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1 **Outcomes of a community based weight management programme for morbid obese**
2 **populations**

3

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12 Conflict of Interest:

13 The authors declare no conflict of interest

14

15

16 Keywords: morbid obesity, community, service evaluation, weight management
17 programme

18 **Abstract**

19 *Background:* Morbid obesity (BMI >40kg/m²) is an ongoing concern for health care
20 providers worldwide. There is a paucity of research reporting primary care outcomes
21 focussed on complex obesity and morbidly obese populations. National Institutes of
22 Clinical Excellence (NICE) recommends a specialist, multidisciplinary weight management
23 team for the successful management of such populations. This is the first service
24 evaluation which reports primary (weight change) and secondary (BMI, waist
25 circumference, physical activity levels, fruit and vegetable intake and Rosenberg self-
26 esteem score) outcome measures in morbidly and complex obesity patients.

27 *Methods:* A prospective observational study of a cohort data set for patients (n= 288)
28 attending their 3 month and 6 month (n= 115) assessment appointments at a specialist
29 community weight management programme.

30 *Results:* Patients had a mean (SD) initial BMI of 45.5 (6.6) kg/m²; 66% were females. Over
31 82% of patients attending the service lost some weight by 3 months. Average weight loss
32 was 3.28 (3.82)% (4.11(4.95) kg) at 3 months and 4.90 (6.26)% (6.30(8.41) kg) at 6
33 months providing statistically significant weight change at both time points ($P<0.001$). This
34 meets NICE best practice guidelines for commissioning of services which lead to a
35 minimum of 3% average weight loss, with at least 30% of patients losing at $\geq 5\%$ of their
36 initial weight. Waist measurement and BMI reduced significantly at 3 months.
37 Improvements were seen in physical activity levels, fruit and vegetable consumption and
38 self-esteem levels ($P < 0.001$).

39 *Conclusion:* This service was successful in aiding weight loss in the morbidly obese
40 population. This supports the view that sensible weight loss targets of 3% are realistic for
41 this under-researched population.

42

43

44

45 **Introduction**

46 Overweight and obesity are defined as abnormal or excessive fat accumulation that
47 presents a risk to health (1). Morbid obesity ($\text{BMI} \geq 40 \text{ kg/m}^2$) levels are rising in the UK
48 adult population; from 0.2% of men and 1.4% of women in 1993 to 1.6% of men and 3.9%
49 of women in 2013 (2-4). The higher the BMI, the greater the chance of developing obesity-
50 associated conditions such as cardio-vascular disease, diabetes, osteoarthritis and some
51 cancers (1,5,6), resulting in high total healthcare costs (7,8). Additionally, the
52 psychological aspects of obesity have been well documented, with an established
53 relationship between weight loss, better emotional wellbeing and health-related quality of
54 life (9). For the purpose of this paper, 'complex obesity' is defined as a $\text{BMI} \geq 35 \text{ kg/m}^2$ with
55 at least one obesity-related comorbidity.

56 There are very few published data which evaluate the current NHS service provision within
57 the UK outside of the research context (10-12). NHS services are often set up quickly to
58 provide evidence-based information and support for patient groups. The outcomes of
59 these services may range significantly as statistical analysis and service evaluation
60 outcomes are not often embedded into the service at pre-planning stages, and therefore it
61 is difficult to collect useful statistical data. The lack of published evidence for NHS
62 services, in comparison to commercial slimming organisations, means that it is difficult to
63 provide substantial evidence for the commissioning and decommissioning of services and
64 is unhelpful when bidding for investment for such services. This is particularly relevant in
65 the current climate where widespread financial constraint sees NHS organisations
66 competing against commercial slimming organisations for provision of public health
67 services.

68 In 2004, the UK government white paper *Choosing health: making healthy choices easier*
69 (13) emphasised the role of primary care in obesity management and recognised primary
70 care as a suitable setting in which to promote weight loss. Despite clinical guidelines for
71 obesity management (4,14-17) and related disease (18), there is little research from
72 primary care about treating morbid or complex obesity populations and indeed, a recent
73 systematic review found no interventions which reported data from solely morbidly obese
74 individuals (19) and research from primary care based on individuals with morbid obesity is
75 limited to a single study. The NHS Glasgow and Clyde Weight Management Service
76 (GCWMS) service evaluation by Logue *et al.* was based on a large cohort of 1 838 obese
77 patients (BMI ≥ 30 kg/m² with obesity-related comorbidities or BMI ≥ 35 kg/m²) which had a
78 mean starting BMI of 43.3 kg/m² and reported weight change data up to 12 months (20).
79 However, it is well recognised that lack of weight loss does not capture the protective
80 benefits of increased fruit and vegetable intake, physical activity or self-esteem (21) all of
81 which are important to the health of this population group. Aside from aiding weight loss
82 maintenance, increased physical activity has been shown to benefit blood lipid profile (22),
83 insulin sensitivity (23) and all-cause and cardiovascular disease mortality (24).

84

85 The UK National Institute for Clinical Excellence (NICE) guidelines recommend that
86 primary care physicians and healthcare professionals identify their obese patients and
87 offer clinical management (4,16). Previously, clinically significant weight loss has been
88 defined as a loss of 5-10% of initial weight (4,25), whilst the Scottish Intercollegiate
89 Guidelines Network (SIGN; 2010) recommend a 15-20% reduction for those with a BMI
90 ≥ 35 kg/m² (14). Evidence suggests that 5–10% of weight loss is associated with
91 meaningful clinical improvements in health-related risk factors, such as serum lipids,
92 glucose tolerance and blood pressure (26,27); although current NICE Public Health
93 guidelines describe a successful weight loss intervention as one which achieves an

94 average of 3% weight loss in all patients attending one or more sessions, and at least 30%
95 of patients having lost $\geq 5\%$ weight loss (16).

96

97 There are many barriers to staff raising the issue of weight in primary care, including lack
98 of evidence of efficacy, time, and training (28,29). Widely available options include
99 commercial weight management groups, National Health Service (NHS) or public sector
100 care programmes which vary in quality and duration. Unfortunately, very little evidence
101 exists for the success of these types of programme for specific population subgroups
102 including morbid and complex obesity patients. The present study aimed to investigate the
103 physical, psychological and dietary impact of a 12 week Specialist Community Weight
104 Management Programme (SCWMP) on morbid and complex obesity patients with
105 assessments at 3 and 6 months.

106

107 **Methods**

108 This service evaluation uses routinely captured data from patients over 18 years old, in a
109 prospective cohort study. The SCWMP was established in August 2010 in-line with NICE
110 recommendations (4). Patients were referred to the service by GPs or health care
111 professionals for a 12-week NHS intervention. Patients were contacted if they were eligible
112 to attend the service and met the inclusion criteria. Patients who did not meet the inclusion
113 criteria were referred to an appropriate alternative service. The most common reasons for
114 exclusion were BMI less than 35kg/m^2 (or 32.5kg/m^2 for South Asians), patient presented
115 with other comorbidities that needed to be prioritised prior to weight loss, not motivated to
116 lose weight, or currently engaged in successful weight loss attempts elsewhere.

117 Inclusion criteria for patients eligible for the service were: Male or female, aged 15 or over;
118 registered with an eligible GP; motivated to make changes to their diet and lifestyle; not

119 pregnant; BMI ≥ 35 kg/m² with a comorbidity such as type 2 diabetes, hypertension, sleep
120 apnoea, osteoporosis, depression or BMI ≥ 40 kg/m² without a comorbidity (≥ 32.5 kg/m²
121 and ≥ 37.5 kg/m² for patients of South Asian origin) (44) and that they had tried and failed
122 Tier 1 services previously such as commercial weight management, gym memberships,
123 walking groups and practice nurse weight management advice.

124 Each eligible patient had a one hour initial assessment appointment with a senior member
125 of the multidisciplinary team (i.e. dietitian, physiotherapist, psychologist) where data on the
126 patients' medical, physical, psychological and social history was collected and a treatment
127 plan was agreed. Treatment plans were tailored to the individuals' needs and consisted of
128 up to 12 contacts via telephone, e-mail, in groups, or face-to-face appointments, over a 12
129 week intervention period. The contact appointments were delivered by dietitians,
130 physiotherapists, psychologists, cognitive-behavioural therapists, nutritionists, and/or
131 physical activity guides. Staff were trained to embed motivational interviewing and
132 behaviour change techniques into their consultations. Evening and weekend appointments
133 were provided for enhanced accessibility of the service. Patients had an interim
134 assessment at the end of the 3 month treatment period, followed by a further follow-up at 6
135 months. This analysis includes those who attended their interim assessment
136 appointments..

137

138 **Demographics and anthropometrics**

139 A detailed multi-component assessment of the patient was achieved using anthropometric
140 measures and questionnaires which were distributed to all patients at three time points:
141 their initial (baseline), interim (3 months) and final assessments (6 months). The primary
142 outcome was weight change from baseline at 3 and 6 months. Secondary outcomes

143 included physical activity levels, fruit and vegetable consumption, self-esteem score and
144 BMI.

145 Anthropometric data was collected in a pre-determined standardised sequence by a
146 trained staff member. Patients were weighed in kilograms on calibrated scales (Tanita BC-
147 420MA or Seca 665 high capacity). Height (in metres) was measured at the initial
148 assessment using a Seca Leicester stadiometer. If the patient was unable to stand, ulna
149 length was measured, and height was calculated using BAPEN charts (30). Body Mass
150 Index (BMI) was calculated using weight (in kg) divided by height (in metres) squared.
151 Waist circumference was measured in centimetres with a standard length, plastic coated
152 tape measure in line with NHANES III protocol guidelines (31). For patients who were
153 wheelchair bound or unable to stand, waist circumference was not measured. The
154 Rosenberg self-esteem scale was used as a measure of psychological wellbeing which is
155 validated and widely used in the obese population (32,33). It ranges from 0 to 30 with a
156 higher score indicating greater self-esteem. Fruit and vegetable intake was assessed as
157 an indicator of dietary quality change using self-reported fruit and vegetable consumption;
158 options for answers were: 0, 1, 2, 3, 4 or 5+ per day. Seven-day physical activity recall
159 was used to assess number of minutes of physical activity perceived to be at moderate-
160 high intensity per week (adapted from the Stanford 7-day recall, (3)). Deprivation quintile
161 proportions for the cohort was provided by the NHS data analysis team as postcode is
162 considered identifiable data (34).

163

164 **Statistical analysis**

165 Data from the patient records was analysed using SPSS (v. 18). Frequency data describes
166 the baseline data. Means, modes, medians, standard deviations, standard error and
167 significance of the data was analysed using appropriate methods for parametric or non-

168 parametric data as appropriate.

169 Change in parametric data were analysed using paired T-tests. Non-parametric data (fruit
170 and vegetable portions and Rosenberg score) was analysed using Wilcoxon Signed Ranks
171 test. Data was deemed to be significant if $P < 0.05$. A regression analysis of change in BMI,
172 (both kg and percent) was completed using STATA 14. Explanatory variables were age,
173 gender, ethnicity, physical activity, fruit/vegetable intake, self-esteem, number of session
174 attended, and type of therapist used.

175

176 Ethical approval was not sought as the focus on service evaluation in the UK, is subject to
177 different guidance in accordance with National Research Ethics Service (2009), thus
178 exempting the work from the need for ethical approval (35).

179 Results

180 The majority of patients who attended an initial assessment were aged 35 to 65 years.
181 Thirty-four per cent of the patients accessing and completing the service to interim were
182 male (Table 1)

183 **Table 01: Demographic data of patients at baseline and at final assessment**

	baseline (n= 288)	final (n= 115)
Gender	<i>n (%)</i>	<i>n (%)</i>
Male	98 (34)	44 (38)
Female	190 (66)	71 (62)
Age Range (years)		
19-24	9 (3.1)	1 (0.9)
25-34	31 (10.8)	14 (12.2)
35-44	67 (23.3)	29 (25.2)
45-54	73 (25.3)	27 (23.5)
55-64	71 (24.7)	32 (27.8)
65+	37 (12.8)	12 (10.4)
Ethnicity		

White British & Irish	259 (89.9)	100 (87.0)
Asian	18 (6.3)	11 (9.6)
Black African/Caribbean	11 (3.8)	4 (3.5)
Deprivation Quintiles		
Most deprived	77 (27)	
2	75 (26)	
3	55 (19)	
4	40 (14)	
Least deprived	35 (12)	
Unknown	6 (2)	
	<i>Mean (SD)</i>	<i>Mean (SD)</i>
BMI (kg/m²)	45.5 (6.6)	43.5 (7.5)
Weight (kg)	126.9 (21.5)	120.3 (2.0)
Waist circumference (cm)	130.7 (14.6)	125.1 (1.4)
Minutes of physical activity	113.2 (233.2)	213.6 (248.1)
Fruit & Vegetables (portions/day)	2.6 (1.5)	4 (1.2)
Rosenberg self-esteem score	16.8 (6.1)	20.3 (6.2)
Number of different therapists seen		
0	1 (0.3)	0
1	38 (13.2)	12 (10.4)
2	144 (50.0)	61 (53.0)
3 or more	105 (36.4)	42 (36.5)

184

185

186 Patients who attended seven or more of their booked appointments were considered to
187 have engaged well with the service. The mean (SD) average number of sessions attended
188 was 9.3 (1.75) with 95 out of 288 (33%) people completing 10 out of a maximum of 12
189 sessions during the intervention period. There was significant loss to follow up (60%)
190 between the 3 and 6 month appointments.

191 Deprivation data . demonstrated that the service was accessed equitably by patients
192 from all deprivation quintiles, including the two most deprived quintiles who comprised
193 53% of attendees.

194

195 **Primary outcome**

196 **Weight change**

197 There were statistically significant declines ($P < 0.001$) in weight at 3 month and 6 month
198 assessments.; the mean average (SD) weight loss at 3 months was 4.11 (4.95) kg, 1.24
199 (4.11) kg between 3 and 6 months, and 6.3 (8.41) kg total weight loss at 6 months (Tables
200 2 and 3). This equates to an average weight loss of 3.28 (3.82)% at 3 months, and
201 average total weight loss of 4.90 (6.26)% for patients attending their 6 month assessment.
202 Overall, 82% of patients who attended their interim appointment lost some weight at 12
203 weeks, with 79.5% having lost some weight at their 6 month final assessment.

204

205 **Table 02: % of patients in the study cohort stratified by weight change at interim and**
206 **final assessments**

207

Weight change	Interim (%) n= 288	Final (%) n= 115
≥10% loss	5.2	17.1
≥5-9.99% loss	19.1	28.3
≥3-4.99% loss	24.3	16.2
0-2.99% loss	36.1	17.9
Gained	14.6	19.7

208

209 **Table 03: Mean (SD) weight, BMI and waist circumference changes in patients**
210 **between initial, interim and final assessments**

211

	Change at 3 months	<i>P</i> value	Change between 3- 6 months	<i>P</i> value	Overall change at 6 months	<i>P</i> value
<i>Weight (kg)</i>	-4.11 (4.95) n= 287	<0.001	-1.24 (4.11) n= 115	0.002	-6.30 (8.41) n= 115	<0.001
<i>BMI (kg/m²)</i>	-1.46 (1.73) n=287	<0.001	-0.42 (1.41) n= 115	0.002	-2.18 (2.84) n= 115	<0.001
<i>Waist circumference (cm)</i>	-4.08 (5.12) n=282	<0.001	-0.82 (4.34) n=115	0.45	-5.64 (7.61) n= 115	<0.001

212

213 .

214 **Secondary outcomes**

215 need a sentence here about the secondary outcomes

216 **Table 04: Mean (SD) physical activity, fruit and vegetable intake and Rosenberg self-**
217 **esteem score in patients between initial, interim and final assessments**

	Baseline	mean change 0-3 months	Interim (3 months)	mean change 3-6 months	Final (6 months)	overall mean change 0-6 months
<i>Physical activity (mins/week)</i>	113.2 (233.2) n= 287	123.2 (363.5) <i>P</i> <0.001	237.9 (362.4) n= 283	-37.9 (254.0) <i>P</i> = 0.146	214.1 (246.8) n= 96	107.4 (209.7) <i>P</i> <0.001
<i>Fruit and vegetable</i>	2.6 (1.5)	1.0 (1.3)	3.6 (1.3)	0.3 (0.7)	4.0 (1.2)	1.3 (1.4)

<i>intake</i> (portions/day)	n= 287	<i>P</i> <0.001	n= 283	<i>P</i> <0.001	n= 97	<i>P</i> <0.001
<i>Rosenberg</i> <i>self-esteem</i> <i>score</i>	16.8 (6.13)	3.1 (5.4)	19.9 (6.26)	0.6 (3.5)	20.3 (6.23)	3.6 (5.6)
	n= 286	<i>P</i> <0.001	n= 283	<i>P</i> = 0.066	n= 97	<i>P</i> <0.001

218

219 In the regression model, none of the variables were identified as being predictive of weight
220 loss at 3 or 6 months except change in physical activity level which was positively
221 associated with weight loss at 6 months (95% CI 0.170-0.001; *P*= 0.028).

222

223

224

225 **Discussion**

226 This paper presents data from a relatively large sample size ($n = 288$) of complex and
227 morbidly obese individuals who have attended a well-designed, multi-professional
228 specialist weight management programme. The analysis shows that for patients who
229 attend the service, SCWMP is a successful way to aid weight management and improve
230 their overall wellbeing. We conclude from the data presented, that for those patients who
231 attended their planned sessions, the prevention of weight gain is likely to be achieved by
232 over 80% of patients, regardless of their age, ethnicity or gender.

233 The current study shows that at 3 months, 24.3% of patients actively participating in the
234 programme had lost 5% or more of their weight, and by 6 months, 45.4% of patients had
235 lost more than 5% of their initial weight. Previous research has reported a variety of weight
236 losses at 12 weeks (29,36-38), from 54.7% of patients (who completed at least 10
237 sessions of a Slimming World programme) who lost over 5% of their initial weight (38), and
238 the Lighten Up study which demonstrated 16-46% of patients lost more than 5% weight
239 (36). The mean BMI for patients in the present study was 45.5 (6.6) kg/m^2 which is
240 considerably higher than previously published data sets which ranged from 31.4 (2.6)
241 kg/m^2 (39) to 39.7 (6.9) kg/m^2 (37). Whilst these findings from this study are lower than
242 previously published data, the mean baseline BMI was higher in this study. This highlights
243 caution when comparing studies as percentage weight loss can mean significantly different
244 absolute (kg) weight losses depending on the initial average BMI of the study populations.
245 There is a stark similarity between the weight loss results from this intervention and the
246 NHS GCWMS service evaluated by Logue et al. (2014) on a large cohort of complex and
247 severe obesity patients which had a mean starting BMI of 43.3 kg/m^2 and reported weight
248 change data up to 12 months (20). At 3 months, 25% of all completers had lost $\geq 5\%$ of
249 their starting weight (compared to 24.3% in the present study) and at 6 months 44% of all
250 completers had lost $\geq 5\%$ (compared to 45.4% in the present study). Based upon this

251 limited available evidence on complex and morbidly obese populations, it may only be
252 possible to achieve a 5% weight loss in fewer than 50% of patients by 6 months. Further
253 follow-up studies on complex obesity patients are needed.

254

255 Overall, 82% of patients who attended their interim appointment lost some weight at 12
256 weeks, with 79.5% having lost some weight at their 6 month final assessment. Prevention
257 of weight gain was achieved by 85.4% of patients at interim, 80.3% at final. This is notably
258 less than in the research presented by Stubbs *et al.* who found that prevention of weight
259 gain was achieved in 92.1% (38), and 96.3% (12) of patients at 6 months. The reason for
260 these differences is beyond the remit of the current evaluation, and could be addressed
261 with further research.

262

263 By interim assessment, 21.5% of patients reported that they do zero minutes of moderate-
264 high physical activity per week, which improved slightly to 19.6% of patients by their final
265 assessment. In 2010, 20% of respondents in the Health Survey for England reported that
266 they took walks of at least 20 minutes “less than once a year or never” (40), which is in line
267 with the findings from this study. Patients were able to engage with increased physical
268 activity with support, but once they had finished the intensive input stage of the
269 programme, they did not increase activity further.

270

271 The increase in Rosenberg scores at interim and final assessment were statistically
272 significantly improved from baseline ($P < 0.001$) which is indicative of higher self-esteem.
273 However, evidence is lacking as to whether an increased Rosenberg score impacts upon
274 ability to lose weight although the relationship between low self-esteem and obesity is well
275 established in children (41).

277 Fruit and vegetable intake increased throughout the intervention and follow-up period (see
278 Table 04) indicating that patients may continue to make dietary changes even after the
279 intensive intervention has finished. The most recent Health Survey for England (2012)
280 found that adults aged 19 to 64 years on average consumed 4.2 portions of fruit and
281 vegetables per day, with older adults consuming a mean average of 4.4 portions (40).
282 Therefore the data presented shows that this study population group at baseline were
283 consuming less than the mean average portions of fruit and vegetables per day. During
284 the SCWMP, they appear to be engaging with dietary changes and increasing their fruit
285 and vegetable consumption in line with the rest of the general population. This supports
286 the conclusions of Carlson *et al.* (2012) who reported that increase in fruit and vegetable
287 intake may be one of the easiest health-promoting behaviour changes to make (42). While
288 portions of fruit and vegetables increased on average, self-reported data is subject to
289 reporting bias. In this study the maximum number of portions of fruit and vegetables per
290 day which could be recorded as consumed was 5. It would be reasonable to estimate that
291 some patients will eat more than 5 portions per day and therefore the mean averages are
292 based on a worst case scenario. This is beneficial as Wang *et al.* (2014) demonstrated a
293 significant correlation between increased fruit and vegetable intake and reduced all-cause
294 mortality, particularly cardiovascular mortality (43), with Tapsell *et al.* (2014) reporting that
295 increased vegetable consumption as part of a calorie-controlled diet results in greater
296 weight loss, which appears to be sustainable (44).

297

298 The improvement in results across all measures demonstrates the benefits of the
299 specialist multidisciplinary team supporting a variety of patients' needs to be attended to
300 within a single service. The SCWMP was designed in line with NICE and Grace
301 recommendations (4,16,17) and the inclusion of a multidisciplinary team may have

302 contributed to the holistic improvement of this patient group. Unlike many of the papers
303 which were examined in the literature review, there were no statistically significant
304 differences in weight change or secondary outcome measures by age, ethnicity, gender,
305 attendance, therapist seen or continuity of same therapist. This may be due to the
306 thorough assessment of patients at their initial assessments and the flexibility of the
307 programme which ensures that patients are seen by the most appropriate clinician or
308 clinicians at the most appropriate time or that the changes in weight reported are seen
309 predominantly in those with simple obesity or a BMI less than 35kg/m². However, it is
310 interesting to note that the patients who attended the service for the initial assessment
311 were more likely to be over 35 years old.

312

313 Data presented in this study is intended to help generate debate over realistic target
314 weight losses for morbidly obese patients, and emphasises the importance of longer term
315 multi-disciplinary specialist weight management programmes to aid patients to achieve
316 physical, social and psychological benefits; not with a pure focus on weight loss targets.
317 Many obese individuals report long-lasting effects of obesity-related stigma due to a focus
318 on weight, which leaves them less likely to engage in health promoting activities and
319 health care services (45,46); and experience stigma-related mental health issues such as
320 depression, anxiety, low self-esteem, and psychological stress (47). This leads to debate
321 as to whether body weight is a realistic or ethical target within public health interventions
322 (48) and whether more holistic “health promotion” services are indeed more beneficial than
323 weight management, with the movement of the ‘Health at Every Size’ agenda
324 (<http://www.haescommunity.org/>).

325

326 **Strengths and Limitations**

327 This study provides a “real-life” insight as to how weight management interventions are
328 attended in practice in NHS settings, and highlights achievable outcomes in the morbidly
329 and complex obese populations. Data is lacking in this area, and it is well-recognised that
330 attrition rates are high (49), and engagement with male patients, and those of low
331 socioeconomic status has previously been reported to be poor (50,51). However, in this
332 study, 38% of subjects who completed the 6 month intervention were males, and
333 engagement with patients from low socioeconomic groups was high, which supports the
334 findings of Moroshko, Brennan and O’Brien (2011) who concluded that whilst many factors
335 have been suggested to correlate with attrition, no individual factor had been consistently
336 identified (49). It is hypothesised that providing a holistic, multi-disciplinary assessment at
337 baseline encouraged otherwise poor engagers to attend the service as it was tailored to
338 the individuals’ needs.

339 Unfortunately, these results are representative of only one city in the UK and further
340 research is therefore required to compare similar services throughout the UK, and
341 internationally which have a specific provision for morbidly and complex obese individuals.
342 Larger data sets with longer-term follow up would also be beneficial, with the data sets
343 following patients from baseline through to completion. However, attrition rates are
344 notoriously high, and participant engagement post-intervention period is low (52). In future
345 studies the improvement of data collection would be valuable, for example an improved
346 fruit and vegetable scale, and the addition of blood biochemistry e.g. blood lipid profiling
347 and anthropometry measures at each assessment period.

348

349 **Implications for future practice and recommendations for service improvement**

350 Due to the nature and complexity of morbidly obese patients, a holistic service evaluation

351 is necessary, and it is unhelpful to use weight change as a sole primary outcome for
352 service evaluation. Data from this service evaluation was considered during the
353 development of the new NICE Public Health guidelines (2014), which suggests a 3%
354 weight loss target is beneficial for this patient group, and is a more realistic target for
355 commissioners to be using in tenders (16). The impact of increased physical activity, self-
356 esteem (alongside other measures of mental health status) and dietary quality should be
357 recognised, and these attributes should be addressed within the service by specialist
358 multi-disciplinary teams (14,16,17).

359

360 Data from this population group is lacking, and provision should be made by
361 commissioners for data collection and thorough service evaluation, with statistical support.
362 Data collected by each service should be standardised to aid ease of comparison, and can
363 be collected using the NOO Standard Evaluation Framework (2009) (53). It is crucial that
364 this data is available in the public domain to improve the understanding of factors which
365 are pertinent to effective services and to aid service development, design and
366 commissioning in the future.

367

368 **Conclusion**

369 By six months, over 60% of patients who actively engaged with the SCWMP lost 3% body
370 weight or more. Therefore, the service appears valuable in aiding weight loss in the
371 morbidly obese population for those patients. Results appear comparable to those
372 provided in previously published studies although it is recognised that data based on
373 comparable populations is lacking.

374

375 In the longer term, additional studies need to be commissioned to fill gaps in knowledge

376 surrounding the impact of current acute or community weight management services in the
377 UK in morbidly obese populations, and provide more qualitative or mixed methods analysis
378 to add depth to our understanding of the current issues, and design suitable programmes
379 with which these populations will successfully engage.

380

381 **Conflict of Interest**

382 The authors declare no conflict of interest

383

384

385 **References:**

- 386 (1) World Health Organization. Obesity. 2015; Available at:
387 <http://www.who.int/topics/obesity/en/>. Accessed 09 July, 2015.
- 388 (2) Moody A. HSE 2013: Vol 1 Chapter 10 Adult Anthropometric Measures, Overweight
389 and Obesity. 2014.
- 390 (3) Sallis J, Haskell W, Wood P, Fortmann S, Rogers T, Blair S, et al. Physical activity
391 assessment methodology in the five-city project. Am J Epidemiol 1985;121:91-106.
- 392 (4) NICE. CG43: Obesity. 2006.
- 393 (5) Chopra M, Galbraith S, Darton-Hill I. A global response to a global problem: the
394 epidemic of overnutrition. Bull World Health Organ 2002;80:952-958.
- 395 (6) Swanton K, Frost M. Lightening the Load: Tackling Overweight and Obesity. A toolkit
396 for developing local strategies to tackle overweight and obesity in children and adults.
397 2007.
- 398 (7) Wang, YC., Baydoun, MA., Liang,L. Will all Americans become overweight or obese?
399 Estimating the progression and cost of the US obesity epidemic. Obesity (Silver Spring)
400 2008;16:2323-2330.
- 401 (8) Wang Y, McPherson K, Marsh T. Health and economic cost burden of the projected
402 obesity trends in the USA and the UK. Lancet 2011;378:815-825.
- 403 (9) Wright F, Boyle S, Baxter K. Understanding the relationship between weight loss,
404 emotional well-being and health related quality of life in patients attending a specialist
405 obesity weight management service. J Health Psychology 2013;18:574-586.

- 406 (10) Dixon K, Shcherba S, Kipping R. Weight loss from three commercial providers of NHS
407 primary care slimming on referral in North Somerset: service evaluation. J Public Health
408 2012;34:555-561.
- 409 (11) Ahern A, Olson A, Aston L. Weight Watchers on prescription: an observational study
410 of weight change among adults referred to Weight Watchers by the NHS. BMC Public
411 Health 2011;11:434.
- 412 (12) Stubbs R, Brogelli D, Pallister C, Whybrow S, Avery A, Lavin J. Attendance and
413 weight outcomes in 4,754 adults referred over 6 months to a primary care/commercial
414 weight management partnership scheme. Clinical Obesity 2012;2:6-14.
- 415 (13) Department of Health. Choosing health: making healthy choices easier. London: The
416 Stationery Office 2004.
- 417 (14) Scottish Intercollegiate Guidelines Network. 115 Management of Obesity: A National
418 Clinical Guideline. Edinburgh: Scottish Intercollegiate Guidelines Network 2010.
- 419 (15) Health Development Agency. The management of obesity and overweight: an
420 analysis of reviews of diet, physical activity and behavioural approaches. 2003.
- 421 (16) National Institute for Clinical Excellence. CG189: Obesity: identification, assessment
422 and management of overweight and obesity in children, young people and adults. London:
423 National Institute for Clinical Excellence 2014;CG189.
- 424 (17) Grace C. A review of one-to-one dietetic obesity management in adults. J Hum Nutr &
425 Diet 2011;24:13-22.
- 426 (18) Joint British Societies. for the British Cardiac Society; British Hypertension Society;
427 Diabetes UK; HEART UK; Primary Care Cardiovascular Society; Stroke Association. JBS

428 2: Joint British Societies guidelines on prevention of cardiovascular disease in clinical
 429 practice. *Heart* 2005(91 (S5)):v1-v52.

430 (19) Booth H, Prevost T, Wright A, Guilford M. Effectiveness of behavioural weight loss
 431 interventions delivered in a primary care setting: a systematic review and meta-analysis.
 432 *Family practice* 2014;31:643-653.

433 (20) Logue J, Allardice G, Gillies M. Outcomes of a specialist weight management
 434 programme in the UK National Health Service: prospective study of 1,838 patients. *BMJ*
 435 *Open* 2014;4(e003447):01 July 2015.

436 (21) Bacon L, Stean J, Van Loan M, Keim N. Size acceptance and intuitive eating improve
 437 health for obese, female chronic dieters. *J Am Diet Assoc* 2005;15:929-936.

438 (22) Kraus E, Houmard J, Duscha B. Effects of the amount and intensity of exercise on
 439 plasma lipoproteins. *N Eng J Med* 2002;347:1483-1492.

440 (23) Duncan G, Pern M, Theriaque D. Exercise training without weight loss increases
 441 insulin sensitivity and postheparin plasma lipase activity in previously sedentary adults.
 442 *Diabetes care* 2003;26:557-562.

443 (24) Lee C, Blair S, Jackson A. Cardiorespiratory fitness, body composition and all-cause
 444 and cardiovascular disease mortality in men. *Am J Clin Nutr* 1999;69:373-380.

445 (25) Wing RR, Hill JO. Successful weight loss maintenance. *Annu Rev Nutr* 2001;21:323-
 446 341.

447 (26) Yu-Poth S, Zhao G, Etherton T, Naglak M, Jonnalagadda S, Kris-Etherton P. Effects
 448 of the National Cholesterol Education Program's Step I and Step II dietary intervention

449 programs on cardiovascular disease risk factors: a meta-analysis. . Am J Clin Nutr
 450 1999;69:632-646.

451 (27) Mertens I, Van Gaal L. Overweight, obesity, and blood pressure: the effects of modest
 452 weight reduction. Obes Res 2000;8:270-278.

453 (28) Hiddink G, Hautvast J, Van Woerkum C, Fieren C, Van't Hof M. Nutrition guidance by
 454 primary-care physicians: perceived barriers and low involvement. British Journal of
 455 General Practice 1995;49(11):842-851.

456 (29) Counterweight Project Team. Evaluation of the Counterweight Programme for obesity
 457 management in primary care: a starting point for continuous improvement. British Journal
 458 of General Practice 2008;58:548-554.

459 (30) BAPEN. Alternative measurements: instructions and tables. Available at:
 460 http://www.bapen.org.uk/pdfs/must/must_page6.pdf. Accessed 09 July, 2015.

461 (31) National Center for Health Statistics. U.S. Department of Health and Human Services,
 462 PHS. NHANES III Anthropometric Procedures Video. U.S. Government Printing Office
 463 Stock Number 017-022-01335-5. Washington, D C : U S GPO, Public Health Service 1996.

464 (32) Bowling A. Measuring Health: A review of quality of life measurement scales. . Third
 465 ed. UK: Open University Press; 2005. p. 143-144.

466 (33) Rosenberg M. Society and the adolescent self-image. Princeton, NJ: Princeton
 467 University Press 1965.

468 (34) Department for Communities and Local Government. Index of Multiple Deprivation
 469 Rank, 2010. 2010; Available at: [http://opendatacommunities.org/data/societal-](http://opendatacommunities.org/data/societal-wellbeing/deprivation/imd-rank-2010)
 470 [wellbeing/deprivation/imd-rank-2010](http://opendatacommunities.org/data/societal-wellbeing/deprivation/imd-rank-2010). Accessed 11/27, 2015.

471 (35) National Research Ethics Service. Defining Research: NRES guidance to help you
 472 decide if your research requires review by a research ethics committee. 2009; Available at:
 473 <http://nres.npsa.nhs.uk>. Accessed 01 July, 2015.

474 (36) Jolly K, Lewis A, Beach J, Denley J, Adab P, Beeks J, et al. Comparison of a range of
 475 commercial or primary-care led weight reduction programmes with minimal intervention
 476 control for weight loss in obesity: Lighten Up randomised controlled trial. BMJ 2011;343.

477 (37) Read A, Ramwell H, Storer H, Webber J. A primary care intervention programme for
 478 obesity and coronary heart disease risk factor reduction. British Journal of General
 479 Practice 2004;54:272-278.

480 (38) Stubbs R, Pallister C, Whybrow S, Avery A, Lavin J. Weight outcome audit for 34,271
 481 adults referred to a primary care commercial weight management partnership scheme.
 482 Obesity Facts 2011;4:113-120.

483 (39) Jebb S, Ahern A, Olson A, Aston L, Holzapfel C, Stoll J, et al. Primary care referral to
 484 a commercial provider for weight loss treatment versus standard care: a randomised
 485 controlled trial. Lancet 2011;378:1485-1492.

486 (40) NHS Information Centre. Statistics on obesity, physical activity and diet: England. The
 487 Health and Social Care Information Centre 2012.

488 (41) Franklin J, Deyner G, Steinbeck KS, Caterson ID, Hill AJ. Obesity and risk of low self-
 489 esteem: A statewide survey of Australian children. Pediatrics 2006;118(6):2481 - 2487.

490 (42) Carlson J, Sallis F, Ramirez E, Patrick K, Norman G. Physical activity and dietary
 491 behaviour change in internet-based weight loss interventions: comparing two multiple-
 492 behaviour change indices. Prev Med 2012;54:50-54.

- 493 (43) Wang X, Ouyang Yingying, Liu Jun, Zhu Minmin, Zhao Gang, Bao Wei et al. Y. Fruit
494 and vegetable consumption and mortality from all causes, cardiovascular disease, and
495 cancer: systematic review and dose-response meta-analysis of prospective cohort studies
496 . BMJ 2014;349:g4490.
- 497 (44) Tapsell L, Batterham M, Thorne R, O'Shea J, Grafenauer S, Probst Y. Weight loss
498 effects from vegetable intake: a 12-month randomised controlled trial. Eur J Clin Nutr 2014.
- 499 (45) Amy N, Aslborg A, Lyons P, Keranen L. Barriers to routine gynecological cancer
500 screening of White and African- American obese women. Int J Obes 2006;30:147- 155.
- 501 (46) Drury C, Louis M. Exploring the association between body weight, stigma or obesity
502 and health care avoidance. J Am Acad Nurse Pract 2002;14:554- 561.
- 503 (47) Thomas S, Karunaratne A, Castle D, Lewis S, Knoesen N, Honigman R. 'Just Bloody
504 Fat!': a qualitative study of body image, self-esteem and coping in obese adults. Int J Ment
505 Health Promotion 2010;12(1):39-49.
- 506 (48) Bacon L, Aphramor L. Weight Science: Evaluating the Evidence for a Paradigm shift.
507 Nutrition Journal 2011;10.
- 508 (49) Moroshko I, Brennan L, O' Brien P. Predictors of dropout in weight loss interventions:
509 a systematic review of the literature. Obes Reviews 2011;12(11):912-934.
- 510 (50) Toussi R, Fujioka K, Coleman K. Pre- and Postsurgery Behavioral Compliance,
511 Patient Health, and Postbariatric Surgical Weight Loss. Obesity (19307381) 2009
512 2012;17(5):996- 1002.
- 513 (51) Bennett G, Jones S. Dropping out of treatment for obesity. J Psychosomatic Res
514 1986;30(5):567- 573.

515 (52) Holzapfel C, Cresswell L, Ahern A, Fuller N, Eberhard M, Stoll J, et al. **The challenge**
516 **of a 2-year follow-up after intervention for weight loss in primary care.** Int J Obesity
517 2014;38:806- 811.

518 (53) National Obesity Observatory. Standard Evaluation Framework for Weight
519 Management Interventions. . Public Health England, London 2009:Available at:
520 www.noo.org.uk/core/frameworks/SEF (accessed 01.07.2015).

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