-up (6-, 12- and 18-months); diet; physical activity; wellbeing; attendance; referrals to other services (tier 3, smoking, alcohol, mental health); and participant satisfaction. However due to unavailability and inconsistencies in data recording, analysis of diet, physical activity, wellbeing, BMI, waist circumference and weight loss outcomes at 12- and 18-month follow-up was not possible. Weight change data was available in all but the two shortest running services (E and F), however missing data remained a concern in all but one district (G). Reasons for missing data included missed data entry and participant attrition.

Data was collected from August 2014-January 2016, with additional follow-up (12-month) data submitted in February 2016 (as not all services commenced their service in 2014, data available for analysis varied between districts). Data was analysed in Excel 2013 and SPSS v.22, with Chi-Square tests used to examine associations between categorical variables with significance reached when $P < 0.05$.

Survey data

Data from three surveys was used to inform this evaluation. A set of questions to assess public awareness and perception of current weight management provision were developed by NYCC. These were delivered to 2000 North Yorkshire residents as part of the regular NYCC Citizens' panel in December 2015. A separate set of questions were developed by NYCC to assess health and social care practitioners' awareness and perceptions of the current weight management provision. These were delivered via an electronic survey circulated via email to health and social care networks across the county by NYCC in November-December 2015. Finally, an e-survey to gain a comprehensive overview of the service provided by each district was developed by the researchers in consultation with NYCC. This was delivered using Bristol Online Survey and emailed by the researchers to the service delivery team for each district. The survey ran from October 2015-January 2016 and collected information on data collection practices, programme delivery, referrals and service integration, programme content, cost and participants. Descriptive statistics were used to assess numerical and categorical data. All free text responses were synthesised and assessed for emerging themes.

Focus groups

Four weight management services were purposively selected to represent different district geographies and delivery structures (service B: longest running group; service C: largest urban catchment; service D: most rural catchment and only service to use private venues; service G: only service to contract out to a private weight loss provider). Focus groups were

conducted from October-December 2015, all participants were recruited from the weight management service groups and provided informed consent and were offered a £10 gift voucher.

A semi-structured format was used; focus group data were transcribed verbatim and entered into N-Vivo 10 analysis software. Data was analysed using a structured approach¹⁷.

Results

Service descriptions

A comprehensive overview of the services delivered across the seven districts (A-G) was collated through the service provider e-survey. Analysis of this data showed that all services were multicomponent, incorporating nutrition education, physical activity and behaviour change components, although delivered using a range of different models (Table 1). Most districts delivered the service on a 12-week rolling basis. Sessions were 1-2 hours in length, delivered face-to-face in a group format; four districts provided additional support by telephone and two by social media. All services accepted GP referrals, and some also included referrals from other healthcare professionals, through NHS health checks and/or self-referrals; only two districts promoted the service through advertising. The inclusion criteria also included participants with long term conditions in two services (B and D). Staff across all services were trained to level 3 in weight management and physical activity; however only two services employed staff qualified in nutrition but four were supported externally by dietetic services. Three services provided staff with formal training in following the prescribed protocol, and four were required to deviate from protocol (i.e. makes changes to how the service was originally set up), reasons for these changes included the need to accommodate changes to the service specification.

The behaviour change content of each service was assessed through questions based on the 26 category taxonomy of behaviour¹⁸ (Table S1) (the newer 40-item CALORE

taxonomy¹⁹ was not used to reduce participant burden). Common techniques reported included setting graded tasks, providing instruction, and modelling of portion size. All services provided contingent rewards in the form of free or discounted physical activity opportunities. However discrepancies between respondent classifications and formal definitions meant it was not always possible to determine whether a technique had been used.

When service providers were asked about unexpected outcomes responses included: low referral rates, high referral rates, inappropriate referrals and referral of participants with complex needs. Cost per participant were reported by four services and ranged from around £97-£122, however only one service provided further detail and stipulated that cost was for completers only. Service providers were also asked about the level of 'in kind' costs they provided, because in theory this resource could have contributed to the level of success of the service. Only one service provided this information numerically, and three of the services provided narrative descriptions which included: provision of free use of gym/swimming facilities, room hire, training and provision of additional sessions/support.

Service user characteristics

Data was collected from just over 2050 participants from across the seven districts, although the vast majority of this data derived from services B, C, D and G, due to later start dates in the remaining services. GPs were the predominant referral source for services A, B, D and E, however self-referral was the predominant referral source for services C and G, with only a small number of referrals from other professionals. Participant characteristics are shown in Table 2, and demonstrate that, where reported, generally participants were more likely to be older, female and affluent. Also where reported, the majority of participants were of white ethnicity (data not shown), due to small numbers in all Black and Minority Ethnic groups it was not possible to present ethnicity data by district. It was also not possible to analyse

marital status by district due to the high volume (67.2%) of missing data. However where reported the majority of service users were married (data not shown). Co-morbidities were comprehensively reported in three districts: with diabetes, muscular skeletal pain, mental health problems, and heart disease most frequently reported (supplementary Table 2). When participant demographics were compared between those enrolled and those referred but not enrolled, there was only one significant finding; younger participants (18-34 years) were significantly more likely to be referred but not enrol in district C.

Completion rates

Participants were categorised as completers if they attended a minimum of two sessions over the duration of the intervention, one of which in the final 3 weeks of the programme². Where reported, the percentage of completers ranged from 8.4-73.4%. Only services B and C achieved the NICE recommended 60% completion rate, although service G was very close at 55%. Combined data across all services indicated no significant differences between completers and non-completers for sex or socio-economic status, although younger participants (18-34 years) were significantly less likely to meet completion criteria than their older counterparts.

Weight loss at 12 weeks

Weight loss data was available for only 4 services (B, C, D and G) as the remaining services had only just started, so had yet to collect outcome data, with analyses conducted for all participants (i.e. non-completers and completers with valid data), and just those meeting the formal completion criteria.

In all four services, over 30% of participants achieved at least 3% weight loss, with higher rates for service G, and large confidence intervals reflecting the small numbers in service D,

² As stipulated in the Department of Health guide on developing a specification for lifestyle weight management services, which was the most current guidance at the time of the service commissioning https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/142723/Weight_Management_Service_Spec_FINAL_with_IRB.pdf

when analysed for all participants (Figure 1A) and completers (Figure 1B). The proportion of participants who achieved at least 5% weight loss for completers are shown in Figure 2B and for all participants in Figure 2A. Data from both analyses show that only two services (D and G) achieved the NICE target of achieving 30% of participants losing at least 5% initial body weight (although again the wide confidence intervals for service D reflect the small numbers available for this service, which should be interpreted with caution).

When data from across the districts were combined, no significant associations were found between weight loss and gender or socio-economic status. However 5% weight loss was significantly higher for those in the middle age group (35-54 years), and lowest in those 55+ years ($P=0.001$). Overall the proportion of participants who achieved a 3% or 5% weight loss was significantly lower in those participants with a co-morbidity compared to those without (see supplementary Table S3). The same trends were observed when analysed for completers and all participants (data not shown).

Follow-up weight loss/maintenance

Data provided at 6-month follow-up warrants cautious interpretation due to a mixture of measured and self-reported weight data that could only be obtained from less than 40% of all participants, and less than 50% of all completers when combined across the services. Insufficient ($n=29$) participants provided 12-month follow-up data and none provided data at 18-months, therefore the longer term impact of the weight management services could not be assessed. Data for all participants indicated that at 6-months, 3% and 5% weight loss remained significantly higher in service G compared to services B and C. The proportion of clients reaching both 3% and 5% weight loss at 6 months (measured as a proportion of all clients measured at 6 months) is higher than observed at 12 weeks for the majority of services, however is likely to be subject to recall and reporting bias. No significant associations were observed between weight loss at 6-month follow-up and age, gender or socio-economic status. In terms of weight loss maintenance, of those patients with 6 month

data available for analysis, significantly more participants lost weight than gained weight between the programme end (12-weeks) and 6-month follow-up in three services (B, C and G) when analysed for completers and all participants (Figure S1A and S1B). However due to the low response rate, the data is very likely to be subject to recall and reporting bias.

Citizens survey

Six hundred and seventy three participants completed the citizen panel survey, percentages presented are based on 'valid' response and exclude 'missing' data. Only 12% of respondents to the NYCC Citizens' panel survey indicated that they were aware of the weight management service, with the majority having heard via advertisements. Four percent indicated that they had used the services themselves, whilst 10% reported use by family or friends. Just over half (53%) felt that the current weight management service meets the needs of people with overweight in their district, and the vast majority stated they would either refer themselves (39%) or ask their GP (46%). The most popular mechanism of informing people about the service was either through GP surgery, social media or flyers.

Health and social care practitioners survey

Only 14 responses to the health and social care practitioner survey were received, consisting: 36% pharmacists, 36% dieticians, 14% GPs, 7% clinical psychologists and 7% physiotherapists. Half of the respondents were aware of the tier 2 weight management service, and 86% felt it met their expectations. However, 62% of respondents were not clear about referral routes, with the majority identifying GP and self-referral routes as the most appropriate options. When asked about key barriers to referring patients to the service, lack of awareness/information about the service was the most prominent theme. The majority (64%) of respondents did not know whether there was a tier 3 service in their district.

Focus groups

Focus group participants consisted of 44 (66% female, 16-83 years) participants from one of the four purposively selected services (B, C, D and G). Although each programme lasted 12-weeks, many participants had the opportunity to continue involvement with the programme after this time and therefore participants had attended the programmes for between 12 weeks and 18 months, with the longest involvement being in service G. Thirty-six (81%) participants had made previous attempts at weight loss.

General participant views

Data indicated that overall participants felt positively with regards to the service they received, had engaged well with the programme and enjoyed the opportunity to meet others. Encouragement and support were viewed as key to success, and were apparent across all services for the nutrition element. However, participants attempting to access fitness facilities as part of programme often felt uncomfortable or intimidated in the gym environment (Quote 1, Table 3), and some felt that the staff were not adequately trained to meet their needs (Quote 2, Table 3). Therefore, preference was shown to the services that provided group exercise classes (C and G), rather than vouchers that facilitated participants to individually access fitness facilities at discounted rates (B and D). These group sessions also encouraged participants to engage in peer support (Quotes 3 and 4, Table 3). Where follow-up/maintenance sessions were provided, they were typically viewed positively and helped participants tackle weight regain, however some participants expressed concern that the purpose of these sessions was unclear (Quote 5, Table 3).

Issues with the current service and ideas for improvement

Participants from services C and G raised no concerns with regards to current service provision, although some participants did suggest expanding the current services and

increasing awareness amongst GPs and the local population. In services B and D however, several concerns were raised. Participants felt there should be more connectedness between the nutrition and fitness elements, with the fitness element viewed more as an add-on than an integral part of the programme (Quote 6, Table 3). They felt that the nutrition and fitness staff should have a closer working relationship, with progress in the gym being monitored and reviewed in line with weight loss (Quote 7, Table 3). Participants felt the provision of group exercise/gym sessions and entry level sessions for inexperienced or nervous participants would have been useful (Quote 8, Table 3). The need for a greater level of support from fitness staff was identified and participants felt that these staff should be adequately trained to meet the specific needs of the participant group (Quote 9, Table 3). Additional recommendations included: ensuring that all facilities accepted vouchers consistently (D); ensuring there were no unexpected breaks in the programme, which could lead to loss of motivation (D); and commencing intakes every six weeks to avoid the repetition experienced with a rolling programme, and reducing the length of the programme to compensate for the additional group (B).

Service outcomes

Although weight loss was reported by participants from all services, some were quite small or had not been maintained since completion of the programme (Quote 10, Table 3). Several participants in service G had however, achieved and maintained substantial weight losses (Quote 11, Table 3) and many of these participants reported continuing involvement with the commercial weight loss provider past the 12-week programme (Quote 12, Table 3), or had taken up annual membership to the leisure service (Quote 13, Table 3). The group dynamic and peer support were important to their success (Quote 14, Table 3). Participants from all services reported general improvements to their health and positive changes in dietary and physical activity behaviours as a result of the programme (Quotes 15-18, Table 3).

Discussion

This study aimed to provide a robust process and outcome evaluation to help inform future service development and commissioning. Amongst all participants at the end of the programme (12 weeks) 5% weight loss ranged from 10-50%, which is similar to the findings from a large multi-arm randomised controlled trial of tier 2 weight management provision, in which 5% weight loss was achieved by 16-46% of participants²⁰. Although NICE targets of achieving 5% weight loss in at least 30% of participants were realised in two services (D and G), the data for one of these services (D) was very limited so this finding should be treated with caution. Furthermore, service G received the highest proportion of self-referrals, indicating that participants in this service may have been more ready to change than those in other services.

Although younger participants were more likely to be non-completers than older participants, when data across all services were combined there was a significantly higher weight loss observed amongst the 35-54 age group, with the lowest rate in the participants aged 55+. The presence of comorbidities also appeared to impact weight loss; this is perhaps not surprising given these participants may benefit from more specialised tier 3 services²¹. It is possible an association exists between these two findings, whereby older participants are more likely to present with comorbidities, making weight loss more difficult. In service G, men were found to be significantly more likely to achieve 5% weight loss than women, however overall no significant differences in gender were observed; this supports findings from another large UK weight management evaluation²² and complements a recent systematic review which suggested there was no evidence to support men and women adopting different weight loss strategies²³. However, as fewer men join weight management groups, targeting services remains essential²⁴. No significant differences were observed with regards to weight loss and socioeconomic status, however participants tended towards being more affluent than the local deprivation profile. There is consequently a need to

engage with participants from more deprived areas, as previous UK research has shown deprivation to influence outcome²⁵. In addition, poor data quality made it impossible to conduct analyses according to ethnicity. As a strong association has been observed between both deprivation or certain black and ethnic minorities and obesity, examining the impact of weight management on health inequalities is essential in future research²⁶. This is particularly important given the findings from this evaluation mirror a pragmatic UK trial in primary care which also found that men, younger people, and those from less affluent populations were least likely to engage in weight management services²⁷.

Data on lifestyle related behaviour changes, wellbeing and other adiposity measures such as waist circumference would have been beneficial in helping to further interpret the data: providing a more comprehensive understanding of disease risk reduction, and how effective different components of the service may have been. However, this was not possible due to the use of different data collection methodologies and data quality issues, and thus emphasises the need to standardised data collection practices and assessment tools.

In all districts the programme could be categorised as multicomponent, however there was substantial variation in the number and type of behaviour change techniques employed by each service. Interestingly, the service that reported using the most techniques, also saw the most favourable weight loss outcomes (G). However, it was clear from the responses that staff had difficulty in accurately assessing which behaviour change techniques were used, so future evaluations would benefit from exploring this in more depth, and providing further behaviour change guidance and training. A task that could be assisted by a recently published guide to effective behaviour change techniques for adult weight management²⁸.

All services provided staff qualified in physical activity and weight management, however only half received support from dietetic services and just two had staff specifically qualified in nutrition. Furthermore, issues were raised regarding the competency of staff to manage participants with comorbidities, particularly when exercising. Therefore, delivery teams

should ensure staff are adequately trained in managing participants' needs in terms of nutrition and comorbidities. There was also a lack of awareness amongst health professionals regarding the availability of tier 3 services, which were provided in only one district. As data indicated that participants in some services had BMIs greater than 40, and that weight loss outcomes were lowest in those with co-morbidities, it is important that: 1) tier 3 services are provided to meet the complex needs of these participants; 2) these services are integrated with the tier 2 services; and 3) steps are taken to increase awareness of these services amongst health professionals.

Unfortunately due to the poor quality of data it was not possible to determine which factors contributed to participant drop out. However, barriers and facilitators to participation were explored in both the participant focus groups and service provider e-survey. It was clear that key elements contributing to success, centred around the ongoing provision of support and encouragement, from both service providers and peers. A finding that was mirrored in a recent review examining successful characteristics of a tier 2 service.²⁹ Barriers included the lack of these elements, as well as a lack of knowledge or awareness of the services.

Similarly, there was a lack of follow-up data, with no data available at 18-months and only 29 participants returning for 12-month follow-up. Data collection at 6-month follow-up included a mix of measured and self-reported data, which is also problematic given there are known biases in self-reported weight³⁰. Furthermore, as the proportion of participants achieving 5% weight loss at 6-months was higher than at 12-weeks, recall bias may be present, whereby only participants who continued to be successful were prepared to return for follow-up measurement. Weight regain post intervention was experienced across all services where data was provided, and also discussed in the focus groups. However, this was significantly less in the two services offering some form of directed post-intervention support, providing evidence to support the inclusion of a weight maintenance component in all programmes; this aligns with findings from a recent systematic review which demonstrated that lifestyle

interventions targeting diet and physical activity can be effective in reducing weight regain after initial weight loss for up to 1 year³¹. This continued engagement may also help to enhance the number of participants willing to return for follow-up measurements.

Focus group participants indicated a number of additional ways in which the services could be enhanced, including: combined diet and activity sessions; activities tailored to individual participant needs; use of monitoring, feedback and peer support; and providing a range of physical activity options, with fitness staff trained to support participants with comorbidities or complex needs. The findings from this evaluation also suggested a reliance on GP referrals and the need to increase awareness of the services amongst other health care professionals; the focus group participants also suggested increased publicising amongst the local population, a point that was supported by the findings from the citizens panel survey.

Four districts provided data regarding costs per participant, ranging from £97-£122. These figures align with a recent randomised controlled trial of different tier 2 weight management programmes, where costs per participant ranged from £71.37-£112.73²⁰, as well as the costs reported in a recent service mapping exercise¹². However, due to a lack of detail it is very difficult to determine the main factors contributing to differences in cost per participant between programmes. A range of in-kind services were described but as no monetary value was provided for these, it prevented any further assessment of the findings. As a comprehensive economic assessment was not possible in this evaluation, it would be beneficial for future research to conduct comprehensive reviews and consultations on the costs of current service provision, to establish whether they are cost effective and cost saving.

Limitations

This research was constrained by the pre-post study design, which limits the inferences that can be made about effectiveness. Coupled with the data quality issues and inconsistencies

in data collection, it was difficult to draw any firm conclusions about each individual programme. This is particularly apparent with regards to important long term follow-up data, with less than 40% of data available from all participants available at 6 months giving rise to the potential for significant recall and reporting bias, and insufficient data at 12 and 18 months to facilitate any analysis. The small number of responses to the health and social care practitioner survey also limits the inferences that can be made from this data. The evaluation is also limited in terms of the geographical scope, covering just one county in England.

Strengths

Despite the issues with participant outcome data, this research provides important insight into the provision of local authority commissioned tier 2 services. The findings highlight important learning, which has been used to help inform the development of national commissioning and delivery guidance³².

Recommendations

Based on the findings of this evaluation a number of recommendations can be made, these include:

- *Data collection:* commissioners should specify data collection methodologies and protocols, to ensure consistent collection and recording of high quality data; these systems should be comprehensive and easy to use, with clear instructions as to the requirements of each data field. Data collection systems should be based on the standard evaluation framework¹⁶ and in England, comply with the new minimum data set³².
- *Service delivery:* weight management services should be tailored to local population needs, with easily accessible centres. To reduce reliance on GPs, wider health and social care professionals should be engaged in service referrals, and where possible self-referral options should be considered. Services should provide a range of physical

activity options to support individual needs, in particular, participants who are new to exercise or have co-morbidities; they should not rely on self-directed exercise. Effective services should also: encourage peer and provider support, include a directed maintenance programme and integrate monitoring and feedback as part of both the diet and physical activity components.

- *Staff training:* weight management service providers may benefit from further training in the identification, understanding and use of different behaviour change techniques. All services should provide staff with appropriate nutrition qualifications or develop formal collaborations with local dietetic services. Service delivery staff should be appropriately trained in correctly managing nutrition and physical activity in participants with co-morbidities. Strong consideration should be given to providing training to data collection officers to standardise inputting and reduce data entry errors.
- *Service promotion and user engagement:* health care practitioners should be provided with more information about available service provision, including the qualifications and experience of delivery staff and expectations of the service in terms of primary weight loss outcomes. There should also be clear referral criteria so health care practitioners can direct patients to the most appropriate service. The services should also be publicised more widely to the public to gain greater population reach, including through social media, GP surgeries and flyers through the post and supermarkets; consideration should be given as to how best to target and engage male participants, those from deprived areas, younger (18-34) age groups and black and minority ethnic groups.
- *Wider service support and integration:* there is a need for a tier 3 service to support any tier 2 provision. This is required to support participants with morbid and more complex forms of obesity, who would benefit from this more specialised support. However, this service should be fully integrated with the tier 2 provision, providing a seamless transition between services. Each service must provide a clear, integrated pathway of care, so

both delivery staff and participants are aware of additional support services, and to facilitate referral to and from wider lifestyle support services.

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Conflicts of Interest

Louisa Ells is seconded by Public Health England two days per week but undertook this work as part of her role as Reader at Teesside University. None of the authors have a conflict of interest to declare.

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Authors contributions:

LE developed the study design, drafted the initial manuscript and approved the final manuscript as submitted.

VW developed the study design, conducted the statistical analyses, drafted the initial manuscript and approved the final manuscript as submitted.

PW conducted the focus groups, drafted the initial manuscript and approved the final manuscript as submitted.

SC contributed to the interpretation and presentation of results, reviewed and approved the final manuscript as submitted.

DJ contributed to the interpretation and presentation of results, reviewed and approved the final manuscript as submitted.

DM contributed to the interpretation and presentation of results, reviewed and approved the final manuscript as submitted.

COM contributed to the interpretation and presentation of results, reviewed and approved the final manuscript as submitted.

HC contributed to the interpretation and presentation of results, reviewed and approved the final manuscript as submitted.

PW contributed to the interpretation and presentation of results, reviewed and approved the final manuscript as submitted.

KN contributed to the interpretation and presentation of results, reviewed and approved the final manuscript as submitted.

CS contributed to the interpretation and presentation of results, reviewed and approved the final manuscript as submitted.

VC contributed to the interpretation and presentation of results, reviewed and approved the final manuscript as submitted.

VAS contributed to the interpretation and presentation of results, reviewed and approved the final manuscript as submitted.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Table and Figure Legends

Table 1: Service delivery characteristics

Table 2: Participant characteristics

(small numbers <5 and associated percentages are removed to present disclosure)

Table 3: Collation of quotes

Figure 1A: Percentage of all participants achieving at least 3% weight loss over 12 weeks, by gender (including 95% confidence intervals)

n	Female	Male
service B	89	38
service C	100	21
service D	15 x	
service G	381	67
All	585 x	

Figure 1B: Percentage of completers achieving at least 3% weight loss over 12 weeks, by gender (including 95% confidence intervals)

n	Female	Male
service B	86	37
service C	99	21
service D	12 x	
service G	279	52
All	476 x	

Figure 2A: Percentage of all participants achieving at least 5% weight loss over 12 weeks, by gender (including 95% confidence intervals)

**P=0.007*

n	Female	Male
service B	36	11
service C	38	8
service D	9 x	
service G	242	54
All	325 x	

Figure 2B: Percentage of completers achieving at least 5% weight loss over 12 weeks, by gender (including 95% confidence intervals)

**P=0.004*

n	Female	Male
service B	35	11
service C	38	8
service D	6 x	
service G	209	48
All	288 x	

Table 1: Service delivery characteristics

Programme details	Service A	Service B	Service C	Service D	Service E	Service F	Service G
Content	Multi-component	Multi-component	Multi-component	Multi-component	Multi-component	Multi-component	Multi-component
Referral route	GP	GP, Health Visitor (HV), health check	GP, self-referral, pharmacist, HV, Social worker, health check, all HPs	GP, health check, self-referral, social work, health check, other HPs	GP, health check	GP, health check	GP, self-referral, peer recommendation, leisure centre staff, other programmes
Clients accepted on	A rolling basis	A rolling basis	A rolling basis	A rolling basis & 12 week cohorts	A rolling basis	A rolling basis	A rolling basis
Duration (weeks)		12	12	12	12	12	12
Duration of sessions	1.25hrs (45mins exercise & 30mins nutrition)	1hour	45 mins exercise 30 mins education talk 10 mins weight taken weekly for those who want it	1-2 hrs	1.5hrs – 45mins exercise & 45 mins nutrition	1.5hrs – 45mins exercise & 45 mins nutrition	Physical activity sessions – 1 hr commercial weight loss provider Groups – 1hr 45mins
Format of client interaction	Face to face group sessions	Face to face individual sessions, face to face group sessions, telephone support	Face to face individual sessions, face to face group sessions, telephone support, online support	Face to face individual sessions, face to face group sessions, telephone support, online support	Face to face individual sessions, face to face group sessions	Face to face individual sessions, face to face group sessions	Face to face individual sessions, face to face group sessions, telephone support, online support, other (unspecified)
Social media use			Facebook – facilitate group support				Facebook – facilitate group support

Table 2: Service user characteristics

Age group	Service A		Service B		Service C		Service D		Service E		Service G	
	n	%	n	%	n	%	n	%	n	%	n	%
18-34	x	x	70	12.9%	51	11.5%	37	14.2%	x	x	196	25.1%
35-54	x	x	185	34.1%	142	32.1%	108	41.4%	x	x	370	47.4%
55+	14	66.7%	287	53.0%	250	56.4%	116	44.4%	x	x	215	27.5%
Female	15	71.4%	370	68.1%	360	81.3%	199	75.7%	x	x	672	86.0%
Male	6	28.6%	173	31.9%	83	18.7%	64	24.3%	x	x	109	14.0%
IMD quintiles: 1 deprived	x	x	0	0.0%	x	x	11	4.3%	0	0.0%	31	4.2%
2	x	x	87	16.3%	x	x	0	0.0%	0	0.0%	128	17.4%
3	0	0.0%	43	8.0%	86	20.9%	46	18.0%	x	x	117	15.9%
4	6	31.6%	211	39.4%	160	38.8%	106	41.6%	0	0.0%	223	30.3%
5 affluent	9	47.4%	194	36.3%	144	35.0%	92	36.1%	0	0.0%	238	32.3%

(small numbers <5 and associated percentages are removed to present disclosure) NB 1 participant was missing age data in service B and 2 participants were missing age data in service D.

Table 3: Collation of individual quotes that illustrate the key themes that emerged from the focus group work.

Quote No.	Quote	Service
General participant views:		
1	<i>"I used a couple of the centres but at the [centre location] particularly, there was an awful lot of very fit people there and I was very intimidated."</i>	B
2	<i>"I've been coming to this gym for many years. I have a lot of issues with my joints. They are very painful and my movements are limited and rather than giving me a programme that I could do, they told me to do more standard stuff that I couldn't manage. . . I had to really push them for a programme that I could manage."</i>	D
3	<i>"Classes were exclusive to [names weight loss programme] and I think to begin with that helps people, you know, who are maybe unsure about it. You can basically tell them, look, you're not going to have these super fit bodies jumping around so it helps people get involved and it helps with the whole support thing because people are in the same boat."</i>	G
4	<i>"We just get more and more raucous and we boost each other up if we are feeling particularly down or feeling we just can't do it this week. We know that someone will come knocking on your door to see what's the matter and then next week we have to try a bit harder."</i>	C
5	<i>"I did the 12 weeks and then we had another meeting and I went to that but . . . a bit of a waste of time."</i>	D
Issues with current service provision/ideas for improvement		
6	<i>"Its two separate entities. You have this class here [nutrition] as a satellite but it doesn't seem to have encompassed their leisure centre itself to the same extent. Therefore there is that disjointed aspect to the programme that has come to light because what [nutrition delivery staff member] wants to do and what we are trying to do, hasn't got the support of the centre staff."</i>	B
7	<i>"I did get a personal programme. . . you don't get people watching over you all the time, you are on your own but I would say they are there if you need anything but you might have to ask at reception. The thing with this scheme is that they are not working closely with the gym instructors about what we need or are doing. I think there should be more people working in the gym. I think the gym should join in on the scheme and help out. At the moment we have [delivery staff member] talking about food and the weight side of things. She's not actually working with the gym staff or going into the gym herself. There has got to be some people added into the project to watch the health of the group and the exercise and fitness."</i>	B
8	<i>"If you were joining classes there was nothing at the level I needed to join and I always felt, very much, sort of tagging along and not at that level. I wanted to work up to it gradually, rather than being thrown in at the deep end and frankly I was really struggling."</i>	D
9	<i>"I thought that the staff in the gym felt it was possibly a bit of an imposition and it wasn't something they had been inducted into."</i>	D
Service outcomes		
10	<i>"I lost a lot of weight but it was a lot of effort, a lot of pain but I've probably put half of that back on now."</i>	D

- | | | |
|----|--|---|
| 11 | <i>"It's the actual friendships actually growing between us, the full group. It's something very special in [service G location]. I've been very lucky. I've lost 6½ stone in that time and it's changed my life completely. It's the first time that I've ever been on a diet where I've actually thought this is for life. I never had before."</i> | G |
| 12 | <i>"I started last May and I'd lost a lot of weight by the November and I've been going [commercial weight loss provider] ever since because I want to keep within my ideal weight. If I didn't go I'd probably start putting it on again."</i> | G |
| 13 | <i>"Most of us don't just come when they do the classes. We are using the gym, we're using other bits. Most of us I think are now gym members. We come for 12 weeks and continue using it, so there are a lot of plusses all round."</i> | G |
| 14 | <i>"I always go to my [commercial weight loss] group every single week and I know that helps me because you've got the motivation, you make friends in that group as well and you always want to see how everyone else is doing and [you have] the driver to keep going."</i> | G |
| 15 | <i>"It really opens your eyes on what things do contain sugar and how much. I tend to eat little and often now which is better than eating 3 or 4 big meals a day. It sinks into your head that you can eat whatever you want but it has to be in moderation. I just have to be careful."</i> | B |
| 16 | <i>"It made the difference between me having or not having a major operation and being able to survive it so it has meant a lot to me. I lost inches rather than weight and I am a lot stronger. I don't take inhalers as much. I was able to be anaesthetised properly for a full general and to come through it. When I first went for it they said I wouldn't survive if they put me under general anaesthetic and now I have been there, done that, survived it, going back to work tomorrow. It has made the difference between life and death as it was a cancer related operation."</i> | C |
| 17 | <i>"I am more aware, particularly of what they called the traffic light system. I do look although I do forget sometimes. If I see something I think I've got to have, when I get it home and look at what it contains you think 'flipping heck look at all them reds on it'."</i> | D |
| 18 | <i>"My doctor recommended I lose weight because I have arthritis and high blood pressure. That was about 15 weeks ago since I started. I lost 2½ stone, my joints are easier and my blood pressure is almost back to normal."</i> | G |

Figure 1A

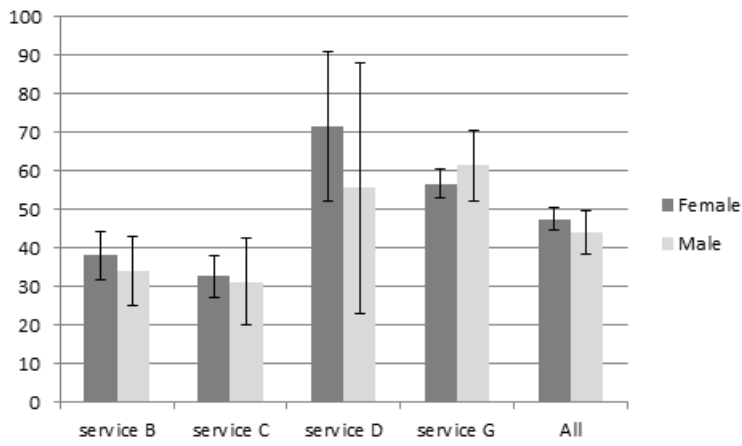


Figure 1B

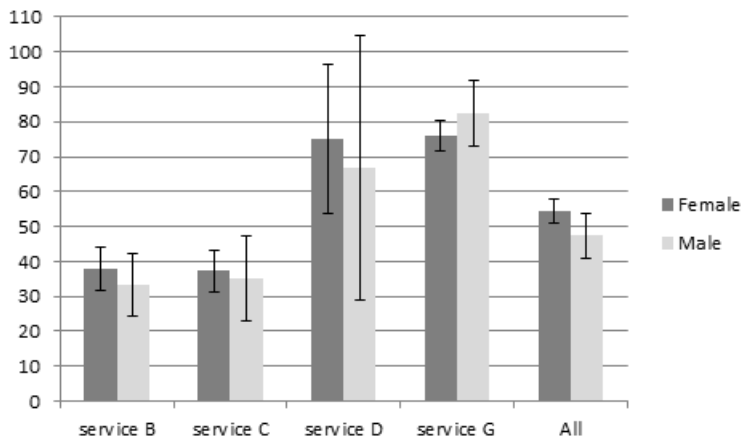


Figure 2A

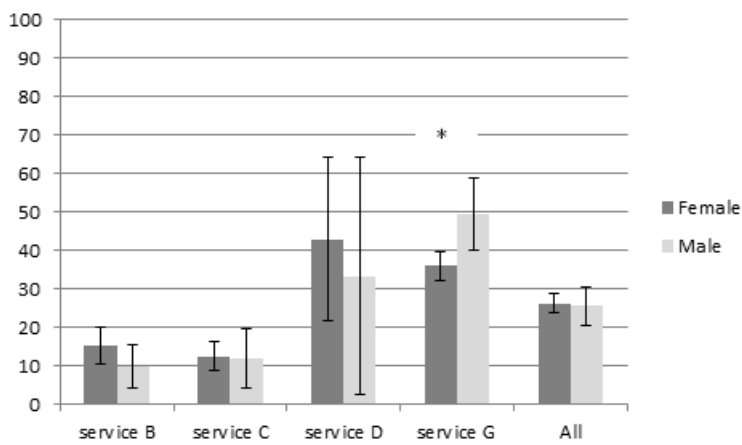


Figure 2B

