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Prototyping for public health in a local context: a streamlined implementation and effectiveness evaluation of a community-based weight management programme (Momenta), Northumberland, UK

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Complete List of Authors:	Dodd-Reynolds, Caroline; Durham University, Department of Sport and Exercise Sciences; Durham University, Wolfson Research Institute for Health and Wellbeing Physical Activity Special Interest Group Nevens, Lisa; Northumbria Healthcare NHS Foundation Trust Community Services Business Unit Oliver, Emily; Durham University, Wolfson Research Institute for Health and Wellbeing Physical Activity Special Interest Group; Durham University, Department of Sport and Exercise Sciences, Finch, Tracy; Northumbria University, Nursing, Midwifery and Health Lake, Amelia; Department of Science, School of Science, Engineering and Design, Teesside University Hanson, Coral; Edinburgh Napier University, School of Health and Social Care; Durham University, Wolfson Research Institute for Health and Wellbeing Physical Activity Special Interest Group
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3 1 Prototyping for public health in a local context: a streamlined implementation and
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5 2 effectiveness evaluation of a community-based weight management programme (Momenta),
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13 5 Caroline J Dodd-Reynolds^{1,2} (corresponding author*), Lisa Nevens³, Emily J Oliver^{1,2}, Tracy
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15 6 Finch⁴, Amelia A Lake^{5,6} Coral L Hanson⁷
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17
18
19

20 8 ¹Department of Sport and Exercise Sciences, Durham University, Durham, DH1 3HN, UK*.
21
22 9 Email: caroline.dodd-reynolds@durham.ac.uk Tel: +44(0)191 3342000
23

24 10 ²Wolfson Research Institute for Health and Wellbeing Physical Activity Special Interest
25
26 11 Group, Durham University, Durham, UK.
27
28

29 12 ³Northumbria Healthcare NHS Foundation Trust, Northumberland, UK.
30

31 13 ⁴Department of Nursing, Midwifery and Health, Northumbria University, Newcastle upon
32
33 14 Tyne, UK
34
35

36 15 ⁵Department of Science, School of Science, Engineering and Design, Teesside University,
37
38 16 Teesside, UK
39

40 17 ⁶Fuse – UKCRC Centre for Translational Research in Public Health, UK
41

42 18 ⁷School of Health and Social Care, Edinburgh Napier University, Edinburgh, UK
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1 ABSTRACT

2 **Objectives** Stakeholder co-production in design of public health programmes may reduce the
3 ‘implementation gap’ but is time-consuming and costly. Prototyping, iterative refining
4 relevant to delivery context, offers a potential solution. This evaluation explored prototyping
5 in the implementation and effectiveness of a referral-based, 12-week weight-management
6 programme, ‘Momenta’, in Northumberland, UK.

7 **Design** Anonymised service evaluation data examined physiological and psychological
8 outcomes at 12 and 52 weeks. Qualitative interviews with referring healthcare professionals
9 and focus groups with service users explored implementation and prototyping.

10 **Setting** Two leisure centres in northeast England.

11 **Participants** Overweight and obese individuals (n=182) referred by healthcare professionals.
12 Referring professionals (n=5) participated in individual interviews and service users (n=13)
13 in focus groups.

14 **Interventions** Three 12-week interventions: Momenta (n=59), Momenta plus Fitness
15 membership (Momenta-Fitness) (n=58), and Fitness membership only (n=65).

16 **Primary and secondary outcome measures** Primary outcome: weight loss. Secondary
17 outcomes: uptake, adherence, mental wellbeing, anxiety, depression, and implementation and
18 prototyping effectiveness.

19 **Results** 12-week weight loss [median kg, (interquartile range)] was observed for Momenta -
20 2.9 (-5.0 to -2.0) and Momenta-Fitness -2.9 (-5.1 to -1.6) $p < 0.001$, but not Fitness-only. 52-
21 week follow-up suggested persistence of weight loss for Momenta-Fitness. Uptake and 12-
22 week adherence were higher for Momenta (84.7%, 45.8%) and Momenta-Fitness (93.1%,

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3 1 60.3%) versus Fitness-only (75.4%, 24.6%). 12-week mental wellbeing, anxiety and
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5 2 depression improved in Momenta and Momenta-Fitness, remaining at 52 weeks ($p < 0.05$).
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7 3 Prototyping did not detrimentally impact on participants' experiences and enabled important
8
9 4 refinements such as broadening inclusion criteria. Implementation gaps were revealed around
10
11 5 the referral process and practitioner knowledge.
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16 6 **Conclusions** Momenta was effective for weight loss, particularly combined with fitness
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18 7 membership. Prototyping aided implementation and appropriate in evaluations providing 1.
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20 8 A strong theoretical and empirical underpinning of the intervention; 2. use of co-production
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22 9 methods to allow iterative refinement during implementation.
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1 ARTICLE SUMMARY

3 Strengths and limitations of this study

- 5 • This study advances understanding about whether prototyping is a cost-effective and
6 time-efficient approach to design and implementation of public health programmes.
- 8 • This mixed methods evaluation provides insight into the implementation and
9 effectiveness for an ‘off-the-shelf’ weight management programme, in a local context.
- 11 • Embedding stakeholders’ views in the entire evaluation process allowed for ongoing,
12 iterative refinement.
- 14 • A limitation to the quantitative component is the small sample size.
- 16 • Qualitative interviews and focus groups can only provide information about what
17 participants recall about their experiences, meaning that there is a potential for recall
18 bias.

1 INTRODUCTION

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8 Failure to implement effective public health interventions when programmes are scaled up or
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10 transferred across contexts is widely reported.¹ Proposed approaches attempting to address
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12 this implementation gap include; effectiveness-implementation hybrid designs,² linking
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14 action to theory and models based on theory,³ and application of the replicating effective
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16 programmes framework.⁴ Common to all is advocacy of a developmental process reflecting
17
18 on existing knowledge about the target population and planned programme prior to delivery.
19
20 Engagement of service users is encouraged. Although this increases the likelihood of services
21
22 meeting all stakeholder's needs, it is costly in both time and financial resources. Resulting
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24 well-designed services will be tailored to a problem that may have changed during the time
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26 spent developing the intervention. Additionally, public access is delayed. Resource-pressured
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28 public health services must therefore consider pragmatic alternatives to service design and
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30 implementation. In this paper, we explore a novel evaluation approach to these
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32 implementation challenges, focusing on a problem high on the public health agenda: obesity
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34 and overweight.
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43 Targeting elevated weight status is a public health priority, obesity being a recognised risk
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45 factor for many physical and psychological health outcomes.⁵⁻⁹ In England for example,
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47 obesity and overweight are associated with 30,000 deaths and an estimated National Health
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49 Service cost of £6.1 billion per annum.¹⁰ Globally, countries with higher income inequalities
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51 tend to have higher rates of obesity.¹¹ Excess weight is also associated with widening social
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53 and economic deprivation,¹² with calls to improve the effectiveness of behaviour change
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55 interventions for low-income groups.¹³ There is a clear need for effective public health
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57 programmes that can be refined according to local need. This evaluation focuses on
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1 Northumberland, in northeast England. Northumberland is one of the lowest ranked counties
2 in England by Gross Value Added per capita (£16,140).¹⁴ Unemployment is higher (5.5%
3 versus 4.8%) than the England average¹⁵ and Northumberland public health spend per person
4 is £53, compared to a £59 national average.¹⁶ 63.8% of adults are classified as having excess
5 weight, higher than the national average of 61.3%.¹⁷

6
7 The need for innovation within public health has been postulated, shifting away from the
8 traditional linear pre-conceived and evidence-based model.¹⁸ One alternative is prototyping
9 where projects test innovations iteratively, with ongoing refinement considering the interplay
10 between a programme and its delivery context.¹⁹ A small number of studies to date, for
11 example in drug prevention²⁰ and web-based support of long-term weight loss²¹ have
12 demonstrated efficiencies when including elements of prototyping within programme
13 development. Such an approach seems particularly well-suited to weight management, where
14 there are many examples of ‘good’ practice, or effectiveness, but no clear consensus on ‘best’
15 practice at service-delivery level. There is also limited understanding of how tailoring
16 programmes or interventions to local contexts may impact on effectiveness. This evaluation
17 has particular value therefore in testing a prototyping approach for a weight management
18 programme delivered at local authority level. Specifically, we take an ‘off-the-shelf’
19 programme, ‘Momenta’²² and evaluate its implementation and effectiveness in a challenging
20 context. Emergent findings will facilitate understanding not only of whether the programme
21 is adaptable, demonstrating promise for ‘scaling up’, but more importantly whether the
22 prototyping approach can be a resource-effective way of informing and refining public health
23 delivery.

1 2 3 1 **METHODS** 4 5 2 6 7

8 3 **The prototyping process: local context and evaluation design** 9 10 4

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12 5 A local authority health needs assessment identified a gap in provision for a lifestyle-based
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14 6 weight management referral programme within Northumberland. Overweight and obese
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16 7 adults were at the time eligible for referral to the Northumberland exercise referral scheme
17
18 8 (ERS). Although the ERS doubled as a weight management intervention, previous evaluation
19
20 9 demonstrated modest weight loss²³ and a body mass index (BMI) >30 kg/m² was negatively
21
22 10 associated with adherence.²⁴ Thus ‘Momenta’ was commissioned for local adaptation and
23
24 11 delivery. Momenta is an evidence-based, outcome-driven behavioural programme designed
25
26 12 to be delivered by fitness professionals in a leisure environment.²² Developed by the MEND
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28 13 childhood weight management programme²⁵ designers, this 12-week programme aims to
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30 14 facilitate weight loss by engaging participants in 12 key behaviours broadly encompassing
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32 15 psychology, diet and physical activity. It was offered free to service users.
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40 17 The local Leisure Trust was commissioned to deliver a pilot Momenta programme.
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42 18 Stakeholder meetings were held with Leisure Trust managers, delivery staff and Momenta
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44 19 programme developers. Members of the evaluation team (CDR, EO) provided guidance on
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46 20 evaluation design and light touch advice about tools to explore effectiveness. The evaluation
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48 21 was thus co-produced to ensure a robust framework, whilst meeting strategic local needs. For
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50 22 example, commissioners were concerned about meeting recruitment targets for an existing
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52 23 tier three weight management service for pre-bariatric patients and Momenta was initially
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54 24 commissioned for overweight patients only (BMI 25.0-29.9 kg/m²), although this was later
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56 25 amended. Furthermore, commissioners were keen to consider accessibility of provision and
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1 wished to explore the effect of offering free gym, swimming and fitness class membership.

2 The evaluation was designed to accommodate this.

3

4 The pilot programme was delivered at two leisure sites situated within the 20% and 50%
5 most deprived neighbourhoods in the country. Six General Practice (GP) surgeries, identified
6 as the best referrers to the existing ERS, were asked to refer suitable patients to Momenta.

7 The programme manager and the public health improvement manager (LN) attended practice
8 meetings to articulate referral criteria and disseminate advertising materials. Attendance
9 varied from two to all practice staff, meaning that in some surgeries knowledge of the
10 programme was reliant on dissemination by those who attended.

11

12 A mixed methods evaluation was agreed between the evaluation team and commissioners.

13 Quantitative and qualitative components were conducted concurrently and had equal status.²⁶

14

15 **Quantitative evaluation component**

16

17 Programme providers allocated service users into one of three comparison groups:

18 a) Combined Momenta plus fitness membership (Momenta-Fitness);

19 b) Momenta;

20 c) Fitness membership (Fitness-only).

21 Referrals by healthcare professionals (HCPs) were made via a standardised form to the
22 appropriate leisure site. Due to maximum recommended Momenta group size, referrals were
23 split into delivery cohorts of 15, with groups rolling through March 2015 to April 2016.

24

1 Outcome measures included anthropometric measurements to determine weight change.

2

3 Secondary well-being outcome measures were of specific interest to commissioners. Prior to

4

5 programme commencement the Leisure Trust, in conjunction with the Momenta programme

6

7 designer and members of the evaluation team, held a training day for delivery staff. Although

8

9 staff were qualified to deliver Momenta, extra bespoke training (including role-play scenarios

10

11 and problem-solving discussions) was delivered by the clinical psychologist who designed

12

13 Momenta. The evaluation team (CDR, CH) trained delivery staff in international standard

14

15 anthropometric techniques²⁷ and familiarised them with other evaluation measures.

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24 Age, gender and postcode (for index of multiple deprivation, IMD) were recorded by

25

26 referring HCPs on the referral form. Employment status, level of education, cohort wave and

27

28 programme group were recorded by leisure staff, who also measured height, weight, and

29

30 waist circumference at baseline and programme end. Measures were taken in at least

31

32 duplicate, using standardised tools. Body mass index was calculated and classified according

33

34 to WHO guidelines.²⁸ The Warwick-Edinburgh Mental Well-being Scale,²⁹ and the Hospital

35

36 Anxiety and Depression Scale³⁰ were administered at each time-point. Attendance at

37

38 Momenta and leisure centre usage was monitored via swipe-card tracking. 52 weeks after

39

40 commencing the programme, participants were invited to attend a follow-up session, where

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42 leisure staff repeated physiological and psychological measures. Programme providers

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44 collected and collated quantitative data and provided an anonymised dataset to the evaluation

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46 team for analysis.

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1 **Qualitative evaluation component**

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3 Implementation effectiveness for the referral process was explored through semi-structured
4 interviews with referring HCPs (undertaken at referring surgeries) and focus groups with
5 service users (in leisure centres). All were conducted by LN during March-July 2015, as part
6 of her Public Health Masters degree (which contained qualitative methods training), mentored
7 by TF, an experienced qualitative researcher. Questions are included in supplementary file 1.
8 Data were audio-recorded. Results are reported using the Consolidated criteria for Reporting
9 Qualitative research guidelines³¹

10

11 Practice managers from all six referring surgeries were sent an invitation for staff to take part.
12 Individual correspondence was sent to those agreeing. Interviews aimed to explore HCPs'
13 referral experiences; raising weight issues; assessing readiness to change; marketing and
14 referral materials; and the referral process. Interview questions were pilot tested with public
15 health colleagues to assess timing and ensure validity. One question (*Thinking about after*
16 *you referred the patient, what happened next?*) was omitted after piloting as it was realised
17 HCPs would not have had patient feedback at that point. Interviews lasted on average 26
18 minutes and were transcribed verbatim. Data were analysed following each interview, with
19 developing themes considered to determine whether questions required refinement. Initial
20 themes generated from the first two interviews did not change and thus questions remained
21 constant, although prompts were added.

22

23 During the initial assessment session for the first wave of referrals, all ($n = 39$) were invited
24 to participate in a series of focus groups at programme-end to explore experiences. Emphasis
25 was placed on the referral process, initial expectations and experiences of participation; how

1 weight issues were raised by HCPs; time from referral to initial assessment; and facilitators
2 and barriers to taking part. Focus groups lasted between 26 and 44 minutes.

3 4 **Patient and public involvement**

5
6 Commissioners, deliverers and service users were involved in the iterative evaluation.

7 8 **Data analyses**

9
10 The anonymised quantitative dataset was analysed using PSAW Statistics V.22. Descriptive
11 statistics were calculated for age, gender, IMD, employment status, initial BMI, leisure site,
12 level of education, and uptake and adherence. Distribution and normality of measures
13 (weight, BMI, waist circumference, psychological wellbeing and attendance) were assessed
14 using Shapiro Wilk tests and median and interquartile range (IQR) scores calculated for each
15 group at baseline and 12 weeks (attendance, 12 weeks only). Kruskal-Wallis H tests were
16 used to determine between group differences at baseline and 12 weeks for viable data.
17 Wilcoxon-signed rank tests examined differences between baseline and 12-week scores. Data
18 available at 52 weeks ($n = 37$) were analysed separately.

19
20 Qualitative data were audio-recorded and transcribed by LN using a thematic process.³² Data
21 were organised according to concepts, key themes and developing categories. Data coding
22 was discussed with TF, allowing comparison of data interpretation and subsequent coding
23 refinement. Evolving key themes were refined through the analysis process and subsequent
24 cross-sectional thematic labelling of data, thus generating deeper understanding. Where

1 possible, key phrases or expressions identified from interviews and focus groups were
2 retained within coding and thematic labelling. A public health colleague helped to verify
3 interpretations of the data and appropriateness of codes applied. Once initial interviews were
4 coded this framework was applied to remaining data. Notes taken during focus groups helped
5 to contextualise when developing themes and included information about dynamics within
6 groups, such as influence, disagreement, humour and peer exposure.

8 **RESULTS**

10 Between December 2014 and March 2016, the programme received 182 referrals and was
11 delivered in four cohorts across leisure sites. Due to initial low levels of recruitment, the first
12 cohort did not start until March 2015. Referrals were mainly female (83%) and 30.6% lived
13 in the 20% most deprived areas (table 1).

Table 1. Demographic characteristics of referrals (n=165)

	Median	IQR
Age (years)	53	24
Gender (n=167)	n	%
Male	29	17.4%
Female	138	82.6%
Initial BMI category (kg/m², n=150)		
25.0-29.9	40	26.7%
30.0-34.9	73	48.6%
35.0-39.9	27	18.0%
≥40.0	10	6.7%
Leisure site (n=170)		
Leisure site 1 (IMD quintile 2)	80	44.7%
Leisure site 2 (IMD quintile 3)	99	55.3%
Index of multiple deprivation (n=170)		
20% most deprived	52	30.6%
21-40%	41	24.1%
41-60%	20	11.8%
61-80%	20	11.8%
20% least deprived	37	21.6%
Employment status (n=123)		
Employed full time	37	30.1%
Employed part time	24	19.5%
Retired	51	41.5%
Claiming incapacity benefit	5	4.1%
Claiming job seekers allowance	6	4.9%
Level of education (n=127)		
Primary	15	11.8%
Secondary (O level/GCSE)	35	27.6%
Secondary (A level)	26	20.5%
Further education (HND)	25	19.7%
Bachelors or equivalent	21	16.5%
Masters or equivalent	5	3.9%

Programme Effectiveness

Of all referrals, 153 (84%) attended the baseline measurement session and 78 (51% of those who started) attended the 12-week measurement session. Uptake and adherence varied by programme group (table 2).

Table 2. Programme uptake, adherence and attendance.

Uptake and adherence	Momenta plus fitness		Momenta only		Fitness only	
Number referred		58		59		65
Uptake* (n, %)		54 (93.1%)		50 (84.7%)		49 (75.4%)
Uptake Adherence** (n, %)		35 (64.8%)		27 (54.0%)		16 (32.7%)
Overall adherence*** (n, %)		58 (60.3%)		59 (45.8%)		65 (24.6%)
Momenta session attendance	Momenta plus fitness		Momenta only		Fitness only	
	n	Median (IQR)	n	Median (IQR)		
Uptake	54	9.0 (7.3)	50	9.0 (8.0)		
Dropouts	19	3.0 (3.0)	23	3.0 (5.0)		N/A
Adherers	35	10.0 (2.0)	27	11.0 (1.3)		
Exercise session attendance	Momenta plus fitness		Momenta only		Fitness only	
	n	Median (IQR)	n	Median (IQR)	n	Median (IQR)
Uptake	54	7.0 (16.3)	50	0.0 (4.5)	49	0.0 (1.5)
Dropouts	19	0.0 (1.0)	23	0.0 (0.0)	33	0.0 (0.0)
Adherers	35	10.0 (14.0)	26	0.0 (5.0)	16	4.5 (18.0)

*Uptake** participant attended baseline assessment; *Uptake adherence*** % of participants who attended the baseline assessment who also attended the 12-week assessment; *Overall adherence**** % of all those referred who attended both baseline and 12-week assessment

Physiological and psychological data were not normally distributed. No significant differences were found between programme groups either at baseline or at 12 weeks, for any measures. Significant within-group differences between baseline and 12 weeks were evident for weight, BMI and waist circumference for Momenta-Fitness, and Momenta (Table 3). Follow-up analysis at 52-weeks (available sub-sample) showed changes were maintained for Momenta-Fitness ($n = 18$) only.

1 **Table 3. Weight, BMI and waist circumference change.**

End of programme results	Median (IQR) Baseline	Median (IQR) 12 weeks	z	p	Median (IQR) Change
Weight (kg)					
Momenta plus fitness (n=35)	88.9 (80.5 - 100.0)	88.0 (77.2 - 95.8)	-4.531	<0.001	-2.9 (-5.1 - -1.6)
Momenta only (n=26)	87.8 (74.5 - 77.0)	83.3 (74.5 - 92.5)	-4.344	<0.001	-2.9 (-5.0 - -2.0)
Fitness only (n=15)	76.2 (71.6 - 86.9)	76.6 (70.4 - 84.6)	-0.879	0.379	0.0 (-3.2 - 1.0)
BMI (kg/m²)					
Momenta plus fitness (n=35)	32.0 (30.3 - 35.7)	31.3 (29.2 - 35.3)	-4.494	<0.001	-1.1 (-1.9 - -0.6)
Momenta only (n=26)	32.0 (30.0 - 34.5)	31.3 (28.6 - 33.6)	-4.356	<0.001	-1.2 (-1.6 - -0.8)
Fitness only (n=14)	29.2 (27.3 - 33.0)	29.7 (27.0 - 33.3)	-0.454	0.650	0.1 (-1.2 - +0.4)
Waist circumference (cm)					
Momenta plus fitness (n=35)	106.0 (98.0 - 115.0)	99.0 (93.0 - 110.0)	-4.996	<0.001	-7.0 (-9.5 - -5.0)
Momenta only (n=25)	108.0 (99.5 - 114.5)	101.0 (93.8 - 111.5)	-4.166	<0.001	-5.0 (-7.3 - -2.5)
Fitness only (n=11)	90.0 (87.0 - 95.0)	91.0 (90.0 - 96.0)	0.358	0.650	1.0 (-3.0 - 3.0)
52-week follow-up	Median (IQR) Baseline	Median (IQR) 52 weeks	z	p	Median (IQR) Change
Weight (kg)					
Momenta plus fitness (n=18)	95.2 (87.1 - 101.4)	91.4 (82.7 - 95.9)	-3.006	<0.001	-4.8 (-6.2 - -1.5)
Momenta only (n=16)	84.7 (72.3 - 95.2)	82.7 (73.2 - 94.6)	-1.533	0.120	-0.7 (-7.6 - 0.8)
BMI (kg/m²)					
Momenta plus fitness (n=18)	32.0 (30.49 - 35.1)	30.8 (28.7 - 34.0)	-3.157	<0.05	-1.7 (-2.0 - -0.6)
Momenta only (n=16)	31.7 (29.3 - 33.9)	31.1 (26.7 - 33.6)	-1.603	0.109	-0.3 (-2.3 - 0.3)
Waist circumference (cm)					
Momenta plus fitness (n=18)	109.0 (101.0 - 114.8)	100.5 (94.8 - 107.3)	-3.221	<0.001	-6.0 (-13.3 - -1.75)
Momenta only (n=16)	106.0 (94.5 - 115.8)	103.5 (98.5 - 113.3)	-0.780	0.938	-2.5 (-9.0 - -10.0)
* Fitness only n=3 therefore no 52-week calculations					

3
4
5 Significant improvement in mental wellbeing, and reductions in depression and anxiety, were
6 evident between baseline and 12 weeks for Momenta-Fitness, and Momenta (Table 4). The
7 magnitude of change was relatively small but functionally and clinically meaningful. For
8 example, the median value for anxiety for Momenta dropped from a moderate symptomology
9 to a not symptomatic classification. 52-week sub-sample analysis showed that significant
10 improvements for wellbeing and depression were maintained for Momenta-Fitness (n=18),
11 and wellbeing and anxiety for Momenta (n=16).

Table 4. Wellbeing, anxiety and depression measures change.

End of programme results	Median (IQR) Baseline	Median (IQR) 12 weeks	z	p	Median (IQR) Change
Mental wellbeing scale					
Momenta plus fitness (n=29)	46.0 (40.0 - 51.5)	53.0 (40.0 - 51.5)	3.810	<0.001	5.0 (1.5 - 12.0)
Momenta only (n=23)	49.0 (39.0 - 58.0)	55.0 (51.0 - 63.0)	2.818	<0.05	6.0 (-1.0 - 10.0)
Fitness only (n=13)	47.0 (40.5 - 59.5)	46.0 (42.0 - 63.5)	0.157	0.875	0.0 (-4.0 - 5.0)
Anxiety scale					
Momenta plus fitness (n=28)	5.5 (4.0 - 9.8)	4.5 (2.0 - 7.0)	-3.027	<0.001	-1.0 (-3.0 - 1.0)
Momenta only (n=23)	8.0 (6.0 - 10.0)	4.0 (2.5 - 9.0)	-2.329	<0.05	-1.0 (-3.0 - 0.0)
Fitness only (n=13)	8.0 (3.5 - 10.0)	6.0 (4.0 - 9.0)	-0.499	0.618	-1.0 (-2.0 - 2.0)
Depression scale					
Momenta plus fitness (n=28)	5.5 (3.3 - 8.0)	2.0 (1.0 - 6.0)	-3.214	<0.05	-2.5 (-4.8 - -0.3)
Momenta only (n=23)	5.0 (3.0 - 7.5)	3.0 (1.0 - 5.0)	-3.049	<0.05	-1.0 (-4.5 - 1.0)
Fitness only (n=13)	4.0 (2.0 - 8.5)	2.0 (2.0 - 7.0)	-1.226	0.220	-2.0 (-4.5 - 0.0)
52-week follow-up	Median (IQR) Baseline	Median (IQR) 52 weeks	z	p	Median (IQR) Change
Mental wellbeing scale					
Momenta plus fitness (n=15)	44.0 (39.0 - 52.0)	55.0 (48.0 - 59.0)	2.984	<0.05	5.0 (3.0 - 15.0)
Momenta only (n=13)	58.0 (47.5 - 59.0)	56.0 (54.0 - 63.5)	2.282	<0.05	4.0 (0.5 - 6.5)
Anxiety scale					
Momenta plus fitness (n=15)	6.0 (2.0 - 10.0)	2.0 (1.0 - 7.0)	-1.785	0.074	-3.0 (-6.0 - 0.0)
Momenta only (n=15)	7.0 (4.0 - 9.0)	5.0 (1.0 - 8.0)	-1.990	<0.05	-3.0 (-4.0 - 0.0)
Depression scale					
Momenta plus fitness (n=15)	7.0 (3.3 - 11.3)	3.5 (1.0 - 6.0)	-2.908	<0.05	-3.5 (-6.3 - -0.8)
Momenta only (n=15)	4.0 (1.0 - 6.0)	3.0 (1.0 - 4.0)	-0.762	0.446	0.0 (-2.0 - 1.0)

* Fitness only n=3 therefore no 52-week calculations

Overall, the results suggested those who participated in the two groups incorporating Momenta, had enhanced physical and psychological health indicators from baseline, whereas those who had only free fitness membership did not. There is some evidence that the combination of Momenta and fitness membership produces the best outcomes at 52 weeks.

1 **Implementation effectiveness: reflections from referring healthcare professionals**

2

3 Five face-to-face semi-structured interviews took place with HCPs across five referring
4 surgeries: two GPs, two Practice Nurses and one Health Care Assistant. HCPs perceived that
5 four key themes influenced the effectiveness of programme implementation: (i) difficulties
6 raising weight with patients, (ii) how gender affected patient engagement, (iii) availability of
7 information and resources, and (iv) additional barriers constraining programme promotion.

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9 Raising the issue of weight with patients:

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11 Concerns about raising weight may have contributed to slow recruitment, with nurses and
12 healthcare assistants expressing unease, *'not really up to me... well I talk about it if they want*
13 *to.... Better if they [patients] bring it up.'* (Interview 2, Healthcare Assistant). GPs seemed
14 more comfortable raising weight with patients, but with the caveat that this is easier in the
15 context of a longer-term GP/patient relationship.

16 *'the people I see I've known for a very long time... it's the rapport you have...if I'd*
17 *never met anyone before and they came in for a sore throat I'm not going to say*
18 *you're fat...If there was someone I'd known for a long time and it seemed*
19 *relevant...I'd mention it.'* (Interview 5, GP).

20

21 Gender and engagement in the referral process:

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23 Gender was highlighted as influencing the referral process, women being more likely than
24 men to seek support for weight. This may help explain the low rate of referral for males
25 (17%):

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3 1 *'More women talk about it...men don't really talk about weight...I do mention weight*
4
5 2 *to men if I'm doing a well man [sic] but it doesn't come up really...it's a woman*
6
7 3 *thing...'* (Interview 3, Practice Nurse).
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13 5 Availability of information and resources:
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17 7 Several interviewees highlighted training needs around programme information and
18
19 8 resources, (e.g., additional programme information would help to engage patients). For
20
21 9 example, the GPs both discussed the longstanding ERS and stated they needed to become
22
23 10 more familiar with Momenta, as they had with the ERS:
24
25

26 11 *'when we get opportunities to do things in the practice we normally discuss it, let*
27
28 12 *everyone know where appropriate forms and information is and it's in your*
29
30 13 *head...that didn't happen with this and I don't know why that was.'* (Interview 5, GP).
31
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36 15 All HCPs interviewed felt the referral leaflet (provided by programme providers) was
37
38 16 important in the process, either as a tool to promote the intervention or to convey information
39
40 17 to patients:
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43 18 *'The leaflet was good, bright...explained the programme and patients like taking a*
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45 19 *leaflet away.'* (Interview 3, Practice Nurse)
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3 1 Additional Barriers to Engagement:
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9 3 Several sub-themes highlighted additional barriers to the referral process. The most
10
11 4 prominent sub-themes were around initial BMI referral criteria (25.0-29.9 kg/m²) and delayed
12
13 programme start. Both implementation factors were beyond the control of the referrers, but
14 5
15 consequently amended through iterative refinement during the prototyping process following
16 6
17 early data analysis. Both were reported by practice nurses as exacerbating each other:
18 7

19 8 *'we were referring but then it didn't start so people were not sure what was*
20
21 9 *happening [pause]...Think it was more people were needed to start...but you know if*
22
23 10 *the BMI was higher then there would have been more.'* (Interview 3, Practice Nurse).
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30 12 In one case, a decision was taken to relax the referral criteria, *'...31.5 [kg/m²]...was just*
31
32 13 *outside so I just referred him.'* (Interview 4, GP).
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36
37 15 Programme location was perceived by HCPs to overcome an existing barrier to the tier three
38
39 16 weight management programme, as Momenta was *'round the corner for people,'* as opposed
40
41 17 to *'a bit far away at the hospital.'* Cost barriers were also discussed, both with reference to
42
43 18 the patient, *'in this sort of area...cost..., if you've got to pay it's a barrier.'* (Interview 4, GP),
44
45 19 and to expected targets from Clinical Commissioning Groups (CCG),
46
47

48 20 *'we are constantly told by the CCG that we must keep down on numbers and that if*
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50 21 *there are costs attached to this referral that would definitely impact... and that would*
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52 22 *be for all practices.'* (Interview 5, GP)
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1 **Implementation effectiveness: reflections from participants**

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8 3 Three focus groups allowed programme participant voices to be heard: three females and one
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10 4 male from Momenta (focus group 1), three males and three females from Momenta-Fitness
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12 5 (focus group 2) and three females (one of whom emailed her views separately) from Fitness-
13
14 6 only. Across the groups, 12 participants reported having lost weight and one reported weight
15
16 7 gain. Three themes developed: (i) outcomes of the programme, (ii) facilitators and barriers to
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18 8 engagement, and (iii) raising the issues of weight with HCPs.
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25 10 Outcomes of the programme:
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12 Focus group findings aligned closely with quantitative outcomes in terms of the physical and
13 psychological benefits of participation: *'[I've] lost a good bit of weight. It's been very*
14 *positive for me... I'm feeling a lot more active...'* (Momenta-Fitness, Participant 5).
15 Participants reported a sense of weight loss achievement, increased physical activity levels,
16 and positive mood states. In addition, elements of the Momenta programme were perceived
17 as facilitating engagement, including the *'group feeling... I looked forward to it,'* (Momenta-
18 Fitness, Participant 4), the *'information that we got every week... so very well planned.'*
19 (Momenta-Fitness, Participant 3) and the ongoing support e.g., *'she phoned me the other day*
20 *to see if I was coming,'* (Momenta-Fitness, Participant 4). Momenta participants reflected
21 back on, and identified and discussed lifestyle factors that related to their initial weight gain
22 (e.g., *'I did the usual thing... I started eating toffees,'* Momenta-Fitness, Participant 5),
23 demonstrating both self-awareness and an openness to discussing the topic.
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3 1 Facilitators and barriers to engagement:
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8 3 One participant reported being initially excluded but later allowed to take part, and others
9
10 4 raised concerns that the initial BMI threshold for referral was too low, '*was a little bit high,*
11
12 5 *BMI...managed to get it down... [and then] the doctor put us forward,*' (Momenta, Participant
13
14 6 2). Data also indicated the importance of subsidised access, particularly important in the
15
16 7 context of a deprived region such as this, e.g., '*I also joined Weight Watchers for short period*
17
18 8 *of time but found the classes too expensive,*' (Fitness-only, Participant 3, emailed response).
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24 10 Raising the issue of weight with HCPs:
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28 12 Some data did suggest implementation was problematic, however, this focused exclusively
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30 13 on the referral process. Participants overwhelmingly felt that they had opened the
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32 14 conversation about weight, as opposed to discussions being initiated by HCPs (e.g., '*my*
33
34 15 *glucose levels were quite high but nobody ever said that I was overweight,*' Momenta-
35
36 16 Fitness, Participant 4). In addition, participants perceived limitations in HCPs' knowledge of
37
38 17 intervention components ('*she [nurse] didn't know anything about it,*' Fitness-only,
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40 18 Participant 1), something with potential to impact on likelihood of referral, and
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42 19 participants' expectations of programme success.
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48 49 21 **DISCUSSION**

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53 23 We explored 'prototyping', as a cost-effective and time-efficient approach to public health
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55 24 evaluation, via an 'off-the-shelf' weight management programme implemented in a local
56
57 25 context of mixed and high deprivation. Participation in Momenta and Momenta-Fitness
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1 resulted in 12-week weight loss for those who completed the programme. Free fitness
2 membership without the weight-management programme was poorly engaged with and did
3 not result in weight change. After a year, weight reductions equivalent to 5% were
4 maintained for Momenta-Fitness, greater than seen for some commercial weight-loss
5 programmes,³³ although a limited sample was available for follow-up analyses. Providing
6 free access to fitness facilities alongside the behaviour change programme was potentially a
7 factor, allowing for continuous and self-driven behaviour change³⁴ and sustaining optimal
8 changes in adiposity over 12 months.³⁵ Swipe card monitoring during the initial 12-week
9 period indicated that fitness sessions were accessed an average 10 occasions for this group,
10 whereas no access was apparent for Momenta, despite Momenta sessions being held in
11 leisure centres. This may be important for community providers making decisions about
12 delivery location. Both Momenta groups reported improved wellbeing, and reduced anxiety
13 and depression at 12-weeks suggesting that the behavioural intervention drives this effect.
14 This is consistent with previous work reporting co-varying changes in weight loss,
15 depression, and quality of life in weight management services.³⁶ It is unclear whether the
16 primary mechanism was weight loss, or the wider social benefits of participation. Both were
17 valued in the qualitative data. Maintenance of significant improvements in wellbeing for
18 these groups at 52 weeks is important given previously evidenced associations between poor
19 mental health, and obesity and overweight status.³⁷

20
21 Experiences of both referrers and referrals highlighted that HCPs needed to be better-
22 informed and more confident raising weight-related conversations. Whilst patient-led action
23 is desirable, staff reluctance to raise weight issues may mean that opportunities for
24 engagement of less knowledgeable or motivated patients will be missed. The problematic
25 positioning of GPs within obesity care has been highlighted previously,³⁸ with a range of

1 strategies to change HCPs' behaviour resulting in little or no change to patients' weight. A
2 practical training need is highlighted for those working at the patient-practitioner interface,
3 however communication with patients about weight may well be hindered by the 'stigma'
4 attached to obesity.³⁹ This has wider implications for patient outcomes and requires further
5 exploration through the implementation process. Additionally, HPCs need better
6 understanding of referral-based public health programmes offered. Despite efforts of
7 programme and public health managers, awareness was reportedly low for some referring
8 professionals. We suggest consideration of resource-efficient ways to signpost both HPCs
9 and patients themselves as part of the implementation process.

10
11 This programme was delivered across a social gradient in a region with low health indices
12 and areas of high deprivation. Some issues in relation to inequalities and service access for
13 future community-based weight management programmes were highlighted. Only 17% of
14 referrals to Momenta were males. Gender bias in weight management referral has been
15 reported elsewhere,⁴⁰⁻⁴¹ and interviews showed that practitioners struggled to raise the topic
16 of weight with male patients. Alternative referral strategies have been employed in other
17 settings in an attempt to overcome this.⁴² Marketing in other community spaces, or targeted
18 postal referrals could be explored in future implementation. The initial decision to restrict
19 referral to overweight-only substantially impacted on referral rates, with HCPs and referrals
20 indicating they felt limited until this restriction was reversed. Had this continued, worsening
21 health inequalities may have been an unintended consequence, something to be actively
22 avoided within public health programmes⁴³. The roles of, and interactions between, those
23 operating in the 'system' (i.e. the context within which the intervention operates) must be
24 considered at the point of implementation to minimise any impact from unintended
25 consequences.⁴⁴ In practical terms, this may be through continued dialogue with

1 commissioners, referring professionals and referrals themselves, something which
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6 2 prototyping evaluation allows.
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10 4 Given that no systematic problems emerged with participants' experiences of the programme
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12 5 itself, our findings lend support to a streamlined approach to involvement of all stakeholders
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14 6 in programme implementation. Furthermore, the prototyping evaluation format allowed for
15
16 7 changes following programme commencement, suggesting that this route offers opportunities
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18 8 for off-the-shelf programmes to be pragmatically moulded to local context, in real-time.
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20 9 However, emergence of some negative experiences of referral suggests that prototyping can
21
22 10 be problematic without networks or channels for ensuring key outcomes are widely
23
24 11 communicated to relevant actors. Overall, the evaluation demonstrated that a balance is
25
26 12 needed to allow quick and efficient adaptation of off-the-shelf programmes, but with focused
27
28 13 professional user engagement in the early stages of development. Some confidence in the
29
30 14 approach was derived from the strong theoretical grounding of the programme; we would
31
32 15 consider it unwise to adopt such a streamlined approach otherwise. The prototyping
33
34 16 approach had particular utility given that project resources were limited and meant that issues
35
36 17 were identified and acted upon rapidly. While the programme may have progressed similarly
37
38 18 without this, prototyping provided a greater structure for, and confidence in, on-going
39
40 19 refinements. This was achieved via the support provided by academics, public health
41
42 20 practitioners and providers. Fundamentally, adopting a prototyping approach enabled the
43
44 21 delivery of a new service to an in-need population, alongside the generation of initial
45
46 22 evidence of local effectiveness. A minimum of 1 kg weight-loss at 3 months, and 0.7 kg at
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48 23 12-months have been suggested as thresholds to influence decisions over commissioning of
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50 24 weight-loss services.³³ Momenta met and indeed exceeded these and shows particular
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52 25 promise when implemented in conjunction with free fitness provision.
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5 2 Demonstrating effectiveness is of limited use, however, unless a successful programme in
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7 3 one area may be adapted and implemented to suit a different context, for example through
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9 4 sharing local-level knowledge, interactions and behaviours of actors within different parts of
10
11 5 that system.⁴⁵ The process for scaling-up of effective health interventions to broader policy
12
13 6 and practice takes years⁴⁶ and certainly within the obesity literature, has been dominated by
14
15 7 initiatives that consider effectiveness but not implementation across specific settings.⁴⁷⁻⁴⁸
16
17 8 Whilst recognising the small sample size in this evaluation, the prototyping approach shows
18
19 9 promise in successfully testing innovations iteratively. Furthermore, ongoing refinement
20
21 10 considering the interplay between a programme and its delivery context could be built into
22
23 11 larger public health interventions.
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31 **CONCLUSION**

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35 15 This evaluation extends the literature by exploring prototyping for a complex problem,
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37 16 community weight-management, in a challenging setting, demonstrating streamlined
38
39 17 implementation of an ‘off-the-shelf’ weight management programme. We demonstrate good
40
41 18 outcome effectiveness for ‘Momenta’, particularly in conjunction with a free fitness offer.
42
43 19 This resource-effective approach is highly relevant in the context of health inequalities and
44
45 20 public health sector funding constraints. We recommend prototyping in public health
46
47 21 evaluation providing: 1. The original programme has a strong theoretical and empirical basis,
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49 22 and 2. All stakeholders shape implementation, with evaluation sought during early delivery
50
51 23 phases to iteratively refine the process.
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3
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20
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23 University, however was not involved in any data collection or entry, only accessing an
24 anonymised database submitted to the University. LN was a Public Health Improvement

1
2
3 1 Manager within the Public Health Team and had responsibility for commissioning the
4
5 2 Momenta programme. The qualitative evaluation component was submitted in partial
6
7 3 fulfilment of her Masters in Public Health at Newcastle University.
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12
13 5 **Participant consent:** Consent was obtained for face-to-face interviews and focus groups.
14
15 6 Service users were informed in writing of the nature of the quantitative service evaluation and
16
17 7 how to withdraw from it. The presented data are anonymised with risk of identification low.
18
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23
24 9 **Ethics approval:** Ethical advice was sought from the local Research Manager of North of
25
26 10 England Commissioning Support, and this project was classed as a service evaluation in line
27
28 11 with National Research Ethics Service guidance.
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34 13 **Data sharing statement:** No additional data are available
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SUPPLEMENTARY FILE 1.**Healthcare professionals' semi-structured interview guide**

Semi Structured Interview Set the interviewee at ease; explain purpose of the interview; offer a better understanding of what the referral process requires to aid tier 2 weight management to be delivered in Northumberland; explanation about how the interview will be recorded; reaffirmation of consent; and how the information will be analysed and stored; rules of confidentiality / anonymity etc.

Questions:

1. Thinking about raising the weight issue, tell me about your experience of discussing weight with patients.

Prompts

- *How does it feel to raise weight as an issue?*
- *Are patients open to discussing weight problems?*
- *Do you find a difference between genders when discussing weight?*
- *What helps you, such as the NHS Health Check Programme, to raise the issue of weight?*
- *What else would help to raise the issue or weight in appointments?*

2. Greater retention is often achieved when patients are ready to change, tell me how you work with / assess patient's readiness to change.

Prompts

- *Have you had training around the cycle of change?*
- *Do you use any specific tools or resources to assess the patient?*
- *What would help you to assess the patient's readiness to change?*

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3. Thinking the information and resources available to you during the referral, do you feel you had enough information and resources to encourage patient take up of the programme?

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Prompts

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- *Did you have enough background information?*
 - *Were the referral forms suitable / capture all the information required?*
 - *Were the patient leaflets / resources suitable?*
 - *Were there questions or issues raised that couldn't be answered?*
 - *Was the process easy to use?*
 - *What else could help you to make referrals to weight management programmes?*

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4. Thinking about after you referred the patient, what happened next? (excluded after pilot)

Prompts

- *Did you get feedback from the weight management programme on the progress of your patient?*
- *Did your patients achieve weight loss?*
- *Did your patient come back and talk about their experience?*

5. What things are most likely to prevent you from making the referral a weight management programme, either commercial or Public Health funded?

Prompts

- *Are there barriers that you perceive, such as cost to the patient?*
- *Are you concerned with raising the weight issue?*
- *Is it a time factor if the patient has an appointment for anything other than a weight issue?*
- *What would help you to overcome the barriers that prevent you from making the referral?*

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6. Is there anything else that you would like to tell me about your expectations and experiences of the weight management programme?

8 **Focus Group Topic Guide**

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14 *Set group at ease; explain purpose of the focus group; offer a better understanding of what works for*
15 *people in terms of tier 2 weight management and what doesn't, aiding development of an effective*
16 *programme for Northumberland residents; explanation about how the focus group will be recorded;*
17 *reaffirmation of consent; and how the information will be analysed and stored; rules of confidentiality /*
18 *anonymity etc.*

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1. Tell me a bit about what sort of weight management activity you have taken part in, in the past.

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32 *Prompts*

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- *What influence have others had on your weight management?*
 - *Do you have any particular likes/dislikes of physical activity/managing weight/nutrition*
 - *Has there been anything else that has influenced your management of weight?*

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2. So thinking about the weight management programme you have undertaken, how did you find out about it?

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51 *Prompts*

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- *Who / what motivated you to attend?*
 - *What made you decide that this is the right time to look at managing your weight?*
 - *Did the time of year make a difference?*

1 3. Thinking about your experience of when you were referred to the weight management programme,
2
3 how did you find the process?
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5 *Prompts*
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- 8 • *What type of health professional referred you? (GP / Practice Nurse)*
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 - 10 • *Did you specifically attend Primary Care to discuss your weight?*
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 - 12 • *How was weight raised?*
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 - 14 • *What did the referrer explain to you about the programme? Did you get enough information?*
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 - 16 • *How long was it from your referral from Primary Care to the first assessment in the weight*
17 *management programme; was this what you expected? Were you still motivated?*
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25 4. How did you feel about being referred?
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- 28 • *Prompts*
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 - 30 • *How confident did you feel about taking part in the programme?*
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 - 32 • *Was there anything that you were particularly looking forward to?*
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 - 34 • *Was there anything that you were worried about?*
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40 5. What did you hope to achieve by taking part in the weight management programme?
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42 *Prompts*
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- 45 • *What were your expectations when you start attending the scheme?*
 - 46
 - 47 • *Have there been changes to your health that you expected happen as a result of*
48 *participation?*
 - 49
 - 50 • *How quickly did you expect to see these changes? And did this happen?*
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58 6. Thinking about after you were referred, what happened next?
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60 *Prompts*

- *How long after referral did it take to be contacted by the Active Northumberland?*
- *What information did you receive prior to the initial consultation?*
- *How comfortable did you feel coming to the initial consultation?*

7. What influenced you most to attend the weight management programme?

Prompts

- *What did you expect from the staff?*
- *How important to you were changes in health or weight?*
- *Why were the influences raised important?*

8. What things were most likely to prevent you from attending the programme?

Prompts

- *Tell me about any worries you might have had about health issues.*
- *Tell me about any other things, such as other commitments, that might have stopped you from attending*
- *Did any of these issues arise? How did you overcome these issues?*

9. Now that you have completed the programme, tell me how did you felt about undertaking the weight management programme?

Prompts

- *Did you achieve the health / weight outcomes you expected?*
- *Why do you think it worked or not for you?*
- *Do you feel you now have the tools to continue to make positive lifestyle choices?*
- *Is there something that will prevent you to continue to make positive lifestyle choices?*

10. Is there anything else that you would like to tell me about your expectations and experiences
of the weight management programme?

For peer review only

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COREQ (CONsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
<i>Personal characteristics</i>			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	
Occupation	3	What was their occupation at the time of the study?	
Gender	4	Was the researcher male or female?	
Experience and training	5	What experience or training did the researcher have?	
<i>Relationship with participants</i>			
Relationship established	6	Was a relationship established prior to study commencement?	
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	
Interviewer characteristics	8	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	
Domain 2: Study design			
<i>Theoretical framework</i>			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	
<i>Participant selection</i>			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	
Sample size	12	How many participants were in the study?	
Non-participation	13	How many people refused to participate or dropped out? Reasons?	
<i>Setting</i>			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	
<i>Data collection</i>			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	
Repeat interviews	18	Were repeat interviews carried out? If yes, how many?	
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	
Field notes	20	Were field notes made during and/or after the interview or focus group?	
Duration	21	What was the duration of the interviews or focus group?	
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or	

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
<i>Data analysis</i>			
Number of data coders	24	How many data coders coded the data?	
Description of the coding tree	25	Did authors provide a description of the coding tree?	
Derivation of themes	26	Were themes identified in advance or derived from the data?	
Software	27	What software, if applicable, was used to manage the data?	
Participant checking	28	Did participants provide feedback on the findings?	
<i>Reporting</i>			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	
Data and findings consistent	30	Was there consistency between the data presented and the findings?	
Clarity of major themes	31	Were major themes clearly presented in the findings?	
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.

BMJ Open

Prototyping for public health in a local context: a streamlined evaluation of a community-based weight management programme (Momenta), Northumberland, UK

Journal:	<i>BMJ Open</i>
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Primary Subject Heading:	Public health
Secondary Subject Heading:	Nutrition and metabolism
Keywords:	public health evaluation, prototyping, implementation, community weight management, NUTRITION & DIETETICS, exercise referral

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Manuscripts

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3 1 Prototyping for public health in a local context: a streamlined evaluation of a community-
4 based weight management programme (Momenta), Northumberland, UK
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10 4 Caroline J Dodd-Reynolds^{1,2} (corresponding author*), Lisa Nevens³, Emily J Oliver^{1,2}, Tracy
11 Finch⁴, Amelia A Lake^{5,6} Coral L Hanson⁷
12
13 5
14
15 6

16
17
18 7 ¹Department of Sport and Exercise Sciences, Durham University, Durham, DH1 3HN, UK*.
19

20 8 Email: caroline.dodd-reynolds@durham.ac.uk Tel: +44(0)191 3342000
21

22 9 ²Wolfson Research Institute for Health and Wellbeing Physical Activity Special Interest
23 Group, Durham University, Durham, UK.
24
25 10

26
27 11 ³Northumbria Healthcare NHS Foundation Trust, Northumberland, UK.
28

29 12 ⁴Department of Nursing, Midwifery and Health, Northumbria University, Newcastle upon
30 Tyne, UK
31
32 13

33 14 ⁵Department of Science, School of Science, Engineering and Design, Teesside University,
34 Teesside, UK
35
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37
38 16 ⁶Fuse – UKCRC Centre for Translational Research in Public Health, UK
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40 17 ⁷School of Health and Social Care, Edinburgh Napier University, Edinburgh, UK
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46 19 **Word count:** 4214
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49 20 **Keywords:** Public health evaluation, prototyping, implementation, community weight
50 management, diet, exercise referral
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1 ABSTRACT

2 **Objectives** Stakeholder co-production in design of public health programmes may reduce the
3 ‘implementation gap’ but can be time-consuming and costly. Prototyping, iterative refining
4 relevant to delivery context, offers a potential solution. This evaluation explored
5 implementation and lessons learned for a 12-week referral-based weight-management
6 programme, ‘Momenta’, along with feasibility of an iterative prototyping evaluation
7 framework.

8 **Design** Mixed methods evaluation: analysis of anonymised service data provided for
9 physiological and psychological outcomes (12 and 52 weeks), qualitative exploration of
10 implementation with referrers and service users.

11 **Setting** Two leisure centres in Northumberland, northeast England.

12 **Participants** Individuals (n=182) with BMI>24.9 kg/m², referred by healthcare
13 professionals. Individual interviews with referring professionals (n=5) and focus groups with
14 service users (n=13).

15 **Interventions** Three 12-week programme iterations: Momenta (n=59), Momenta-Fitness
16 membership (Momenta-Fitness) (n=58), and Fitness membership only (n=65).

17 **Primary and secondary outcome measures** Weight loss, BMI, waist circumference, uptake,
18 adherence, mental wellbeing, anxiety, depression. Qualitative themes developed through
19 stakeholder-engagement.

20 **Results** 12-week weight loss [median kg, (interquartile range)] was observed for Momenta -
21 2.9 (-5.0 to -2.0) and Momenta-Fitness -2.9 (-5.1 to -1.6) p< 0.001, but not Fitness-only.
22 Preliminary 52-week follow-up suggested weight loss maintenance for Momenta-Fitness.

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3 1 Uptake and 12-week retention were higher for Momenta (84.7%, 45.8%) and Momenta-
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5 2 Fitness (93.1%, 60.3%) versus Fitness-only (75.4%, 24.6%). 12-week mental wellbeing,
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7 3 anxiety and depression improved in Momenta and Momenta-Fitness, remaining at 52 weeks
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10 4 ($p < 0.05$). Service users reported positive experiences of Momenta. Implementation gaps
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12 5 were revealed around the referral process itself and practitioner knowledge. Prototyping
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14 6 enabled important iterative refinements such as broadening inclusion criteria.
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17 7 **Conclusions** Momenta has potential for weight loss, particularly when offered with a fitness
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19 8 membership. Identification of issues with referral process enabled real-time iterative
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21 9 refinement to address some of these, whilst lessons learned may be of value for local
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23 10 implementation of ‘off-the-shelf’ weight management packages more generally.
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3 1 **ARTICLE SUMMARY**
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9 3 **Strengths and limitations of this study**
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15 5 • This study advances understanding about whether prototyping is a time-efficient and
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18 6 cost-effective approach to design and implementation of public health programmes.
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22 8 • This mixed methods evaluation provides insight into the implementation of an ‘off-
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25 9 the-shelf’ weight management programme, in a local context.
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29 11 • Embedding stakeholders’ views throughout the entire evaluation process allowed for
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32 12 ongoing, iterative refinement.
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36 14 • A limitation to the quantitative component is the small sample size and findings
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39 15 should be interpreted with caution.
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43 17 • Qualitative interviews and focus groups can only provide information about what
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46 18 participants recall about their experiences, meaning that there is a potential for recall
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1 INTRODUCTION

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8 Failure to implement effective public health interventions when programmes are scaled up or
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10 transferred across contexts is widely reported.¹ Proposed approaches attempting to address
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12 this implementation gap include; effectiveness-implementation hybrid designs,² linking
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14 action to theory and models based on theory,³ and application of the replicating effective
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16 programmes framework.⁴ Common to all is advocacy of a developmental process reflecting
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18 on existing knowledge about the target population and planned programme prior to service
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20 delivery. Furthermore, engagement of service users is encouraged at all stages of intervention
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22 and evaluation design in MRC guidance.⁵ Although this increases the likelihood of services
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24 meeting all stakeholder's needs, concerns about the practical, personal, and professional costs
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26 of co-production have been raised.⁶ Resulting well-designed services will be tailored to a
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28 problem that may have changed during the time spent developing the intervention.
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31 Additionally, public access may be delayed. Resource-pressured public health services must
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33 therefore consider pragmatic alternatives to service design and implementation. In this paper,
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35 we explore a novel evaluation approach to these implementation challenges, focusing on a
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37 problem high on the public health agenda: obesity and overweight.
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45 Targeting elevated weight status is a public health priority, obesity being a recognised risk
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47 factor for many physical and psychological health outcomes.⁷⁻¹¹ In England for example,
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49 obesity and overweight are associated with 30,000 deaths and an estimated National Health
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51 Service cost of £6.1 billion per annum.¹² Globally, countries with higher income inequalities
52
53 tend to have higher rates of obesity.¹³ Excess weight is also associated with widening social
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55 and economic deprivation,¹⁴ with calls to improve the effectiveness of behaviour change
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57 interventions for low-income groups.¹⁵ There is a clear need for effective public health
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1 programmes that can be refined according to local need. This evaluation focuses on
2 Northumberland, in northeast England. Northumberland is one of the lowest ranked counties
3 in England by Gross Value Added per capita (£16,140).¹⁶ Unemployment is higher (5.5%
4 versus 4.8%) than the England average¹⁷ and Northumberland public health spend per person
5 is £53, compared to a £59 national average.¹⁸ 63.8% of adults are classified as having excess
6 weight, higher than the national average of 61.3%.¹⁹

7
8 The need for innovation within public health has been postulated, shifting away from the
9 traditional linear pre-conceived and evidence-based model.²⁰ Parry and colleagues²¹ highlight
10 a need to explore how a programme works, but also the context and requirements for any
11 adaptations. One such approach is prototyping²² where projects test innovations iteratively,
12 with ongoing refinement considering the interplay between a programme and its delivery
13 context. Evaluation and public health teams are able to communicate at all stages of the
14 programme, with evaluation recommendations incorporated via a rapid-cycle basis²¹. A small
15 number of studies to date, for example in drug prevention²² and web-based support of long-
16 term weight loss²³ have demonstrated efficiencies (including time, adaptation to context and
17 cost) when including elements of prototyping within programme development. Such an
18 approach seems particularly well-suited to weight management, where there are many
19 examples of ‘good’ practice, or effectiveness, but no clear consensus on ‘best’ practice at
20 service-delivery level. There is also limited understanding of how ‘scaling up’ and adapting
21 of programmes or interventions to local contexts may impact on effectiveness. This
22 evaluation has particular value therefore in testing a prototyping approach for a weight
23 management programme, delivered and adapted ‘in real-time’, at local authority level.
24 The aim was to explore implementation of an ‘off-the-shelf’ weight management programme,
25 Momenta²⁴, in a challenging context. Specific objectives were to identify preliminary

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3 1 programme effectiveness, explore local implementation, and consider feasibility of the
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5 2 iterative prototyping evaluation framework.
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10 4 **METHODS**

15 6 **The prototyping process: local context and evaluation design**

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19 8 A local authority health needs assessment identified a gap in provision for a lifestyle-based
20
21 9 weight management referral programme within Northumberland. Adults with overweight or
22
23 10 obesity were at the time eligible for referral to the Northumberland exercise referral scheme
24
25 11 (ERS), however previous evaluation demonstrated modest weight loss²⁵ and body mass index
26
27 12 (BMI) >30 kg/m² was negatively associated with adherence.²⁶ Thus ‘Momenta’ was
28
29 13 commissioned for local adaptation and delivery. Momenta is an outcome-driven programme
30
31 14 incorporating evidence-based behaviour change techniques, that is designed to be delivered
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33 15 by fitness professionals in a leisure environment.²⁴ Developed by the MEND childhood
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35 16 weight management programme²⁷ designers, this 12-week programme aims to facilitate
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37 17 weight loss by engaging participants in 12 key behaviours broadly encompassing psychology,
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39 18 diet and physical activity. Briefly, Momenta sessions explored topics using interactive and
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41 19 experiential learning techniques including brainstorming, group activities and discussion,
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43 20 quizzes and games. At the end of each session, participants set goals focusing on one of the
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45 21 12 key behaviours. At the beginning of each session, the group discussed the previous weeks’
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47 22 goals by exchanging stories and brainstorming challenges. All interventions were free to
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49 23 service users.
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1 The local Leisure Trust was commissioned to deliver a pilot Momenta programme.
2 Commissioners and providers had ideas about alternative delivery options and due to an
3 established academic relationship, asked the study team for advice about robust evaluation
4 that would allow for feedback in real time and at the end of the pilot. Stakeholder meetings
5 were held with Public Health staff (n=2), Leisure Trust managers (n=3), delivery staff (n=2)
6 and Momenta programme developers (n=2). As part of the prototyping process, members of
7 the evaluation team (CDR, EO) provided guidance on evaluation design and light touch
8 advice about tools to explore preliminary effectiveness. The evaluation was thus co-
9 produced to ensure a robust framework, whilst meeting strategic local needs. For example,
10 commissioners were concerned about meeting recruitment targets for an existing specialist
11 weight management service used mainly for pre-bariatric patients and Momenta was initially
12 commissioned for patients with BMI 25.0-29.9 kg/m², although this was later amended.
13 Furthermore, commissioners were keen to consider accessibility of provision and wished to
14 explore offering free gym, swimming and fitness class membership. The evaluation was
15 designed to accommodate this.

16
17 The programme was delivered at two leisure sites situated within the 20% and 50% most
18 deprived neighbourhoods in the country. Six General Practice (GP) surgeries, identified as
19 the best referrers to the existing ERS, were asked to refer suitable patients to Momenta. The
20 programme manager and the public health improvement manager (LN) attended practice
21 meetings to articulate referral criteria and disseminate advertising materials. Attendance
22 varied from two to all practice staff, meaning that in some surgeries knowledge of the
23 programme was reliant on dissemination by those who attended.

24

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3 1 A mixed methods evaluation was agreed between the evaluation team and commissioners.
4
5 2 Quantitative and qualitative components were conducted concurrently and had equal status.²⁸
6
7
8 3 Prototyping allowed for iterative changes to be made to the implementation and delivery of the
9
10 4 programme in real time. We reflect upon these in the results and discussion.
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15 6 **Quantitative evaluation component**

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19 8 Referrals by healthcare professionals (HCPs) were via a standardised form to the appropriate
20
21 9 leisure site. Programme providers allocated service users into one of three comparison
22
23
24 10 groups:

- 25
26 11 a) Combined Momenta plus fitness membership (Momenta-Fitness);
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28 12 b) Momenta;
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30 13 c) Fitness membership (Fitness only).
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33 14 Participants were allocated into groups in order of receipt (the first referral form received was
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35 15 allocated to Momenta-Fitness, the second form to Momenta, the third form to fitness only
36
37 16 etc.). The provider then contacted participants by telephone to arrange attendance. If a
38
39 17 participant was unable to attend the allocated group, (e.g. due to inconvenient session times)
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41 18 provider allocated them to a different group after discussion. Due to maximum
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43 19 recommended Momenta group size, referrals were split into delivery cohorts of 15, with
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45 20 groups rolling through March 2015 to April 2016.
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51 22 Outcome measures included anthropometric measurements to determine weight change.

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53 23 Secondary well-being outcome measures were of specific interest to commissioners. Prior to
54
55 24 programme commencement the Leisure Trust, in conjunction with the Momenta programme
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57 25 designer and members of the evaluation team, held a training day for delivery staff. Although
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1 staff were qualified to deliver Momenta, extra bespoke training (including role-play scenarios
2 and problem-solving discussions) was delivered by the clinical psychologist who designed
3 Momenta. The evaluation team (CDR, CH) trained delivery staff in international standard
4 anthropometric techniques²⁹ and familiarised them with other evaluation measures.
5
6 Age, gender and postcode (for index of multiple deprivation, IMD) were recorded by
7 referring HCPs on the referral form. Employment status, level of education, cohort wave and
8 programme group were recorded by leisure staff, who also measured weight and stature
9 (without shoes or bulky clothing) and waist circumference at baseline and programme end.
10 Measures were taken in at least duplicate, using standardised tools in accordance with
11 international standards²⁹ using SECA 761 scales, a Leicester portable stadiometer and
12 anthropometry tape. Body mass index was calculated and classified according to WHO
13 guidelines.³⁰ The Warwick-Edinburgh Mental Well-being Scale,³¹ and the Hospital Anxiety
14 and Depression Scale³² were administered at each time-point. Attendance at Momenta and
15 leisure centre usage was monitored via swipe-card tracking. 52 weeks after commencing the
16 programme, participants were invited to attend a follow-up session, where leisure staff
17 repeated physiological and psychological measures. Programme providers collected and
18 collated quantitative data and provided an anonymised dataset to the evaluation team for
19 analysis.

21 **Qualitative evaluation component**

23 Implementation effectiveness for the referral process was explored through semi-structured
24 interviews with referring HCPs (undertaken at referring surgeries) and focus groups with
25 service users (in leisure centres). All were conducted by LN during March-July 2015, as part

1 of her Public Health Masters degree (which contained qualitative methods training), mentored
2 by TF, an experienced qualitative researcher. Questions are included in supplementary file 1.
3 Data were audio-recorded. Results are reported using the Consolidated criteria for Reporting
4 Qualitative research guidelines³³

5
6 Practice managers from all six referring surgeries were sent an invitation for staff to take part
7 (n = 84), (General Practitioner = 53, Practice Nurse = 18, Health Care Assistant = 13).
8 Individual correspondence was sent to those agreeing. Interviews aimed to explore HCPs'
9 referral experiences; raising weight issues; assessing readiness to change; marketing and
10 referral materials; and the referral process. Interview questions were pilot tested with public
11 health colleagues to assess timing and ensure validity. One question (*Thinking about after*
12 *you referred the patient, what happened next?*) was omitted after piloting as it was realised
13 HCPs would not have had patient feedback at that point. Interviews lasted on average 26
14 minutes and were transcribed verbatim. Data were analysed following each interview, with
15 developing themes considered to determine whether questions required refinement. Initial
16 themes generated from the first two interviews did not change and thus questions remained
17 constant, although prompts were added.

18
19 During the initial assessment session for the first wave of referrals, all (n = 39) were invited
20 to participate in a series of focus groups at programme-end to explore experiences. Emphasis
21 was placed on the referral process, initial expectations and experiences of participation; how
22 weight issues were raised by HCPs; time from referral to initial assessment; and facilitators
23 and barriers to taking part. Focus groups lasted between 26 and 44 minutes.

24 25 **Patient and public involvement**

1 Data from deliverers and service users, along with direct input from commissioners, fed into
2 the iterative evaluation.

3

4 **Data analyses**

5

6 The anonymised quantitative dataset was analysed using PSAW Statistics V.22. Descriptive
7 statistics were calculated for age, gender, IMD, employment status, initial BMI, leisure site,
8 level of education, and uptake and adherence. Distribution and normality of measures
9 (weight, BMI, waist circumference, psychological wellbeing and attendance) were assessed
10 using Shapiro Wilk tests and median and interquartile range (IQR) scores calculated for each
11 group at baseline and 12 weeks (attendance, 12 weeks only). Using complete cases, Kruskal-
12 Wallis H tests were used to determine between-group differences at baseline and at 12 weeks
13 and Wilcoxon-signed rank tests examined repeated measures differences between baseline
14 and 12-week scores. Complete cases available at 52 weeks ($n = 37$) were considered
15 similarly, but via separate analyses due to limited available data across the comparison
16 groups.

17

18 Qualitative data were audio-recorded and transcribed by LN using a thematic process.³⁴ Data
19 were organised according to concepts, key themes and developing categories. Data coding
20 was discussed with TF, allowing comparison of data interpretation and subsequent coding
21 refinement. Evolving key themes were refined through the analysis process and subsequent
22 cross-sectional thematic labelling of data, thus generating deeper understanding. Where
23 possible, key phrases or expressions identified from interviews and focus groups were
24 retained within coding and thematic labelling. A public health colleague helped to verify

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3 1 interpretations of the data and appropriateness of codes applied. Once initial interviews were
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5 2 coded this framework was applied to remaining data. Notes taken during focus groups helped
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8 3 to contextualise when developing themes and included information about dynamics within
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10 4 groups, such as influence, disagreement, humour and peer exposure.
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15 6 **RESULTS**

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19 8 Between December 2014 and March 2016, the programme received 182 referrals and was
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21 9 delivered in four cohorts across leisure sites. Due to initial low levels of recruitment, the first
22
23
24 10 cohort did not start until March 2015. Referrals were mainly female (83%) and 30.6% lived
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26 11 in the 20% most deprived areas (table 1).
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Table 1. Demographic characteristics of referrals (n=165)

	Median	IQR
Age (years)	53	24
Gender (n=167)	n	%
Male	29	17.4%
Female	138	82.6%
Initial BMI category (kg/m², n=150)		
25.0-29.9	40	26.7%
30.0-34.9	73	48.6%
35.0-39.9	27	18.0%
≥40.0	10	6.7%
Leisure site (n=170)		
Leisure site 1 (IMD quintile 2)	80	44.7%
Leisure site 2 (IMD quintile 3)	99	55.3%
Index of multiple deprivation (n=170)		
20% most deprived	52	30.6%
21-40%	41	24.1%
41-60%	20	11.8%
61-80%	20	11.8%
20% least deprived	37	21.6%
Employment status (n=123)		
Employed full time	37	30.1%
Employed part time	24	19.5%
Retired	51	41.5%
Claiming incapacity benefit	5	4.1%
Claiming job seekers allowance	6	4.9%
Level of education (n=127)		
Primary	15	11.8%
Secondary (O level/GCSE)	35	27.6%
Secondary (A level)	26	20.5%
Further education (HND)	25	19.7%
Bachelors or equivalent	21	16.5%
Masters or equivalent	5	3.9%

Preliminary programme effectiveness

Of all referrals, 153 (84%) attended the baseline measurement session and 78 (51% of those who started) attended the 12-week measurement session. Uptake and adherence varied by programme group (table 2).

1 **Table 2. Programme uptake, adherence and attendance.**

Uptake and adherence	Momenta-Fitness		Momenta only		Fitness only	
Number referred		58		59		65
Uptake* (n, %)		54 (93.1%)		50 (84.7%)		49 (75.4%)
Uptake retention** (n, %)		35 (64.8%)		27 (54.0%)		16 (32.7%)
Uptake adherence^ (n, %)		34 (63.0%)		26 (52.0%)		8 (50.0%)
Overall retention*** (n, %)		35 (60.3%)		27 (45.8%)		16 (24.6%)
Overall adherence^^ (n, %)		34 (58.6%)		26 (44.1%)		8 (12.3%)
Momenta session attendance	Momenta-Fitness		Momenta only		Fitness only	
	n	Median (IQR)	n	Median (IQR)		
Uptake	54	9.0 (7.3)	50	9.0 (8.0)		
Dropouts	19	3.0 (3.0)	23	3.0 (5.0)		N/A
Completers^^^	35	10.0 (2.0)	27	11.0 (1.3)		
Exercise session attendance	Momenta-Fitness		Momenta only		Fitness only	
	n	Median (IQR)	n	Median (IQR)	n	Median (IQR)
Uptake	54	7.0 (16.3)	50	0.0 (4.5)	49	0.0 (1.5)
Dropouts	19	0.0 (1.0)	23	0.0 (0.0)	33	0.0 (0.0)
Completers^^^	35	10.0 (14.0)	26	0.0 (5.0)	16	4.5 (18.0)

*Uptake** participant attended baseline assessment; *Uptake retention*** % of participants who attended the baseline assessment who also attended the 12-week assessment; *Uptake adherence^* % of participants who attended the baseline assessment who also attended ≥ 8 Momenta sessions (Momenta-Fitness and Momenta only) or gym sessions (fitness only); *Overall retention**** % of all those referred who attended both baseline and 12-week assessment; *Overall adherence^^* % of all those referred who attended ≥ 8 Momenta sessions (Momenta-Fitness and Momenta only) or exercise sessions (fitness only); *Completers^^^* those who completed the 12-week assessment

3

4 Physiological and psychological data were not normally distributed. Quantitative findings are
 5 presented as exploratory, due to the small sample size. No significant differences were found
 6 between programme groups either at baseline or at 12 weeks, for any measures. Significant
 7 within-group differences between baseline and 12 weeks were evident for weight, BMI and
 8 waist circumference for Momenta-Fitness, and Momenta (Table 3). Follow-up analysis at 52-
 9 weeks (available sub-sample) showed changes were maintained for Momenta-Fitness ($n=18$)
 10 only.

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1 **Table 3. Weight, BMI and waist circumference change.**

End of programme results	Median (IQR) Baseline	Median (IQR) 12 weeks	z	p	Median (IQR) Change
Weight (kg)					
Momenta-Fitness (n=35)	88.9 (80.5 - 100.0)	88.0 (77.2 - 95.8)	-4.531	<0.001	-2.9 (-5.1 - -1.6)
Momenta only (n=26)	87.8 (74.5 - 77.0)	83.3 (74.5 - 92.5)	-4.344	<0.001	-2.9 (-5.0 - -2.0)
Fitness only (n=15)	76.2 (71.6 - 86.9)	76.6 (70.4 - 84.6)	-0.879	0.379	0.0 (-3.2 - 1.0)
BMI (kg/m²)					
Momenta-Fitness (n=35)	32.0 (30.3 - 35.7)	31.3 (29.2 - 35.3)	-4.494	<0.001	-1.1 (-1.9 - -0.6)
Momenta only (n=26)	32.0 (30.0 - 34.5)	31.3 (28.6 - 33.6)	-4.356	<0.001	-1.2 (-1.6 - -0.8)
Fitness only (n=14)	29.2 (27.3 - 33.0)	29.7 (27.0 - 33.3)	-0.454	0.650	0.1 (-1.2 - +0.4)
Waist circumference (cm)					
Momenta-fitness (n=35)	106.0 (98.0 - 115.0)	99.0 (93.0 - 110.0)	-4.996	<0.001	-7.0 (-9.5 - -5.0)
Momenta only (n=25)	108.0 (99.5 - 114.5)	101.0 (93.8 - 111.5)	-4.166	<0.001	-5.0 (-7.3 - -2.5)
Fitness only (n=11)	90.0 (87.0 - 95.0)	91.0 (90.0 - 96.0)	0.358	0.650	1.0 (-3.0 - 3.0)
52-week follow-up	Median (IQR) Baseline	Median (IQR) 52 weeks	z	p	Median (IQR) Change
Weight (kg)					
Momenta-Fitness (n=18)	95.2 (87.1 - 101.4)	91.4 (82.7 - 95.9)	-3.006	<0.001	-4.8 (-6.2 - -1.5)
Momenta only (n=16)	84.7 (72.3 - 95.2)	82.7 (73.2 - 94.6)	-1.533	0.120	-0.7 (-7.6 - 0.8)
*Fitness only (n=3)	73.4 (69.5 - 80.2)	70.3 (66.0 - 87.0)			0.9 (-7.4 - 6.9)
BMI (kg/m²)					
Momenta-Fitness (n=18)	32.0 (30.49 - 35.1)	30.8 (28.7 - 34.0)	-3.157	<0.05	-1.7 (-2.0 - -0.6)
Momenta only (n=16)	31.7 (29.3 - 33.9)	31.1 (26.7 - 33.6)	-1.603	0.109	-0.3 (-2.3 - 0.3)
*Fitness only (n=3)	27.6 (27.5 - 30.5)	27.8 (24.8 - 33.2)			0.3 (24.8 - 33.2)
Waist circumference (cm)					
Momenta-Fitness (n=18)	109.0 (101.0 - 114.8)	100.5 (94.8 - 107.3)	-3.221	<0.001	-6.0 (-13.3 - -1.75)
Momenta only (n=16)	106.0 (94.5 - 115.8)	103.5 (98.5 - 113.3)	-0.780	0.938	-2.5 (-9.0 - -10.0)
*Fitness only (n=3)	89.0 (87.0 - 95.0)	90.0 (90.0 - 101.0)			3.0 (90.0 - 101.0)

* Fitness only n=3 therefore median and range reported and no statistical test completed.

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Significant improvement in mental wellbeing, and reductions in depression and anxiety, were evident between baseline and 12 weeks for Momenta-Fitness, and Momenta (Table 4). The magnitude of change was relatively small but functionally and clinically meaningful. For example, the median value for anxiety for Momenta dropped from a moderate symptomology to a not symptomatic classification. 52-week sub-sample analysis showed that significant improvements for wellbeing and depression were maintained for Momenta-Fitness (n=18), and wellbeing and anxiety for Momenta (n=16).

Table 4. Wellbeing, anxiety and depression measures change.

End of programme results	Median (IQR) Baseline	Median (IQR) 12 weeks	z	p	Median (IQR) Change
Mental wellbeing scale					
Momenta-Fitness (n=29)	46.0 (40.0 - 51.5)	53.0 (40.0 - 51.5)	3.810	<0.001	5.0 (1.5 - 12.0)
Momenta only (n=23)	49.0 (39.0 - 58.0)	55.0 (51.0 - 63.0)	2.818	<0.05	6.0 (-1.0 - 10.0)
Fitness only (n=13)	47.0 (40.5 - 59.5)	46.0 (42.0 - 63.5)	0.157	0.875	0.0 (-4.0 - 5.0)
Anxiety scale					
Momenta-Fitness (n=28)	5.5 (4.0 - 9.8)	4.5 (2.0 - 7.0)	-3.027	<0.001	-1.0 (-3.0 - 1.0)
Momenta only (n=23)	8.0 (6.0 - 10.0)	4.0 (2.5 - 9.0)	-2.329	<0.05	-1.0 (-3.0 - 0.0)
Fitness only (n=13)	8.0 (3.5 - 10.0)	6.0 (4.0 - 9.0)	-0.499	0.618	-1.0 (-2.0 - 2.0)
Depression scale					
Momenta-Fitness (n=28)	5.5 (3.3 - 8.0)	2.0 (1.0 - 6.0)	-3.214	<0.05	-2.5 (-4.8 - -0.3)
Momenta only (n=23)	5.0 (3.0 - 7.5)	3.0 (1.0 - 5.0)	-3.049	<0.05	-1.0 (-4.5 - 1.0)
Fitness only (n=13)	4.0 (2.0 - 8.5)	2.0 (2.0 - 7.0)	-1.226	0.220	-2.0 (-4.5 - 0.0)
52-week follow-up	Median (IQR) Baseline	Median (IQR) 52 weeks	z	p	Median (IQR) Change
Mental wellbeing scale					
Momenta-Fitness (n=15)	44.0 (39.0 - 52.0)	55.0 (48.0 - 59.0)	2.984	<0.05	5.0 (3.0 - 15.0)
Momenta only (n=13)	58.0 (47.5 - 59.0)	56.0 (54.0 - 63.5)	2.282	<0.05	4.0 (0.5 - 6.5)
*Fitness only (n=3)	47.0 (34.0 - 64.0)	58.0 (45.0 - 60.0)			-2.0 (-6.0 - 26.0)
Anxiety scale					
Momenta-Fitness (n=15)	6.0 (2.0 - 10.0)	2.0 (1.0 - 7.0)	-1.785	0.074	-3.0 (-6.0 - 0.0)
Momenta only (n=15)	7.0 (4.0 - 9.0)	5.0 (1.0 - 8.0)	-1.990	<0.05	-3.0 (-4.0 - 0.0)
*Fitness only (n=3)	9.0 (5.0 - 10.0)	2.0 (1.0 - 8.0)			-3.0 (-8.00 - -2.0)
Depression scale					
Momenta-Fitness (n=15)	7.0 (3.3 - 11.3)	3.5 (1.0 - 6.0)	-2.908	<0.05	-3.5 (-6.3 - -0.8)
Momenta only (n=15)	4.0 (1.0 - 6.0)	3.0 (1.0 - 4.0)	-0.762	0.446	0.0 (-2.0 - 1.0)
*Fitness only (n=3)	3.0 (0.0 - 8.0)	2.0 (1.0 - 8.0)			1.0 (-8.0 - 5.0)

* Fitness only n=3 therefore median and range reported and no statistical test completed.

Overall, the results suggested those who participated in the two groups incorporating Momenta, had enhanced physical and psychological health indicators from baseline, whereas those who had only free fitness membership did not. There is some evidence, for a small follow-up sample, that the combination of Momenta and fitness membership produces the best outcomes at 52 weeks.

1 **Implementation effectiveness: reflections from referring healthcare professionals**

2

3 Five face-to-face semi-structured interviews took place with HCPs across five referring
4 surgeries: two GPs, two Practice Nurses and one Health Care Assistant. HCPs perceived that
5 four key themes influenced the effectiveness of programme implementation: (i) difficulties
6 raising weight with patients, (ii) how gender affected patient engagement, (iii) availability of
7 information and resources, and (iv) additional barriers constraining programme promotion.

8

9 Raising the issue of weight with patients:

10

11 Concerns about raising weight may have contributed to slow recruitment, with nurses and
12 healthcare assistants expressing unease, *'not really up to me... well I talk about it if they want*
13 *to.... Better if they [patients] bring it up.'* (Interview 2, Healthcare Assistant). GPs seemed
14 more comfortable raising weight with patients, but with the caveat that this is easier in the
15 context of a longer-term GP/patient relationship.

16

17 *'the people I see I've known for a very long time... it's the rapport you have...if I'd*
18 *never met anyone before and they came in for a sore throat I'm not going to say*
19 *you're fat...If there was someone I'd known for a long time and it seemed*
20 *relevant...I'd mention it.'* (Interview 5, GP).

21

22 Gender and engagement in the referral process:

23

24 Gender was highlighted as influencing the referral process, women being more likely than
25 men to seek support for weight. This may help explain the low rate of referral for males
(17%):

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3 1 *'More women talk about it...men don't really talk about weight...I do mention weight*
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5 2 *to men if I'm doing a well man [sic] but it doesn't come up really...it's a woman*
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7 3 *thing...'* (Interview 3, Practice Nurse).
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13 5 Availability of information and resources:
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17 7 Several interviewees highlighted training needs around programme information and
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19 8 resources, (e.g., additional programme information would help to engage patients). For
20
21 9 example, the GPs both discussed the longstanding ERS and stated they needed to become
22
23 10 more familiar with Momenta, as they had with the ERS:
24
25

26 11 *'when we get opportunities to do things in the practice we normally discuss it, let*
27
28 12 *everyone know where appropriate forms and information is and it's in your*
29
30 13 *head...that didn't happen with this and I don't know why that was.'* (Interview 5, GP).
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36 15 All HCPs interviewed felt the referral leaflet (provided by programme providers) was
37
38 16 important in the process, either as a tool to promote the intervention or to convey information
39
40 17 to patients:
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43 18 *'The leaflet was good, bright...explained the programme and patients like taking a*
44
45 19 *leaflet away.'* (Interview 3, Practice Nurse)
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52 21 Additional Barriers to Engagement:
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3 1 Several sub-themes highlighted additional barriers to the referral process. The most
4
5 2 prominent sub-themes were around initial BMI referral criteria (25.0-29.9 kg/m²) and delayed
6
7 3 programme start. Both implementation factors were beyond the control of the referrers, but
8
9 4 consequently amended through iterative refinement during the prototyping process following
10
11 5 early data analysis. Both were reported by practice nurses as exacerbating each other:

12
13
14 6 *‘we were referring but then it didn’t start so people were not sure what was*
15
16 7 *happening [pause]...Think it was more people were needed to start...but you know if*
17
18 8 *the BMI was higher then there would have been more.’* (Interview 3, Practice Nurse).
19
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23
24 10 In one case, a decision was taken to relax the referral criteria, *‘...31.5 [kg/m²]...was just*
25
26 11 *outside so I just referred him.’* (Interview 4, GP).
27
28 12

29
30
31 13 Programme location was perceived by HCPs to overcome an existing barrier to the tier three
32
33 14 weight management programme, as Momenta was *‘round the corner for people,’* as opposed
34
35 15 to *‘a bit far away at the hospital.’* Cost barriers were also discussed, both with reference to
36
37 16 the patient, *‘in this sort of area...cost..., if you’ve got to pay it’s a barrier.’* (Interview 4, GP),
38
39 17 and to expected targets from Clinical Commissioning Groups (CCG),

40
41
42 18 *‘we are constantly told by the CCG that we must keep down on numbers and that if*
43
44 19 *there are costs attached to this referral that would definitely impact... and that would*
45
46 20 *be for all practices.’* (Interview 5, GP)
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22 **Implementation effectiveness: reflections from participants**

23

24
25 24 Three focus groups allowed programme participant voices to be heard: three females and one
26
27 25 male from Momenta (focus group 1), three males and three females from Momenta-Fitness
28
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30

1 (focus group 2) and three females (one of whom emailed her views separately) from Fitness-
2 only. Across the groups, 12 participants reported having lost weight and one reported weight
3 gain. Three themes developed: (i) outcomes of the programme, (ii) facilitators and barriers to
4 engagement, and (iii) raising the issues of weight with HCPs.

5
6 Outcomes of the programme:

7
8 Focus group findings aligned closely with quantitative outcomes in terms of the physical and
9 psychological benefits of participation: *'[I've] lost a good bit of weight. It's been very*
10 *positive for me... I'm feeling a lot more active...'* (Momenta-Fitness, Participant 5).
11 Participants reported a sense of weight loss achievement, increased physical activity levels,
12 and positive mood states. In addition, elements of the Momenta programme were perceived
13 as facilitating engagement, including the *'group feeling... I looked forward to it,'* (Momenta-
14 Fitness, Participant 4), the *'information that we got every week... so very well planned.'*
15 (Momenta-Fitness, Participant 3) and the ongoing support e.g., *'she phoned me the other day*
16 *to see if I was coming,'* (Momenta-Fitness, Participant 4). Momenta participants reflected
17 back on, and identified and discussed lifestyle factors that related to their initial weight gain
18 (e.g., *'I did the usual thing... I started eating toffees,'* Momenta-Fitness, Participant 5),
19 demonstrating both self-awareness and an openness to discussing the topic.

20
21 Facilitators and barriers to engagement:

22
23 One participant reported being initially excluded but later allowed to take part, and others
24 raised concerns that the initial BMI threshold for referral (25-29.9 kg/m²) was too low, *'was a*
25 *little bit high, BMI...managed to get it down... [and then] the doctor put us forward,'*

1 (Momenta, Participant 2). Data also indicated the importance of subsidised access,
2 particularly important in the context of a deprived region such as this, e.g., *'I also joined*
3 *Weight Watchers for short period of time but found the classes too expensive,*' (Fitness-only,
4 Participant 3, emailed response).

5
6 Raising the issue of weight with HCPs:

7
8 Some data did suggest implementation was problematic, however, this focused exclusively
9 on the referral process. Participants overwhelmingly felt that they had opened the
10 conversation about weight, as opposed to discussions being initiated by HCPs (e.g., *'my*
11 *glucose levels were quite high but nobody ever said that I was overweight,*' Momenta-
12 Fitness, Participant 4). In addition, participants perceived limitations in HCPs' knowledge of
13 intervention components (*'she [nurse] didn't know anything about it,*' Fitness-only,
14 Participant 1), something with potential to impact on likelihood of referral, and
15 participants' expectations of programme success.

16 17 **Iterative refinements throughout the evaluation process**

18
19 Here we list a number of implementation adjustments which were made throughout the
20 evaluation process, facilitated via the prototyping framework. Real-time advice from
21 Commissioners was considered during early stages of implementation, regarding the nature
22 of comparison offers (e.g. fitness access) and thus initial design and outcome measurements
23 were adapted prior to referrals being made. To better-target recruitment and change the
24 process of engagement at referral point, entry criteria were altered ($BMI \geq 30 \text{ kg/m}^2$) mid-way
25 through programme delivery. On-site implementation of the service offer was adapted in

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3 1 response to delivery staff feedback: increased resource was made available, for example
4
5 2 additional staffing to support delivery for the first wave of referrals. Furthermore, staff were
6
7 3 given additional time for Momenta session preparation and session delivery times were
8
9 4 extended. Follow-up activities (i.e., text or telephone contact) were implemented by staff
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11 5 during the process, to encourage adherence.
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17 7 **DISCUSSION**

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21 9 We explored ‘prototyping’, as a cost-effective and time-efficient approach to public health
22
23 10 evaluation, via an ‘off-the-shelf’ weight management programme implemented in a local
24
25 11 context of mixed and high deprivation. Quantitative findings should be interpreted as
26
27 12 exploratory, due to the relatively small number of complete cases, however lessons can be
28
29 13 learned from these data both in terms of preliminary outcomes and engagement/dropout.
30
31 14 Participation in Momenta and Momenta-Fitness resulted in 12-week weight loss for those
32
33 15 who completed the programme. Free fitness membership without the weight-management
34
35 16 programme was poorly engaged with and did not lead to weight change. A small sub-sample
36
37 17 who attended follow-up demonstrated that after one year, weight reductions equivalent to
38
39 18 ~4% could be maintained for Momenta-Fitness. We caution that this might be best
40
41 19 interpreted as hypothesis-generating for future evaluations, given the small number of
42
43 20 available cases, however we will consider potential mechanisms here. Providing free access
44
45 21 to fitness facilities alongside the behaviour change programme may allow for continuous and
46
47 22 self-driven behaviour change³⁵ and sustaining optimal changes in adiposity over 12 months in
48
49 23 those who remained engaged.³⁶ Swipe card monitoring during the initial 12-week period
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51 24 indicated that fitness sessions were accessed an average 10 occasions for this group, whereas
52
53 25 no access was apparent for Momenta, despite Momenta sessions being held in leisure centres.
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1 This could be important for community providers making decisions about delivery location.
2 Both Momenta groups reported improved wellbeing, and reduced anxiety and depression at
3 12-weeks suggesting that the behavioural intervention may drive this effect. This is consistent
4 with previous work reporting co-varying changes in weight loss, depression, and quality of
5 life in weight management services.³⁷ It is unclear whether the primary mechanism was
6 weight loss, or the wider social benefits of participation. Both were valued in the qualitative
7 data. Our preliminary evidence of maintained improvements in wellbeing for these groups at
8 52 weeks is particularly relevant given previously evidenced associations between poor
9 mental health, and obesity and overweight status.³⁸

10
11 Experiences of both referrers and referrals highlighted that HCPs needed to be better-
12 informed and more confident raising weight-related conversations. Whilst patient-led action
13 is desirable, staff reluctance to raise weight issues may mean that opportunities for
14 engagement of less knowledgeable or motivated patients will be missed. The problematic
15 positioning of GPs within obesity care has been highlighted previously,³⁹ with a range of
16 strategies to change HCPs' behaviour resulting in little or no change to patients' weight. A
17 practical training need is highlighted for those working at the patient-practitioner interface,
18 however communication with patients about weight may well be hindered by the 'stigma'
19 attached to obesity.⁴⁰ This has wider implications for patient outcomes and requires further
20 exploration through the implementation process. Additionally, HPCs need better
21 understanding of referral-based public health programmes offered. Despite efforts of
22 programme and public health managers, awareness was reportedly low for some referring
23 professionals. We suggest consideration of resource-efficient ways to signpost both HPCs
24 and patients themselves as part of the implementation process.

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3 1 This programme was delivered across a social gradient in a region with low health indices
4
5 2 and areas of high deprivation. Some issues in relation to inequalities and service access for
6
7 3 future community-based weight management programmes were highlighted. Only 17% of
8
9 4 referrals to Momenta were males. Gender bias in weight management referral has been
10
11 5 reported elsewhere,⁴¹⁻⁴² and interviews showed that practitioners struggled to raise the topic
12
13 6 of weight with male patients. Alternative referral strategies have been employed in other
14
15 7 settings in an attempt to overcome this.⁴³ Marketing in other community spaces, or targeted
16
17 8 postal referrals could be explored in future implementation. The initial decision to restrict
18
19 9 referral to overweight-only substantially impacted on referral rates, with HCPs and referrals
20
21 10 indicating they felt limited until this restriction was reversed. Had this continued, worsening
22
23 11 health inequalities may have been an unintended consequence, something to be actively
24
25 12 avoided within public health programmes ⁴⁴. The roles of, and interactions between, those
26
27 13 operating in the 'system' (i.e. the context within which the intervention operates) must be
28
29 14 considered at the point of implementation to minimise any impact from unintended
30
31 15 consequences.⁵ In practical terms, this may be through continued dialogue with
32
33 16 commissioners, referring professionals and referrals themselves, something which
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35 17 prototyping evaluation allows.
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45 19 Given that no systematic problems emerged with participants' experiences of the programme
46
47 20 itself, our findings lend support to a streamlined approach to involvement of all stakeholders
48
49 21 in programme implementation. We suggest that prototyping demonstrates opportunities for
50
51 22 off-the-shelf programmes to be pragmatically moulded to local context, in real-time. Many of
52
53 23 the iterative changes made were staff-driven. This demonstrates that real-time consideration
54
55 24 of feedback from on-site delivery teams can be important to the implementation process.
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57 25 Some of the adjustments required commissioning action, as they had resource implications;
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1 others needed advice from the evaluation team. Interestingly changes made throughout the
2 process generally focused on both staff and participant experience.

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10 Emergence of some negative experiences of referral suggests, however, that prototyping can
11 be problematic without networks or channels for ensuring key outcomes are widely
12 communicated to relevant stakeholders. Overall, the evaluation demonstrated that a balance is
13 needed to allow quick and efficient adaptation of off-the-shelf programmes, but with focused
14 professional user engagement in the early stages of development. The prototyping approach
15 had particular utility given that project resources were limited and meant that issues were
16 identified and acted upon rapidly. While the programme may have progressed similarly
17 without this, prototyping provided a greater structure for, and confidence in, on-going
18 refinements. This was achieved via the support provided by academics, public health
19 practitioners and providers. Fundamentally, adopting a prototyping approach enabled the
20 delivery of a new service to an in-need population, alongside the generation of initial
21 evidence of local effectiveness. A minimum of 1 kg weight-loss at 3 months, and 0.7 kg at
22 12-months have been suggested as thresholds to influence decisions over commissioning of
23 weight-loss services.⁴⁵ Our preliminary data shows that Momenta met and indeed exceeded
24 these and shows particular promise when implemented in conjunction with free fitness
25 provision.

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49 Demonstrating preliminary effectiveness is of limited use, however, unless a successful
50 programme in one area may be adapted and implemented to suit a different context, for
51 example through sharing local-level knowledge, interactions and behaviours of individuals
52 within different parts of that system.⁴⁶ The process for scaling-up of effective health
53 interventions to broader policy and practice takes years⁴⁷ and certainly within the obesity
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1 literature, has been dominated by initiatives that consider effectiveness but not
2
3 implementation across specific settings.⁴⁸⁻⁴⁹ We recommend prototyping might be built into
4
5 larger public health evaluations providing that the original programme has a sound theoretical
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8 basis, and iterative refinement is engaged with by all stakeholders from the outset.
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14 **CONCLUSION**

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19 We demonstrate good preliminary outcome effectiveness for ‘Momenta’, particularly in
20
21 conjunction with a free fitness offer. The programme was experienced positively by those
22
23 who attended. Issues with the referral process need to be explored further, however other
24
25 refinements were feasible during delivery. This evaluation extends the literature by exploring
26
27 prototyping for a complex problem, community weight-management, in a challenging setting,
28
29 demonstrating streamlined implementation of an ‘off-the-shelf’ weight management
30
31 programme. This resource-effective approach is highly relevant in the context of health
32
33 inequalities and public health sector funding constraints.
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43
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45
46
47
48
49

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51
52 evaluation, data analysis and preparation the final document. LN contributed to design and
53
54 analyses of the qualitative evaluation component. TF contributed to qualitative design and
55
56 analysis and preparation of the final document. AL contributed to design of the quantitative
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58 evaluation and preparation of the final document.
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12

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14 initiating the evaluation. She was subsequently employed as a research assistant at Durham
15 University, however was not involved in any data collection or entry, only accessing an
16 anonymised database submitted to the University. LN was a Public Health Improvement
17 Manager within the Public Health Team and had responsibility for commissioning the
18 Momenta programme. The qualitative evaluation component was submitted in partial
19 fulfilment of her Masters in Public Health at Newcastle University.

20

21 **Participant consent:** Consent was obtained for face-to-face interviews and focus groups.
22 Service users were informed in writing of the nature of the quantitative service evaluation and
23 how to withdraw from it. The presented data are anonymised with risk of identification low.

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3 1 **Ethics approval:** Ethical advice was sought from the local Research Manager of North of
4
5 2 England Commissioning Support, and this project was classed as a service evaluation in line
6
7 3 with National Research Ethics Service guidance.
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13 5 **Data availability statement:** No additional data are available because this was a service
14
15 6 evaluation.
16
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19 7

For peer review only

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SUPPLEMENTARY FILE 1.**Healthcare professionals' semi-structured interview guide**

Semi Structured Interview Set the interviewee at ease; explain purpose of the interview; offer a better understanding of what the referral process requires to aid tier 2 weight management to be delivered in Northumberland; explanation about how the interview will be recorded; reaffirmation of consent; and how the information will be analysed and stored; rules of confidentiality / anonymity etc.

Questions:

1. Thinking about raising the weight issue, tell me about your experience of discussing weight with patients.

Prompts

- *How does it feel to raise weight as an issue?*
- *Are patients open to discussing weight problems?*
- *Do you find a difference between genders when discussing weight?*
- *What helps you, such as the NHS Health Check Programme, to raise the issue of weight?*
- *What else would help to raise the issue or weight in appointments?*

2. Greater retention is often achieved when patients are ready to change, tell me how you work with / assess patient's readiness to change.

Prompts

- *Have you had training around the cycle of change?*
- *Do you use any specific tools or resources to assess the patient?*
- *What would help you to assess the patient's readiness to change?*

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3. Thinking the information and resources available to you during the referral, do you feel you had enough information and resources to encourage patient take up of the programme?

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Prompts

- *Did you have enough background information?*
- *Were the referral forms suitable / capture all the information required?*
- *Were the patient leaflets / resources suitable?*
- *Were there questions or issues raised that couldn't be answered?*
- *Was the process easy to use?*
- *What else could help you to make referrals to weight management programmes?*

4. Thinking about after you referred the patient, what happened next? (excluded after pilot)

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Prompts

- *Did you get feedback from the weight management programme on the progress of your patient?*
- *Did your patients achieve weight loss?*
- *Did your patient come back and talk about their experience?*

5. What things are most likely to prevent you from making the referral a weight management programme, either commercial or Public Health funded?

Prompts

- *Are there barriers that you perceive, such as cost to the patient?*
- *Are you concerned with raising the weight issue?*
- *Is it a time factor if the patient has an appointment for anything other than a weight issue?*
- *What would help you to overcome the barriers that prevent you from making the referral?*

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6. Is there anything else that you would like to tell me about your expectations and experiences of the weight management programme?

8 **Focus Group Topic Guide**

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14 *Set group at ease; explain purpose of the focus group; offer a better understanding of what works for*
15 *people in terms of tier 2 weight management and what doesn't, aiding development of an effective*
16 *programme for Northumberland residents; explanation about how the focus group will be recorded;*
17 *reaffirmation of consent; and how the information will be analysed and stored; rules of confidentiality /*
18 *anonymity etc.*
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- 29 1. Tell me a bit about what sort of weight management activity you have taken part in, in the past.

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32 *Prompts*

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- *What influence have others had on your weight management?*
 - *Do you have any particular likes/dislikes of physical activity/managing weight/nutrition*
 - *Has there been anything else that has influenced your management of weight?*

- 44 2. So thinking about the weight management programme you have undertaken, how did you find out
45 about it?
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49 *Prompts*

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- *Who / what motivated you to attend?*
 - *What made you decide that this is the right time to look at managing your weight?*
 - *Did the time of year make a difference?*

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3 3. Thinking about your experience of when you were referred to the weight management programme,
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5 how did you find the process?
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Prompts

- *What type of health professional referred you? (GP / Practice Nurse)*
- *Did you specifically attend Primary Care to discuss your weight?*
- *How was weight raised?*
- *What did the referrer explain to you about the programme? Did you get enough information?*
- *How long was it from your referral from Primary Care to the first assessment in the weight management programme; was this what you expected? Were you still motivated?*

4. How did you feel about being referred?

- *Prompts*
- *How confident did you feel about taking part in the programme?*
- *Was there anything that you were particularly looking forward to?*
- *Was there anything that you were worried about?*

5. What did you hope to achieve by taking part in the weight management programme?

Prompts

- *What were your expectations when you start attending the scheme?*
- *Have there been changes to your health that you expected happen as a result of participation?*
- *How quickly did you expect to see these changes? And did this happen?*

6. Thinking about after you were referred, what happened next?

Prompts

- *How long after referral did it take to be contacted by the Active Northumberland?*
- *What information did you receive prior to the initial consultation?*
- *How comfortable did you feel coming to the initial consultation?*

7. What influenced you most to attend the weight management programme?

Prompts

- *What did you expect from the staff?*
- *How important to you were changes in health or weight?*
- *Why were the influences raised important?*

8. What things were most likely to prevent you from attending the programme?

Prompts

- *Tell me about any worries you might have had about health issues.*
- *Tell me about any other things, such as other commitments, that might have stopped you from attending*
- *Did any of these issues arise? How did you overcome these issues?*

9. Now that you have completed the programme, tell me how did you felt about undertaking the weight management programme?

Prompts

- *Did you achieve the health / weight outcomes you expected?*
- *Why do you think it worked or not for you?*
- *Do you feel you now have the tools to continue to make positive lifestyle choices?*
- *Is there something that will prevent you to continue to make positive lifestyle choices?*

10. Is there anything else that you would like to tell me about your expectations and experiences
of the weight management programme?

For peer review only

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BMJ Open

Prototyping for public health in a local context: a streamlined evaluation of a community-based weight management programme (Momenta), Northumberland, UK

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Keywords:	public health evaluation, prototyping, implementation, community weight management, NUTRITION & DIETETICS, exercise referral

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3 1 Prototyping for public health in a local context: a streamlined evaluation of a community-
4 based weight management programme (Momenta), Northumberland, UK
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10 4 Caroline J Dodd-Reynolds^{1,2} (corresponding author*), Lisa Nevens³, Emily J Oliver^{1,2}, Tracy
11 Finch⁴, Amelia A Lake^{5,6} Coral L Hanson⁷
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¹Department of Sport and Exercise Sciences, Durham University, Durham, DH1 3HN, UK*.

Email: caroline.dodd-reynolds@durham.ac.uk Tel: +44(0)191 3342000

²Wolfson Research Institute for Health and Wellbeing Physical Activity Special Interest Group, Durham University, Durham, UK.

³Northumbria Healthcare NHS Foundation Trust, Northumberland, UK.

⁴Department of Nursing, Midwifery and Health, Northumbria University, Newcastle upon Tyne, UK

⁵Department of Science, School of Science, Engineering and Design, Teesside University, Teesside, UK

⁶Fuse – UKCRC Centre for Translational Research in Public Health, UK

⁷School of Health and Social Care, Edinburgh Napier University, Edinburgh, UK

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Keywords: Public health evaluation, prototyping, implementation, community weight management, diet, exercise referral

1 **ABSTRACT**

2 **Objectives** Stakeholder co-production in design of public health programmes may reduce the
3 ‘implementation gap’ but can be time-consuming and costly. Prototyping, iterative refining
4 relevant to delivery context, offers a potential solution. This evaluation explored
5 implementation and lessons learned for a 12-week referral-based weight-management
6 programme, ‘Momenta’, along with feasibility of an iterative prototyping evaluation
7 framework.

8 **Design** Mixed methods evaluation: qualitative exploration of implementation with referrers
9 and service users; preliminary analysis of anonymised quantitative service data (12 and 52
10 weeks).

11 **Setting** Two leisure centres in Northumberland, northeast England.

12 **Participants** Individual interviews with referring professionals (n=5) and focus groups with
13 service users (n=13). Individuals (n=182) referred by healthcare professionals (quantitative
14 data).

15 **Interventions** Three 12-week programme iterations: Momenta (n=59), Momenta-Fitness
16 membership (Momenta-Fitness (n=58), and Fitness membership only (n=65).

17 **Primary and secondary outcome measures** Primary outcome: Qualitative themes
18 developed through stakeholder-engagement. Secondary outcomes included preliminary
19 exploration of recruitment, uptake, retention, and changes in weight, BMI waist
20 circumference and psychological wellbeing.

21 **Results** Service users reported positive experiences of Momenta. Implementation gaps were
22 revealed around the referral process and practitioner knowledge. Prototyping enabled

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3 1 iterative refinements such as broadening inclusion criteria. Uptake and 12-week retention
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5 2 were higher for Momenta (84.7%, 45.8%) and Momenta-Fitness (93.1%, 60.3%) versus
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7 3 Fitness-only (75.4%, 24.6%). Exploration of other preliminary outcomes suggested potential
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9 4 for within-group weight loss and increased psychological wellbeing for Momenta and
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11 5 Momenta-Fitness at programme end. 52-week follow-up data were limited (32%, 33%, and
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13 6 6% of those who started Momenta, Momenta-Fitness and Fitness respectively) but suggested
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15 7 potential for weight loss maintenance in Momenta-Fitness.
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24 9 **Conclusions** Identification of issues within the referral process enabled real-time iterative
25
26 10 refinement, whilst lessons learned may be of value for local implementation of ‘off-the-shelf’
27
28 11 weight management packages more generally. Our preliminary data suggest that Momenta
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30 12 has potential for weight loss, particularly when offered with a fitness membership.
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56 2 **ARTICLE SUMMARY**
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1112 4 **Strengths and limitations of this study**
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19 6 • This study advances understanding about whether prototyping is a time-efficient and
20
21 7 cost-effective approach to design and implementation of public health programmes.
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26 9 • This mixed methods evaluation provides insight into the implementation of an ‘off-
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28 10 the-shelf’ weight management programme, in a local context.
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33 12 • Embedding stakeholders’ views throughout the entire evaluation process allowed for
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35 13 ongoing, iterative refinement.
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40 15 • A limitation to the quantitative component is the small sample size and rate of missing
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42 16 data at 1 year; findings should thus be interpreted with caution.
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47 18 • Qualitative interviews and focus groups can only provide information about what
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49 19 participants recall about their experiences, meaning that there is a potential for recall
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51 20 bias.
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1 INTRODUCTION

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8 Failure to implement effective public health interventions when programmes are scaled up or
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10 transferred across contexts is widely reported.¹ Proposed approaches attempting to address
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12 this implementation gap include; effectiveness-implementation hybrid designs,² linking
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14 action to theory and models based on theory,³ and application of the replicating effective
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16 programmes framework.⁴ Common to all is advocacy of a developmental process reflecting
17
18 on existing knowledge about the target population and planned programme prior to service
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20 delivery. Furthermore, engagement of service users is encouraged at all stages of intervention
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22 and evaluation design in MRC guidance.⁵ Although this increases the likelihood of services
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24 meeting all stakeholder needs, concerns about the practical, personal, and professional costs
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26 of co-production have been raised.⁶ Resulting well-designed services will be tailored to a
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28 problem that may have changed during the time spent developing the intervention.
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31 Additionally, public access may be delayed. Resource-pressured public health services must
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33 therefore consider pragmatic alternatives to service design and implementation. In this paper,
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35 we explore a novel evaluation approach to these implementation challenges, focusing on a
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37 problem high on the public health agenda: obesity and overweight.
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45 Targeting elevated weight status is a public health priority, obesity being a recognised risk
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47 factor for many negative physical and psychological health outcomes.⁷⁻¹¹ In England for
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49 example, obesity and overweight are associated with 30,000 deaths and an estimated National
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51 Health Service cost of £6.1 billion per annum.¹² Globally, countries with higher income
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53 inequalities tend to have higher rates of obesity.¹³ Excess weight is also associated with
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55 widening social and economic deprivation,¹⁴ with calls to improve the effectiveness of
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57 behaviour change interventions for low-income groups.¹⁵ There is a clear need for effective
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1 public health programmes that can be refined according to local need, especially in areas with
2 substantial deprivation. This evaluation focuses on Northumberland, in northeast England.
3 Northumberland is one of the lowest ranked counties in England by Gross Value Added per
4 capita (£16,140).¹⁶ Unemployment is higher (5.5% versus 4.8%) than the England average¹⁷
5 and Northumberland public health spend per person is £53, compared to a £59 national
6 average.¹⁸ 63.8% of adults are classified as having excess weight, higher than the national
7 average of 61.3%.¹⁹

8
9 The need for innovation within public health has been postulated, shifting away from the
10 traditional linear pre-conceived and evidence-based model.²⁰ For example, Parry and
11 colleagues²¹ call for research to explore not only how a programme works, but also the
12 context and requirements for any adaptations. One such approach is prototyping²² where
13 projects test innovations iteratively, with ongoing refinement considering the interplay
14 between a programme and its delivery context. Evaluation and public health teams are able to
15 communicate at all stages of the programme, with evaluation recommendations incorporated
16 via a rapid-cycle basis.²¹ A small number of studies to date, for example in drug prevention²²
17 and web-based support of long-term weight loss²³ have demonstrated efficiencies when
18 including elements of prototyping within programme development (including time,
19 adaptation to context and cost). Such an approach seems particularly well-suited to weight
20 management, where there are many examples of ‘good’ practice, or effectiveness, but no
21 clear consensus on ‘best’ practice at service-delivery level. There is also limited
22 understanding of how ‘scaling up’ and adapting of programmes or interventions to local
23 contexts may impact on effectiveness. This evaluation has particular value therefore in testing
24 a prototyping approach for a weight management programme, delivered and adapted ‘in real-
25 time’, at local authority level.

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3 1 The aim was to explore implementation of an ‘off-the-shelf’ weight management programme,
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5 2 Momenta²⁴, in a challenging context. Specific objectives were to explore local
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7 3 implementation, consider feasibility of the iterative prototyping evaluation framework and
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9 4 explore preliminary outcome domains including recruitment, retention, weight change and
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11 5 wellbeing.
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17 7 **METHODS**

19 8 20 21 9 **The prototyping process: local context and evaluation design**

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26 11 A local authority health needs assessment identified a gap in provision for a lifestyle-based
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28 12 weight management referral programme within Northumberland. Adults with overweight or
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30 13 obesity were at the time eligible for referral to the Northumberland exercise referral scheme
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32 14 (ERS), however previous evaluation demonstrated modest weight loss²⁵ and body mass index
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34 15 (BMI) >30 kg/m² was negatively associated with adherence.²⁶ Thus ‘Momenta’ was
35
36 16 commissioned for local adaptation and delivery. The Momenta programme incorporates
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38 17 evidence-based behaviour change techniques and is designed to be delivered by fitness
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40 18 professionals in a leisure environment.²⁴ Developed by the MEND childhood weight
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42 19 management programme²⁷ designers, this 12-week programme aims to facilitate weight loss
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44 20 by engaging participants in 12 key behaviours broadly encompassing psychology, diet and
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46 21 physical activity (supplementary file 1). Briefly, Momenta sessions explored topics using
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48 22 interactive and experiential learning techniques including brainstorming, group activities and
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50 23 discussion, quizzes and games. At the end of each session, participants set goals focusing on
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52 24 one of the 12 key behaviours. At the beginning of each session, the group discussed the
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1 previous weeks' goals by exchanging stories and brainstorming challenges. All interventions
2 were free to service users.

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10 The local Leisure Trust was commissioned to deliver a pilot Momenta programme.
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12 Commissioners and providers had ideas about alternative delivery options and due to an
13 established academic relationship, asked the study team for advice about robust evaluation
14 that would allow for feedback in real time and at the end of the pilot. Stakeholder meetings
15 were held with Public Health staff (n=2), Leisure Trust managers (n=3), delivery staff (n=2)
16 and Momenta programme developers (n=2). As part of the prototyping process, members of
17 the evaluation team (CDR, EO) provided guidance on evaluation design and light touch
18 advice about tools to explore preliminary effectiveness. The evaluation was thus co-
19 produced to ensure a robust framework, whilst meeting strategic local needs. For example,
20 commissioners were concerned about meeting recruitment targets for an existing specialist
21 weight management service used mainly for pre-bariatric patients and Momenta was initially
22 commissioned for patients with BMI 25.0-29.9 kg/m², although this was later amended.
23 Furthermore, commissioners were keen to consider accessibility of provision and wished to
24 explore offering free gym, swimming and fitness class membership. The evaluation was
25 designed to accommodate this.

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47 The programme was ultimately delivered at two leisure sites situated within the 20% and
48 50% most deprived neighbourhoods in the country. Six General Practice (GP) surgeries,
49 identified as the best referrers to the existing ERS, were asked to refer suitable patients to
50 Momenta. The programme manager and the public health improvement manager (LN)
51 attended practice meetings to articulate referral criteria and disseminate advertising materials.
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3 1 Attendance varied from two to all practice staff, meaning that in some surgeries knowledge
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5 2 of the programme was reliant on dissemination by those who attended.
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10 4 A mixed methods evaluation was agreed between the evaluation team and commissioners.
11
12 5 Qualitative and quantitative components were conducted concurrently and had equal status.²⁸
13
14 6 Prototyping allowed for iterative changes to be made to the implementation and delivery of the
15
16
17 7 programme in real time and we reflect upon these in the results and discussion.
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21 9 Referrals by healthcare professionals (HCPs) were via a standardised form to the appropriate
22
23
24 10 leisure site. Prior to programme commencement the Leisure Trust, in conjunction with the
25
26 11 Momenta programme designer and members of the evaluation team, held a training day for
27
28 12 delivery staff. Although staff were qualified to deliver Momenta, extra bespoke training
29
30
31 13 (including role-play scenarios and problem-solving discussions) was delivered by the clinical
32
33 14 psychologist who designed Momenta. The evaluation team (CDR, CH) trained delivery staff
34
35 15 in international standard anthropometric techniques²⁹ and familiarised them with other
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38 16 evaluation measures.
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42 18 Programme providers allocated service users into one of three comparison groups:

- 43
44 19 a) Combined Momenta plus fitness membership (Momenta-Fitness);
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47 20 b) Momenta;
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49 21 c) Fitness membership (Fitness only).

50
51 22 Participants were allocated into groups in order of receipt (the first referral form received was
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53
54 23 allocated to Momenta-Fitness, the second form to Momenta, the third form to fitness only
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56 24 etc.). The provider then contacted participants by telephone to arrange attendance. If a
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58 25 participant was unable to attend the allocated group, (e.g. due to inconvenient session times)
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1 provider allocated them to a different group after discussion. Due to maximum recommended
2 Momenta group size, referrals were split into delivery cohorts of 15, with groups rolling
3 through March 2015 to April 2016.

4
5 Implementation effectiveness for the referral process was explored through semi-structured
6 interviews with referring HCPs (undertaken at referring surgeries) and focus groups with
7 service users (in leisure centres). All were conducted by LN during March-July 2015, as part
8 of her Public Health Master's degree (which contained qualitative methods training), mentored
9 by TF, an experienced qualitative researcher. LN was employed as a member of the
10 Northumberland public health team at the time of the evaluation. Questions are included in
11 supplementary file 2. Data were audio-recorded. Results are reported using the Consolidated
12 criteria for Reporting Qualitative research guidelines.³⁰

13
14 Practice managers from all six referring surgeries were sent an email invitation for staff to
15 take part (n = 84), (General Practitioner = 53, Practice Nurse = 18, Health Care Assistant =
16 13). Individual correspondence was sent to those agreeing. LN informed participants about
17 her employment status and that the study aimed to understand implementation issues.
18 Interviews aimed to explore HCPs' referral experiences; raising weight issues; assessing
19 readiness to change; marketing and referral materials; and the referral process. Interview
20 questions were pilot tested with public health colleagues to assess timing and ensure validity.
21 One question (*Thinking about after you referred the patient, what happened next?*) was
22 omitted after piloting as it was realised HCPs would not have had patient feedback at that
23 point. Interviews lasted on average 26 minutes and were transcribed verbatim. Data were
24 analysed following each interview, with developing themes considered to determine whether

1 questions required refinement. Initial themes generated from the first two interviews did not
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1 questions required refinement. Initial themes generated from the first two interviews did not
2 change and thus questions remained constant, although prompts were added.

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4 During the initial assessment session for the first wave of referrals, all ($n = 39$) were given a
5 written invitation to participate in a series of focus groups at programme-end to explore
6 experiences. Emphasis was placed on the referral process, initial expectations and
7 experiences of participation; how weight issues were raised by HCPs; time from referral to
8 initial assessment; and facilitators and barriers to taking part. Focus groups lasted between 26
9 and 44 minutes.

10
11 Preliminary outcome data were collected to provide an initial indication of programme
12 success. These included anthropometric measurements to determine weight change. Well-
13 being measures were of specific interest to commissioners. Sociodemographic information
14 was also available as indicated.

15
16 Age, gender and postcode (for index of multiple deprivation, IMD) were recorded by
17 referring HCPs on the referral form. Employment status, level of education, cohort wave and
18 programme group were recorded by leisure staff, who also measured weight and stature
19 (without shoes or bulky clothing) and waist circumference at baseline and programme end.

20 Measures were taken in at least duplicate, using standardised tools in accordance with
21 international standards²⁹ using SECA 761 scales, a Leicester portable stadiometer and
22 anthropometry tape. Body mass index was calculated and classified according to WHO
23 guidelines.³¹ The Warwick-Edinburgh Mental Well-being Scale,³² and the Hospital Anxiety
24 and Depression Scale (HADS)³³ were administered at each time-point. Attendance at
25 Momenta and leisure centre usage was monitored via swipe-card tracking. 52 weeks after

1 commencing the programme, service users were invited to attend a follow-up session, where
2 leisure staff repeated physiological and psychological measures. Programme providers
3 collected and collated quantitative data and provided an anonymised dataset to the evaluation
4 team for analysis.

6 **Patient and public involvement**

7 Patients and the public were not involved in the choice of evaluation topic, assisting in the
8 study design, advising on the project or in carrying out the evaluation.

10 **Data analyses**

12 Qualitative data were audio-recorded and transcribed by LN using a thematic process.³⁴ Data
13 were organised according to concepts, key themes and developing categories. Data coding
14 was discussed with TF, allowing comparison of data interpretation and subsequent coding
15 refinement. Evolving key themes were refined through the analysis process and subsequent
16 cross-sectional thematic labelling of data, thus generating deeper understanding. Where
17 possible, key phrases or expressions identified from interviews and focus groups were
18 retained within coding and thematic labelling. A public health colleague helped to verify
19 interpretations of the data and appropriateness of codes applied. Once initial interviews were
20 coded this framework was applied to remaining data. Notes taken during focus groups helped
21 to contextualise when developing themes and included information about dynamics within
22 groups, such as influence, disagreement, humour and peer exposure.

24 The anonymised quantitative dataset was analysed using PSAW Statistics V.22. Descriptive
25 statistics were calculated for age, gender, IMD, employment status, initial BMI, leisure site,

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3 1 level of education, and uptake and adherence. Distribution and normality of measures
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5 2 (weight, BMI, waist circumference, psychological wellbeing and attendance) were assessed
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7 3 using Shapiro Wilk tests and median and interquartile range (IQR) scores calculated for each
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9 4 group at baseline and 12 weeks (attendance, 12 weeks only). For information and general
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11 5 descriptive purposes, preliminary inferential analyses were undertaken. Using complete
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13 6 cases, Kruskal-Wallis H tests were used to explore between-group differences at baseline and
14
15 7 at 12 weeks and Wilcoxon-signed rank tests explored repeated measures differences between
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17 8 baseline and 12-week scores. Complete cases available at 52 weeks ($n = 37$) were considered
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19 9 similarly, but via separate analyses due to limited available data across comparison groups.
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11 **RESULTS**

12
13 Between December 2014 and March 2016, the programme received 182 referrals and was
14 delivered in four cohorts across leisure sites. Due to initial low levels of recruitment, the first
15 cohort did not start until March 2015. Referrals were mainly female (83%) and 30.6% lived
16 in the 20% most deprived areas (table 1).
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Table 1. Demographic characteristics of referrals who started the programme (n=153)

	Median	IQR	
Age (years)		53	24
Gender		n	%
Male		25	16.3%
Female		120	78.4%
Not stated		8	5.2%
Initial BMI category (kg/m²)			
25.0-29.9		40	26.1%
30.0-34.9		73	47.7%
35.0-39.9		27	17.6%
≥40.0		10	6.5%
Not stated		3	2.0%
Leisure site			
Leisure site 1 (IMD quintile 2)		69	45.1%
Leisure site 2 (IMD quintile 3)		83	54.2%
Not stated		1	0.7%
Index of multiple deprivation			
20% most deprived		42	27.5%
21-40%		33	21.6%
41-60%		17	11.1%
61-80%		20	13.1%
20% least deprived		35	22.9%
Not stated		6	3.9%
Employment status			
Employed full time		36	23.5%
Employed part time		24	15.7%
Retired		51	33.3%
Claiming incapacity benefit		5	3.3%
Claiming job seekers allowance		6	3.9%
Not stated		14	9.2%
Level of education			
Primary		15	9.8%
Secondary (O level/GCSE)		35	22.9%
Secondary (A level)		26	17.0%
Further education (HND)		24	15.7%
Bachelors or equivalent		21	13.7%
Masters or equivalent		5	3.3%
Not stated		27	17.6%

Age, gender and postcode (IMD calculated by the programme provider) recorded from the referral form.

Employment and level of education self-reported by participants during the first session. The provider did not follow up missing data.

BMI and leisure site recorded by the provider. Missing data not available for analysis and presumed to be data entry errors.

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45 2 **Implementation effectiveness: reflections from referring healthcare professionals**
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10 4 Five face-to-face semi-structured interviews took place with HCPs across five referring
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12 5 surgeries: two GPs, two Practice Nurses and one Health Care Assistant. HCPs perceived that
13
14 6 four key themes influenced the effectiveness of programme implementation: (i) difficulties
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16 7 raising weight with patients, (ii) how gender affected patient engagement, (iii) availability of
17
18 8 information and resources, and (iv) additional barriers constraining programme promotion.
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24 10 Raising the issue of weight with patients:
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28 12 Concerns about raising weight may have contributed to slow recruitment, with nurses and
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30 13 healthcare assistants expressing unease, *'not really up to me... well I talk about it if they want*
31
32 14 *to.... Better if they [patients] bring it up.'* (Interview 2, Healthcare Assistant). GPs seemed
33
34 15 more comfortable raising weight with patients, but with the caveat that this is easier in the
35
36 16 context of a longer-term GP/patient relationship.
37

38 17 *'the people I see I've known for a very long time... it's the rapport you have...if I'd*
3940 18 *never met anyone before and they came in for a sore throat I'm not going to say*
4142 19 *you're fat...If there was someone I'd known for a long time and it seemed*
4344 20 *relevant...I'd mention it.'* (Interview 5, GP).
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4647 21
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4950 22 Gender and engagement in the referral process:
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3 1 Gender was highlighted as influencing the referral process, women being more likely than
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5 2 men to seek support for weight. This may help explain the low rate of referral for males
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8 3 (17%):
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10 4 *'More women talk about it...men don't really talk about weight...I do mention weight*
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12 5 *to men if I'm doing a well man [sic] but it doesn't come up really...it's a woman*
13
14 6 *thing...'* (Interview 3, Practice Nurse).
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20 8 Availability of information and resources:
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24 10 Several interviewees highlighted training needs around programme information and
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26 11 resources, (e.g., additional programme information would help to engage patients). For
27
28 12 example, the GPs both discussed the longstanding ERS and stated they needed to become
29
30 13 more familiar with Momenta, as they had with the ERS:
31
32

33 14 *'when we get opportunities to do things in the practice we normally discuss it, let*
34
35 15 *everyone know where appropriate forms and information is and it's in your*
36
37 16 *head...that didn't happen with this and I don't know why that was.'* (Interview 5, GP).
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42 18 All HCPs interviewed felt the referral leaflet (provided by programme providers) was
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44 19 important in the process, either as a tool to promote the intervention or to convey information
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46 20 to patients:
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50 21 *'The leaflet was good, bright...explained the programme and patients like taking a*
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52 22 *leaflet away.'* (Interview 3, Practice Nurse)
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3 1 Additional Barriers to Engagement:
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9 3 Several sub-themes highlighted additional barriers to the referral process. The most
10
11 4 prominent sub-themes were around initial BMI referral criteria (25.0-29.9 kg/m²) and delayed
12
13 programme start. Both implementation factors were beyond the control of the referrers, but
14 5
15 consequently amended through iterative refinement during the prototyping process following
16 6
17 early data analysis. Both were reported by practice nurses as exacerbating each other:
18 7

19 8 *'we were referring but then it didn't start so people were not sure what was*
20
21 9 *happening [pause]...Think it was more people were needed to start...but you know if*
22
23 10 *the BMI was higher then there would have been more.'* (Interview 3, Practice Nurse).
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30 12 In one case, a decision was taken to relax the referral criteria, *'...31.5 [kg/m²]...was just*
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32 13 *outside so I just referred him.'* (Interview 4, GP).
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37 15 Programme location was perceived by HCPs to overcome an existing barrier to the tier three
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39 16 weight management programme, as Momenta was *'round the corner for people,'* as opposed
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41 17 to *'a bit far away at the hospital.'* Cost barriers were also discussed, both with reference to
42
43 18 the patient, *'in this sort of area...cost..., if you've got to pay it's a barrier.'* (Interview 4, GP),
44
45
46 19 and to expected targets from Clinical Commissioning Groups (CCG),
47

48 20 *'we are constantly told by the CCG that we must keep down on numbers and that if*
49
50 21 *there are costs attached to this referral that would definitely impact... and that would*
51
52 22 *be for all practices.'* (Interview 5, GP)
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1 **Implementation effectiveness: reflections from participants**

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3 Three focus groups in the leisure centres allowed programme participant voices to be heard:
4 three females and one male from Momenta (focus group 1), three males and three females from
5 Momenta-Fitness (focus group 2) and three females (one of whom emailed her views
6 separately) from Fitness-only. Across the groups, 12 participants reported having lost weight
7 and one reported weight gain. Three themes developed: (i) outcomes of the programme, (ii)
8 facilitators and barriers to engagement, and (iii) raising the issues of weight with HCPs.

9

10 Outcomes of the programme:

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12 Focus group findings aligned closely with quantitative outcomes in terms of the physical and
13 psychological benefits of participation: *'[I've] lost a good bit of weight. It's been very*
14 *positive for me... I'm feeling a lot more active...'* (Momenta-Fitness, Participant 5).

15 Participants reported a sense of weight loss achievement, increased physical activity levels,
16 and positive mood states. In addition, elements of the Momenta programme were perceived
17 as facilitating engagement, including the *'group feeling... I looked forward to it,'* (Momenta-
18 Fitness, Participant 4), the *'information that we got every week... so very well planned.'*
19 (Momenta-Fitness, Participant 3) and the ongoing support e.g., *'she phoned me the other day*
20 *to see if I was coming,'* (Momenta-Fitness, Participant 4). Momenta participants reflected
21 back on, and identified and discussed lifestyle factors that related to their initial weight gain
22 (e.g., *'I did the usual thing... I started eating toffees,'* Momenta-Fitness, Participant 5),
23 demonstrating both self-awareness and an openness to discussing the topic.

24

25 Facilitators and barriers to engagement:

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5 2 One participant reported being initially excluded but later allowed to take part, and others
6
7 3 raised concerns that the initial BMI threshold for referral (25-29.9 kg/m²) was too low, '*was a*
8
9 4 *little bit high, BMI...managed to get it down... [and then] the doctor put us forward,*'
10
11 5 (Momenta, Participant 2). Data also indicated the importance of subsidised access,
12
13 6 particularly important in the context of a deprived region such as this, e.g., '*I also joined*
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15 7 *Weight Watchers for short period of time but found the classes too expensive,*' (Fitness-only,
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17 8 Participant 3, emailed response).
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24 10 Raising the issue of weight with HCPs:
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28 12 Some data did suggest implementation was problematic, however, this focused exclusively
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30 13 on the referral process. Participants overwhelmingly felt that they had opened the
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32 14 conversation about weight, as opposed to discussions being initiated by HCPs (e.g., '*my*
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34 15 *glucose levels were quite high but nobody ever said that I was overweight,*' Momenta-
35
36 16 Fitness, Participant 4). In addition, participants perceived limitations in HCPs' knowledge of
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38 17 intervention components ('*she [nurse] didn't know anything about it,*' Fitness-only,
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40 18 Participant 1), something with potential to impact on likelihood of referral, and
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42 19 participants' expectations of programme success.
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48 49 21 **Preliminary outcome domains** 50 51 22

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53 23 Of all referrals, 153 (84%) attended the baseline measurement session and 78 (51% of those
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55 24 who started) attended the 12-week measurement session. Uptake and adherence varied by
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57 25 programme group (table 2).
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1 **Table 2. Programme uptake, adherence and attendance.**

Uptake (week 1), adherence and retention (both week 12)	Momenta-Fitness		Momenta only		Fitness only	
Number referred		58		59		65
Uptake* (n, %)		54 (93.1%)		50 (84.7%)		49 (75.4%)
Uptake retention** (n, %)		35 (64.8%)		27 (54.0%)		16 (32.7%)
Uptake adherence^ (n, %)		34 (63.0%)		26 (52.0%)		8 (50.0%)
Overall retention*** (n, %)		35 (60.3%)		27 (45.8%)		16 (24.6%)
Overall adherence^^ (n, %)		34 (58.6%)		26 (44.1%)		8 (12.3%)
Momenta session attendance	Momenta-Fitness		Momenta only		Fitness only	
	n	Median (IQR)	n	Median (IQR)		
Uptake	54	9.0 (7.3)	50	9.0 (8.0)		
Dropouts	19	3.0 (3.0)	23	3.0 (5.0)		N/A
Completers^^^	35	10.0 (2.0)	27	11.0 (1.3)		
Exercise session attendance	Momenta-Fitness		Momenta only		Fitness only	
	n	Median (IQR)	n	Median (IQR)	n	Median (IQR)
Uptake	54	7.0 (16.3)	50	0.0 (4.5)	49	0.0 (1.5)
Dropouts	19	0.0 (1.0)	23	0.0 (0.0)	33	0.0 (0.0)
Completers^^^	35	10.0 (14.0)	26	0.0 (5.0)	16	4.5 (18.0)

*Uptake** participant attended baseline assessment; *Uptake retention*** % of participants who attended the 12-week assessment out of those who attended the baseline assessment; *Uptake adherence^* % of participants who attended the baseline assessment who also attended ≥ 8 Momenta sessions (Momenta-Fitness and Momenta only) or gym sessions (fitness only); *Overall retention**** % of all those referred who attended both baseline and 12-week assessment; *Overall adherence^^* % of all those referred who attended \geq eight Momenta sessions (Momenta-Fitness and Momenta only) or exercise sessions (fitness only); *Completers^^^* those who completed the 12-week assessment

3
4 Physiological and psychological data were not normally distributed. Quantitative data are
5 presented as exploratory, due to the small sample size and are presented here for information
6 and general description. No significant differences were found between programme groups
7 either at baseline or at 12 weeks, for any measures. Despite the small sample size, significant
8 within-group differences between baseline and 12 weeks were evident for weight, BMI and
9 waist circumference for Momenta-Fitness, and Momenta (Table 3). Follow-up analysis at 52-
10 weeks (available sub-sample) showed changes were maintained for Momenta-Fitness ($n=18$)
11 only.

12

1 **Table 3. Weight, BMI and waist circumference change.**

End of programme results	Median (IQR) Baseline	Median (IQR) 12 weeks	z	p	Median (IQR) Change
Weight (kg)					
Momenta-Fitness (n=35)	88.9 (80.5 - 100.0)	88.0 (77.2 - 95.8)	-4.531	<0.001	-2.9 (-5.1 - -1.6)
Momenta only (n=26)	87.8 (74.5 - 77.0)	83.3 (74.5 - 92.5)	-4.344	<0.001	-2.9 (-5.0 - -2.0)
Fitness only (n=15)	76.2 (71.6 - 86.9)	76.6 (70.4 - 84.6)	-0.879	0.379	0.0 (-3.2 - 1.0)
BMI (kg/m²)					
Momenta-Fitness (n=35)	32.0 (30.3 - 35.7)	31.3 (29.2 - 35.3)	-4.494	<0.001	-1.1 (-1.9 - -0.6)
Momenta only (n=26)	32.0 (30.0 - 34.5)	31.3 (28.6 - 33.6)	-4.356	<0.001	-1.2 (-1.6 - -0.8)
Fitness only (n=14)	29.2 (27.3 - 33.0)	29.7 (27.0 - 33.3)	-0.454	0.650	0.1 (-1.2 - +0.4)
Waist circumference (cm)					
Momenta-fitness (n=35)	106.0 (98.0 - 115.0)	99.0 (93.0 - 110.0)	-4.996	<0.001	-7.0 (-9.5 - -5.0)
Momenta only (n=25)	108.0 (99.5 - 114.5)	101.0 (93.8 - 111.5)	-4.166	<0.001	-5.0 (-7.3 - -2.5)
Fitness only (n=11)	90.0 (87.0 - 95.0)	91.0 (90.0 - 96.0)	0.358	0.650	1.0 (-3.0 - 3.0)
52-week follow-up	Median (IQR) Baseline	Median (IQR) 52 weeks	z	p	Median (IQR) Change
Weight (kg)					
Momenta-Fitness (n=18)	95.2 (87.1 - 101.4)	91.4 (82.7 - 95.9)	-3.006	<0.001	-4.8 (-6.2 - -1.5)
Momenta only (n=16)	84.7 (72.3 - 95.2)	82.7 (73.2 - 94.6)	-1.533	0.120	-0.7 (-7.6 - 0.8)
*Fitness only (n=3)	73.4 (69.5 - 80.2)	70.3 (66.0 - 87.0)			0.9 (-7.4 - 6.9)
BMI (kg/m²)					
Momenta-Fitness (n=18)	32.0 (30.49 - 35.1)	30.8 (28.7 - 34.0)	-3.157	<0.05	-1.7 (-2.0 - -0.6)
Momenta only (n=16)	31.7 (29.3 - 33.9)	31.1 (26.7 - 33.6)	-1.603	0.109	-0.3 (-2.3 - 0.3)
*Fitness only (n=3)	27.6 (27.5 - 30.5)	27.8 (24.8 - 33.2)			0.3 (24.8 - 33.2)
Waist circumference (cm)					
Momenta-Fitness (n=18)	109.0 (101.0 - 114.8)	100.5 (94.8 - 107.3)	-3.221	<0.001	-6.0 (-13.3 - -1.75)
Momenta only (n=16)	106.0 (94.5 - 115.8)	103.5 (98.5 - 113.3)	-0.780	0.938	-2.5 (-9.0 - -10.0)
*Fitness only (n=3)	89.0 (87.0 - 95.0)	90.0 (90.0 - 101.0)			3.0 (90.0 - 101.0)

* Fitness only n=3 therefore median and range reported and no statistical test completed.

3
4 Differences in mental wellbeing, depression and anxiety were not apparent between groups,
5 however improvements in mental wellbeing, and reductions in depression and anxiety were
6 evident between baseline and 12 weeks for Momenta-Fitness, and Momenta groups only
7 (Table 4), although the magnitude of change was similar for all groups. The changes
8 observed, though small, could be argued to be functionally and clinically meaningful, with a
9 minimal important difference of 1.5 points previously identified for the HADS, for
10 example³⁵. 52-week sub-sample analysis showed that significant improvements for wellbeing

1 and depression were maintained for Momenta-Fitness (n=18), and wellbeing and anxiety for
2 Momenta (n=16).

3

4 **Table 4. Wellbeing, anxiety and depression measures change.**

End of programme results	Median (IQR) Baseline	Median (IQR) 12 weeks	z	p	Median (IQR) Change
Mental wellbeing scale					
Momenta-Fitness (n=29)	46.0 (40.0 - 51.5)	53.0 (40.0 - 51.5)	3.810	<0.001	5.0 (1.5 - 12.0)
Momenta only (n=23)	49.0 (39.0 - 58.0)	55.0 (51.0 - 63.0)	2.818	<0.05	6.0 (-1.0 - 10.0)
Fitness only (n=13)	47.0 (40.5 - 59.5)	46.0 (42.0 - 63.5)	0.157	0.875	0.0 (-4.0 - 5.0)
Anxiety scale					
Momenta-Fitness (n=28)	5.5 (4.0 - 9.8)	4.5 (2.0 - 7.0)	-3.027	<0.001	-1.0 (-3.0 - 1.0)
Momenta only (n=23)	8.0 (6.0 - 10.0)	4.0 (2.5 - 9.0)	-2.329	<0.05	-1.0 (-3.0 - 0.0)
Fitness only (n=13)	8.0 (3.5 - 10.0)	6.0 (4.0 - 9.0)	-0.499	0.618	-1.0 (-2.0 - 2.0)
Depression scale					
Momenta-Fitness (n=28)	5.5 (3.3 - 8.0)	2.0 (1.0 - 6.0)	-3.214	<0.05	-2.5 (-4.8 - -0.3)
Momenta only (n=23)	5.0 (3.0 - 7.5)	3.0 (1.0 - 5.0)	-3.049	<0.05	-1.0 (-4.5 - 1.0)
Fitness only (n=13)	4.0 (2.0 - 8.5)	2.0 (2.0 - 7.0)	-1.226	0.220	-2.0 (-4.5 - 0.0)
52-week follow-up	Median (IQR) Baseline	Median (IQR) 52 weeks	z	p	Median (IQR) Change
Mental wellbeing scale					
Momenta-Fitness (n=15)	44.0 (39.0 - 52.0)	55.0 (48.0 - 59.0)	2.984	<0.05	5.0 (3.0 - 15.0)
Momenta only (n=13)	58.0 (47.5 - 59.0)	56.0 (54.0 - 63.5)	2.282	<0.05	4.0 (0.5 - 6.5)
*Fitness only (n=3)	47.0 (34.0 - 64.0)	58.0 (45.0 - 60.0)			-2.0 (-6.0 - 26.0)
Anxiety scale					
Momenta-Fitness (n=15)	6.0 (2.0 - 10.0)	2.0 (1.0 - 7.0)	-1.785	0.074	-3.0 (-6.0 - 0.0)
Momenta only (n=15)	7.0 (4.0 - 9.0)	5.0 (1.0 - 8.0)	-1.990	<0.05	-3.0 (-4.0 - 0.0)
*Fitness only (n=3)	9.0 (5.0 - 10.0)	2.0 (1.0 - 8.0)			-3.0 (-8.00 - -2.0)
Depression scale					
Momenta-Fitness (n=15)	7.0 (3.3 - 11.3)	3.5 (1.0 - 6.0)	-2.908	<0.05	-3.5 (-6.3 - -0.8)
Momenta only (n=15)	4.0 (1.0 - 6.0)	3.0 (1.0 - 4.0)	-0.762	0.446	0.0 (-2.0 - 1.0)
*Fitness only (n=3)	3.0 (0.0 - 8.0)	2.0 (1.0 - 8.0)			1.0 (-8.0 - 5.0)

* Fitness only n=3 therefore median and range reported and no statistical test completed.

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8 Overall, the results suggested those who participated in the two groups incorporating
9 Momenta, had enhanced physical and psychological health indicators from baseline, whereas
10 those who had only free fitness membership did not. From the small follow-up sample, there

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3 1 is scope to suggest that the combination of Momenta and fitness membership may produce
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5 2 favourable outcomes at 52 weeks.
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4 **Iterative refinements throughout the evaluation process**

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6 Here we list a number of implementation adjustments which were made throughout the
7 evaluation process, facilitated via the prototyping framework. Real-time advice from
8 Commissioners was considered during early stages of implementation, regarding the nature
9 of comparison offers (e.g. fitness access) and thus initial design and outcome measurements
10 were adapted prior to referrals being made. To better-target recruitment and change the
11 process of engagement at referral point, entry criteria were altered ($\text{BMI} \geq 30 \text{ kg/m}^2$) mid-way
12 through programme delivery. On-site implementation of the service offer was adapted in
13 response to delivery staff feedback: increased resource was made available, for example
14 additional staffing to support delivery for the first wave of referrals. Furthermore, staff were
15 given additional time for Momenta session preparation and session delivery times were
16 extended. Follow-up activities (i.e., text or telephone contact) were implemented by staff
17 during the process, to encourage adherence.
18

19 **DISCUSSION**

20

21 We explored 'prototyping', as a cost-effective and time-efficient approach to public health
22 evaluation, via an 'off-the-shelf' weight management programme implemented in a local
23 context of mixed and high deprivation.
24

1 Experiences of both referrers and referrals highlighted that HCPs needed to be better-
2 informed and more confident raising weight-related conversations. Whilst patient-led action
3 is desirable, staff reluctance to raise weight issues may mean that opportunities for
4 engagement of less knowledgeable or motivated patients will be missed. The problematic
5 positioning of GPs within obesity care has been highlighted previously,³⁶ with a range of
6 strategies to change HCPs' behaviour resulting in little or no change to patients' weight. A
7 practical training need is highlighted for those working at the patient-practitioner interface,
8 however communication with patients about weight may well be hindered by the 'stigma'
9 attached to obesity.³⁷ This has wider implications for patient outcomes and requires further
10 exploration through the implementation process. Additionally, HCPs need better
11 understanding of referral-based public health programmes offered. Despite efforts of
12 programme and public health managers, awareness was reportedly low for some referring
13 professionals. We suggest consideration of resource-efficient ways to signpost both HCPs
14 and patients themselves as part of the implementation process.

15
16 This programme was delivered across a social gradient in a region with low health indices
17 and areas of high deprivation. Some issues in relation to inequalities and service access for
18 future community-based weight management programmes were highlighted. Only 17% of
19 referrals to Momenta were males. Gender bias in weight management referral has been
20 reported elsewhere,³⁸⁻³⁹ and interviews showed that practitioners struggled to raise the topic
21 of weight with male patients. Alternative referral strategies have been employed in other
22 settings in an attempt to overcome this.⁴⁰ Marketing in other community spaces, or targeted
23 postal referrals could be explored in future implementation. The initial decision to restrict
24 referral to overweight-only substantially impacted on referral rates, with HCPs and referrals
25 indicating they felt limited until this restriction was reversed. Had this continued, worsening

1 health inequalities may have been an unintended consequence, something to be actively
2 avoided within public health programmes ⁴¹. The roles of, and interactions between, those
3 operating in the 'system' (i.e. the context within which the intervention operates) must be
4 considered at the point of implementation to minimise any impact from unintended
5 consequences.⁵ In practical terms, this may be through continued dialogue with
6 commissioners, referring professionals and referrals themselves, something which
7 prototyping evaluation allows.

8
9 Quantitative data should be interpreted as exploratory, due to the relatively small number of
10 complete cases, however lessons can be learned from these data both in terms of preliminary
11 outcomes and engagement/dropout. Participation in Momenta and Momenta-Fitness resulted
12 in 12-week weight loss for those who completed the programme. Free fitness membership
13 without the weight-management programme was poorly engaged with and did not lead to
14 weight change. A small sub-sample who attended follow-up demonstrated that after one year,
15 weight reductions equivalent to ~4% could be maintained for Momenta-Fitness. We caution
16 that while this might be best interpreted as hypothesis-generating for future evaluations,
17 given these effects emerged despite an underpowered sample it is worth briefly considering
18 potential mechanisms here. Providing free access to fitness facilities alongside the behaviour
19 change programme may allow for continuous and self-driven behaviour change⁴² and
20 sustaining optimal changes in adiposity over 12 months in those who remained engaged.⁴³
21 Swipe card monitoring during the initial 12-week period indicated that fitness sessions were
22 accessed an average 10 occasions for this group, whereas no access was apparent for
23 Momenta, despite Momenta sessions being held in leisure centres. This could be important
24 for community providers making decisions about delivery location. Both Momenta groups
25 reported improved wellbeing, and reduced anxiety and depression at 12-weeks suggesting

1 that the behavioural intervention may drive this effect. This is consistent with previous work
2 reporting co-varying changes in weight loss, depression, and quality of life in weight
3 management services.⁴⁴ It is unclear whether the primary mechanism was weight loss, or the
4 wider social benefits of participation. Both were valued in the qualitative data. Our
5 preliminary evidence of maintained improvements in wellbeing for these groups at 52 weeks
6 is particularly relevant given previously evidenced associations between poor mental health,
7 and obesity and overweight status.⁴⁵ Long-term follow-up rates will need to be considered in
8 future similar programmes and we suggest year-long follow-up (at least) is included as a key
9 programme component from the outset. Consideration should be given to how providers can
10 maintain contact with participants after programme end to increase likelihood of successful
11 follow-up. Potential 'light touch' support after 12 weeks may be helpful and other means of
12 obtaining follow-up data should be explored where service users disengage. Reasons for
13 disengagement might also be usefully explored in future work.

14
15 Given that no systematic problems emerged with service-user's experiences of the
16 programme itself, our findings lend support to a streamlined approach to involvement of all
17 stakeholders in programme implementation. We suggest that prototyping demonstrates
18 opportunities for off-the-shelf programmes to be pragmatically moulded to local context, in
19 real-time. Many of the iterative changes made were staff-driven. This demonstrates that real-
20 time consideration of feedback from on-site delivery teams can be important to the
21 implementation process. Some of the adjustments required commissioning action, as they had
22 resource implications; others needed advice from the evaluation team. Interestingly changes
23 made throughout the process generally focused on both staff and participant experience.

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3 1 Emergence of some negative experiences of referral suggests, however, that prototyping can
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5 2 be problematic without networks or channels for ensuring key outcomes are widely
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7 3 communicated to relevant stakeholders. Overall, the evaluation demonstrated that a balance is
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9 4 needed to allow quick and efficient adaptation of off-the-shelf programmes, but with focused
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11 5 professional user engagement in the early stages of development. The prototyping approach
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13 6 had particular utility given that project resources were limited and meant that issues were
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15 7 identified and acted upon rapidly. While the programme may have progressed similarly
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17 8 without this, prototyping provided a greater structure for, and confidence in, on-going
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19 9 refinements. This was achieved via the support provided by academics, public health
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21 10 practitioners and providers. Fundamentally, adopting a prototyping approach enabled the
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23 11 delivery of a new service to an in-need population, alongside the generation of initial
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25 12 evidence of local effectiveness. A minimum of 1 kg weight-loss at 3 months, and 0.7 kg at
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27 13 12-months have been suggested as thresholds to influence decisions over commissioning of
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29 14 weight-loss services.⁴⁶ Our preliminary data suggests that Momenta may have potential to
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31 15 meet or even exceed these thresholds, showing particular promise when implemented in
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33 16 conjunction with free fitness provision.
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42 18 Demonstrating preliminary effectiveness is of limited use, however, unless a successful
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44 19 programme in one area may be adapted and implemented to suit a different context, for
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46 20 example through sharing local-level knowledge, interactions and behaviours of individuals
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48 21 within different parts of that system.⁴⁷ The process for scaling-up of effective health
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50 22 interventions to broader policy and practice takes years⁴⁸ and certainly within the obesity
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52 23 literature, has been dominated by initiatives that consider effectiveness but not
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54 24 implementation across specific settings.⁴⁹⁻⁵⁰ We recommend prototyping might be built into
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1 larger public health evaluations providing that the original programme has a sound theoretical
2 basis, and iterative refinement is engaged with by all stakeholders from the outset.

4 **CONCLUSION**

6 The Momenta programme was experienced positively by those who attended. Issues with the
7 referral process need to be explored further, however other refinements were feasible during
8 delivery. Promising preliminary outcome data for ‘Momenta’, particularly in conjunction
9 with a free fitness offer, implies potential for the scheme within future commissioning. This
10 evaluation extends the literature by exploring prototyping for a complex problem, community
11 weight-management, in a challenging setting, demonstrating streamlined implementation of
12 an ‘off-the-shelf’ weight management programme. This resource-effective approach is
13 highly relevant in the context of health inequalities and public health sector funding
14 constraints.

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3
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9
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20
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22 initiating the evaluation. She was subsequently employed as a research assistant at Durham
23 University, however was not involved in any data collection or entry, only accessing an
24 anonymised database submitted to the University. LN was a Public Health Improvement

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2
3 1 Manager within the Public Health Team and had responsibility for commissioning the
4
5 2 Momenta programme. The qualitative evaluation component was submitted in partial
6
7 3 fulfilment of her Master's in Public Health at Newcastle University.
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13 5 **Participant consent:** Consent was obtained for face-to-face interviews and focus groups.
14
15 6 Service users were informed in writing of the nature of the quantitative service evaluation and
16
17 7 how to withdraw from it. The presented data are anonymised with risk of identification low.
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24 9 **Ethics approval:** Ethical advice was sought from the local Research Manager of North of
25
26 10 England Commissioning Support, and this project was classed as a service evaluation in line
27
28 11 with National Research Ethics Service guidance.
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34 13 **Data availability statement:** No additional data are available because this was a service
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36 14 evaluation.
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SUPPLEMENTARY FILE 1. Momenta session content

Week	Key topic	Week	Key topic
Getting started session	Motivation for weight loss Weight loss goals Differences from other weight management programmes Monitoring		
Week 1	Snacking Fatty, sugary snacks Calories from snacking Healthy snack choices Healthy eating patterns	Week 7	Fats Reducing fat Different types of fat Lower-fat cooking techniques Hidden fats
Week 2	Heart rate Cardiovascular exercise and health Cardiovascular exercise and weight management Recommended amounts of CV activity Heart rate and exercise	Week 8	Internal triggers Introduction to internal triggers Identifying internal triggers Managing internal triggers
Week 3	Food as fuel A balanced diet and health Planning meals Fibre	Week 9	Active lifestyles Physical activity and health Physical activity and weight management Different types of physical activity
Week 4	External triggers Introduction to external triggers External triggers and over-eating Managing triggers	Week 10	Meals Positive meal environment Shopping Food labels
Week 5	Strength Resistance activity and health Resistance activity and weight management	Week 11	Sugars Sugary foods and drinks and weight loss Alcohol Added sugars Sugary drinks and appetite regulation
Week 6	Breakfast Eating breakfast Retraining appetite Barriers to eating breakfast Developing new breakfast habits Beyond marketing	Week 12	Eating out Challenges when eating away from home Management and coping strategies Moving forwards

SUPPLEMENTARY FILE 2.**Healthcare professionals' semi-structured interview guide**

Semi Structured Interview Set the interviewee at ease; explain purpose of the interview; offer a better understanding of what the referral process requires to aid tier 2 weight management to be delivered in Northumberland; explanation about how the interview will be recorded; reaffirmation of consent; and how the information will be analysed and stored; rules of confidentiality / anonymity etc.

Questions:

1. Thinking about raising the weight issue, tell me about your experience of discussing weight with patients.

Prompts

- *How does it feel to raise weight as an issue?*
- *Are patients open to discussing weight problems?*
- *Do you find a difference between genders when discussing weight?*
- *What helps you, such as the NHS Health Check Programme, to raise the issue of weight?*
- *What else would help to raise the issue or weight in appointments?*

2. Greater retention is often achieved when patients are ready to change, tell me how you work with / assess patient's readiness to change.

Prompts

- *Have you had training around the cycle of change?*
- *Do you use any specific tools or resources to assess the patient?*
- *What would help you to assess the patient's readiness to change?*

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3. Thinking the information and resources available to you during the referral, do you feel you had enough information and resources to encourage patient take up of the programme?

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Prompts

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- *Did you have enough background information?*
 - *Were the referral forms suitable / capture all the information required?*
 - *Were the patient leaflets / resources suitable?*
 - *Were there questions or issues raised that couldn't be answered?*
 - *Was the process easy to use?*
 - *What else could help you to make referrals to weight management programmes?*

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4. Thinking about after you referred the patient, what happened next? (excluded after pilot)

Prompts

- *Did you get feedback from the weight management programme on the progress of your patient?*
- *Did your patients achieve weight loss?*
- *Did your patient come back and talk about their experience?*

5. What things are most likely to prevent you from making the referral a weight management programme, either commercial or Public Health funded?

Prompts

- *Are there barriers that you perceive, such as cost to the patient?*
- *Are you concerned with raising the weight issue?*
- *Is it a time factor if the patient has an appointment for anything other than a weight issue?*
- *What would help you to overcome the barriers that prevent you from making the referral?*

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6. Is there anything else that you would like to tell me about your expectations and experiences of the weight management programme?

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Focus Group Topic Guide

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Set group at ease; explain purpose of the focus group; offer a better understanding of what works for people in terms of tier 2 weight management and what doesn't, aiding development of an effective programme for Northumberland residents; explanation about how the focus group will be recorded; reaffirmation of consent; and how the information will be analysed and stored; rules of confidentiality / anonymity etc.

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1. Tell me a bit about what sort of weight management activity you have taken part in, in the past.

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Prompts

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- *What influence have others had on your weight management?*
 - *Do you have any particular likes/dislikes of physical activity/managing weight/nutrition*
 - *Has there been anything else that has influenced your management of weight?*

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2. So thinking about the weight management programme you have undertaken, how did you find out about it?

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Prompts

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- *Who / what motivated you to attend?*
 - *What made you decide that this is the right time to look at managing your weight?*
 - *Did the time of year make a difference?*

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3 3. Thinking about your experience of when you were referred to the weight management programme,
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5 how did you find the process?
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Prompts

- *What type of health professional referred you? (GP / Practice Nurse)*
- *Did you specifically attend Primary Care to discuss your weight?*
- *How was weight raised?*
- *What did the referrer explain to you about the programme? Did you get enough information?*
- *How long was it from your referral from Primary Care to the first assessment in the weight management programme; was this what you expected? Were you still motivated?*

4. How did you feel about being referred?

- *Prompts*
- *How confident did you feel about taking part in the programme?*
- *Was there anything that you were particularly looking forward to?*
- *Was there anything that you were worried about?*

5. What did you hope to achieve by taking part in the weight management programme?

Prompts

- *What were your expectations when you start attending the scheme?*
- *Have there been changes to your health that you expected happen as a result of participation?*
- *How quickly did you expect to see these changes? And did this happen?*

6. Thinking about after you were referred, what happened next?

Prompts

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- *How long after referral did it take to be contacted by the Active Northumberland?*
 - *What information did you receive prior to the initial consultation?*
 - *How comfortable did you feel coming to the initial consultation?*

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7. What influenced you most to attend the weight management programme?

Prompts

- *What did you expect from the staff?*
- *How important to you were changes in health or weight?*
- *Why were the influences raised important?*

8. What things were most likely to prevent you from attending the programme?

Prompts

- *Tell me about any worries you might have had about health issues.*
- *Tell me about any other things, such as other commitments, that might have stopped you from attending*
- *Did any of these issues arise? How did you overcome these issues?*

9. Now that you have completed the programme, tell me how did you felt about undertaking the weight management programme?

Prompts

- *Did you achieve the health / weight outcomes you expected?*
- *Why do you think it worked or not for you?*
- *Do you feel you now have the tools to continue to make positive lifestyle choices?*
- *Is there something that will prevent you to continue to make positive lifestyle choices?*

10. Is there anything else that you would like to tell me about your expectations and experiences
of the weight management programme?

For peer review only

COREQ GUIDELINES REPORTING CHECKLIST: Prototyping for public health in a local context: a streamlined evaluation of a community-based weight management programme (Momenta), Northumberland, UK

No	Item	Guide questions/description	Information	Reported in manuscript (Section, page no.)
Domain 1: Research team and reflexivity				
Personal Characteristics				
1	Interviewer/facilitator:	Which author/s conducted the interview or focus group?	LN	Qualitative evaluation component, page 10
2	Credentials	What were the researcher's credentials?	LN: part of her Public Health Masters degree	Qualitative evaluation component, page 10
3	Occupation	What was their occupation at the time of the study?	LN: Masters student and employed as a member of the Northumberland public health team at the time of the evaluation.	Qualitative evaluation component, page 10
4	Gender	Was the researcher male or female?	Female (referred to as her)	Qualitative evaluation component, page 10
5	Experience and training	What experience or training did the researcher have?	LN: Masters in Public Health (which contained qualitative methods training), mentored by TF, an experienced qualitative researcher.	Qualitative evaluation component, page 10
Relationship with participants				
6	Relationship established	Was a relationship established prior to study commencement?	No. Practice managers from all six referring surgeries were sent an invitation for staff to take part.	Qualitative evaluation component, page 10
7	Participant knowledge of the interviewer	What did the participants know about the researcher? <i>e.g. personal goals, reasons for doing the research</i>	LN informed HCP participants about her employment status and that the study aimed to understand implementation issues. Programme participants were invited to participate in a series of focus groups at programme-end to explore experiences	Qualitative evaluation component, page 10-11
8	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? <i>e.g. Bias, assumptions, reasons and interests in the research topic</i>	Not discussed	N/A

Domain 1: Study design				
Theoretical framework				
9	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? <i>e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis</i>	Qualitative data were audio-recorded and transcribed by LN using a thematic process	Data analysis, page 12
Participant selection				
10	Sampling	How were participants selected? <i>e.g. purposive, convenience, consecutive, snowball</i>	All HCPs involved were invited: Practice managers from all six referring surgeries were sent an invitation for staff to take part Programme participants: for the first wave of referrals, all (n = 39) were invited to participate in a series of focus groups.	Qualitative evaluation component, page 10-11
11	Method of approach	How were participants approached? <i>e.g. face-to-face, telephone, mail, email</i>	HCPs: by email Programme participants: written information handed out during the first session	Qualitative evaluation component, page 10-11
12	Sample size	How many participants were in the study?	5 HCPs 13 Intervention participants	Results, page 18 Results, page 18
13	Non-participation	How many people refused to participate or dropped out? Reasons?	HCPs: 84 invited, 5 participated. Programme participants: 39 invited, 13 participated Reasons for refusal not documented	Qualitative evaluation component, page 10-11 and Results, page 15 Results, page 18
Setting				
14	Setting of data collection	Where was the data collected? <i>e.g. home, clinic, workplace</i>	HCPs: in referring surgeries Programme participants: in the leisure centres	Results, page 15 Results, page 18
15	Presence of non-participants	Was anyone else present besides the participants and researchers?	Not stated	N/A
16	Description of sample	What are the important characteristics of the	HCPs: role reported	Results, page 15 Results, page 18

		sample? <i>e.g. demographic data, date</i>	Programme participants: programme group and weight loss status reported Date range for interviews reported	Qualitative evaluation component, page 10
	Data collection			
17	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Semi-structured interview guide used. Pilot tested. Guides provided as supplementary file	Qualitative evaluation component, page 10-11 Supplementary file 2
18	Repeat interviews	Were repeat interviews carried out? If yes, how many?	No not applicable to study design	N/A
19	Audio/visual recording	Did the research use audio or visual recording to collect the data?	Yes, the interviews were audio recorded	Data analysis, page 12
20	Field notes	Were field notes made during and/or after the interview or focus group?	Notes taken from focus groups helped to contextualise developing themes	Data analysis, page 12
21	Duration	What was the duration of the interviews or focus groups?	HCPs average length reported: 26 minutes Programme participants: range reported: 26-44 minutes	Qualitative evaluation component, page 10 Qualitative evaluation component, page 11
22	Data saturation	Was data saturation discussed?	No	N/A
23	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	No	N/A
	Domain 3: analysis and findings			
	Data analysis			
24	Number of data coders	How many data coders coded the data?	N=2 (LN and TF)	Data analysis, page 12
25	Description of the coding tree	Did authors provide a description of the coding tree?	Yes key themes described at beginning of HCP qualitative results section and at beginning of programme participant qualitative results section	Results, page 15 Results, page 18
26	Derivation of themes	Were themes identified in advance or derived from the data?	Identified from data	Data analysis, page 12

27	Software	What software, if applicable, was used to manage the data?	Not stated	N/A
28	Participant checking	Did participants provide feedback on the findings?	No	N/A
Reporting				
29	Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. participant number	Yes, participants identified using a participant label	Results, page 15-19
30	Data and findings consistent	Was there consistency between the data presented and the findings?	Themes were illustrated by participant quotations	Results, page 15-19
31	Clarity of major themes	Were major themes clearly presented in the findings?	Themes identified and presented under sub headings for both HCPs and programme participants	Results, page 15-19
32	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	For HCPs minor themes highlighted under additional barriers to engagement	Results, page 17

BMJ Open

Prototyping for public health in a local context: a streamlined evaluation of a community-based weight management programme (Momenta), Northumberland, UK

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Primary Subject Heading:	Public health
Secondary Subject Heading:	Nutrition and metabolism
Keywords:	public health evaluation, prototyping, implementation, community weight management, NUTRITION & DIETETICS, exercise referral

SCHOLARONE™
Manuscripts

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3 1 Prototyping for public health in a local context: a streamlined evaluation of a community-
4 based weight management programme (Momenta), Northumberland, UK
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10 4 Caroline J Dodd-Reynolds^{1,2} (corresponding author*), Lisa Nevens³, Emily J Oliver^{1,2}, Tracy
11 Finch⁴, Amelia A Lake^{5,6} Coral L Hanson⁷
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¹Department of Sport and Exercise Sciences, Durham University, Durham, DH1 3HN, UK*.

Email: caroline.dodd-reynolds@durham.ac.uk Tel: +44(0)191 3342000

²Wolfson Research Institute for Health and Wellbeing Physical Activity Special Interest Group, Durham University, Durham, UK.

³Northumbria Healthcare NHS Foundation Trust, Northumberland, UK.

⁴Department of Nursing, Midwifery and Health, Northumbria University, Newcastle upon Tyne, UK

⁵Department of Science, School of Science, Engineering and Design, Teesside University, Teesside, UK

⁶Fuse – UKCRC Centre for Translational Research in Public Health, UK

⁷School of Health and Social Care, Edinburgh Napier University, Edinburgh, UK

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Keywords: Public health evaluation, prototyping, implementation, community weight management, diet, exercise referral

1 ABSTRACT

2 **Objectives** Stakeholder co-production in design of public health programmes may reduce the
3 ‘implementation gap’ but can be time-consuming and costly. Prototyping, iterative refining
4 relevant to delivery context, offers a potential solution. This evaluation explored
5 implementation and lessons learned for a 12-week referral-based weight-management
6 programme, ‘Momenta’, along with feasibility of an iterative prototyping evaluation
7 framework.

8 **Design** Mixed methods evaluation: qualitative implementation exploration with referrers and
9 service users; preliminary analysis of anonymised quantitative service data (12 and 52
10 weeks).

11 **Setting** Two leisure centres in Northumberland, northeast England.

12 **Participants** Individual interviews with referring professionals (n=5) and focus groups with
13 service users (n=13). Individuals (n=182) referred by healthcare professionals (quantitative
14 data).

15 **Interventions** Three 12-week programme iterations: Momenta (n=59), Momenta-Fitness
16 membership (Momenta-Fitness (n=58), and Fitness membership only (n=65).

17 **Primary and secondary outcome measures** Primary outcome: Qualitative themes
18 developed through stakeholder-engagement. Secondary outcomes included preliminary
19 exploration of recruitment, uptake, retention, and changes in weight, BMI waist
20 circumference and psychological wellbeing.

21 **Results** Service users reported positive experiences of Momenta. Implementation gaps were
22 revealed around the referral process and practitioner knowledge. Prototyping enabled

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3 1 iterative refinements such as broadening inclusion criteria. Uptake and 12-week retention
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5 2 were higher for Momenta (84.7%, 45.8%) and Momenta-Fitness (93.1%, 60.3%) versus
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7 3 Fitness-only (75.4%, 24.6%). Exploration of other preliminary outcomes (completers only)
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9 4 suggested potential for within-group weight loss and increased psychological wellbeing for
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11 5 Momenta and Momenta-Fitness at 12 weeks. 52-week follow-up data were limited (32%,
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13 6 33%, and 6% retention for those who started Momenta, Momenta-Fitness and Fitness
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15 7 respectively) but suggested potential weight loss maintenance in Momenta-Fitness.
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9 **Conclusions** Identification of issues within the referral process enabled real-time iterative
10 refinement, whilst lessons learned may be of value for local implementation of ‘off-the-shelf’
11 weight management packages more generally. Our preliminary data for completers suggest
12 Momenta may have potential for weight loss, particularly when offered with a fitness
13 membership.

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ARTICLE SUMMARY

Strengths and limitations of this study

- This study advances understanding about whether prototyping is a time-efficient and cost-effective approach to design and implementation of public health programmes.
- This mixed methods evaluation provides insight into the implementation of an ‘off-the-shelf’ weight management programme, in a local context.
- Embedding stakeholders’ views throughout the entire evaluation process allowed for ongoing, iterative refinement.
- A limitation to the quantitative component is the small sample size and rate of missing data at 1 year; findings should thus be interpreted with caution.
- Qualitative interviews and focus groups can only provide information about what participants recall about their experiences, meaning that there is a potential for recall bias.

1 INTRODUCTION

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8 Failure to implement effective public health interventions when programmes are scaled up or
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10 transferred across contexts is widely reported.¹ Proposed approaches attempting to address
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12 this implementation gap include; effectiveness-implementation hybrid designs,² linking
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14 action to theory and models based on theory,³ and application of the replicating effective
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16 programmes framework.⁴ Common to all is advocacy of a developmental process reflecting
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18 on existing knowledge about the target population and planned programme prior to service
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20 delivery. Furthermore, engagement of service users is encouraged at all stages of intervention
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22 and evaluation design in MRC guidance.⁵ Although this increases the likelihood of services
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24 meeting all stakeholder needs, concerns about the practical, personal, and professional costs
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26 of co-production have been raised.⁶ Resulting well-designed services will be tailored to a
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28 problem that may have changed during the time spent developing the intervention.
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31 Additionally, public access may be delayed. Resource-pressured public health services must
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33 therefore consider pragmatic alternatives to service design and implementation. In this paper,
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35 we explore a novel evaluation approach to these implementation challenges, focusing on a
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37 problem high on the public health agenda: obesity and overweight.
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45 Targeting elevated weight status is a public health priority, obesity being a recognised risk
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47 factor for many negative physical and psychological health outcomes.⁷⁻¹¹ In England for
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49 example, obesity and overweight are associated with 30,000 deaths and an estimated National
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51 Health Service cost of £6.1 billion per annum.¹² Globally, countries with higher income
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53 inequalities tend to have higher rates of obesity.¹³ Excess weight is also associated with
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55 widening social and economic deprivation,¹⁴ with calls to improve the effectiveness of
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57 behaviour change interventions for low-income groups.¹⁵ There is a clear need for effective
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1 public health programmes that can be refined according to local need, especially in areas with
2 substantial deprivation. This evaluation focuses on Northumberland, in northeast England.
3 Northumberland is one of the lowest ranked counties in England by Gross Value Added per
4 capita (£16,140).¹⁶ Unemployment is higher (5.5% versus 4.8%) than the England average¹⁷
5 and Northumberland public health spend per person is £53, compared to a £59 national
6 average.¹⁸ 63.8% of adults are classified as having excess weight, higher than the national
7 average of 61.3%.¹⁹
8
9 The need for innovation within public health has been postulated, shifting away from the
10 traditional linear pre-conceived and evidence-based model.²⁰ For example, Parry and
11 colleagues²¹ call for research to explore not only how a programme works, but also the
12 context and requirements for any adaptations. One such approach is prototyping²² where
13 projects test innovations iteratively, with ongoing refinement considering the interplay
14 between a programme and its delivery context. Evaluation and public health teams are able to
15 communicate at all stages of the programme, with evaluation recommendations incorporated
16 via a rapid-cycle basis.²¹ A small number of studies to date, for example in drug prevention²²
17 and web-based support of long-term weight loss²³ have demonstrated efficiencies when
18 including elements of prototyping within programme development (including time,
19 adaptation to context and cost). Such an approach seems particularly well-suited to weight
20 management, where there are many examples of ‘good’ practice, or effectiveness, but no
21 clear consensus on ‘best’ practice at service-delivery level. There is also limited
22 understanding of how ‘scaling up’ and adapting of programmes or interventions to local
23 contexts may impact on effectiveness. This evaluation has particular value therefore in testing
24 a prototyping approach for a weight management programme, delivered and adapted ‘in real-
25 time’, at local authority level.

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3 1 The aim was to explore implementation of an ‘off-the-shelf’ weight management programme,
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5 2 Momenta²⁴, in a challenging context. Specific objectives were to explore local
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7 3 implementation, consider feasibility of the iterative prototyping evaluation framework and
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9 4 explore preliminary outcome domains including recruitment, retention, weight change and
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11 5 wellbeing.
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17 7 **METHODS**

18 8 19 20 21 9 **The prototyping process: local context and evaluation design**

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26 11 A local authority health needs assessment identified a gap in provision for a lifestyle-based
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28 12 weight management referral programme within Northumberland. Adults with overweight or
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30 13 obesity were at the time eligible for referral to the Northumberland exercise referral scheme
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32 14 (ERS), however previous evaluation demonstrated modest weight loss²⁵ and body mass index
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34 15 (BMI) >30 kg/m² was negatively associated with adherence.²⁶ Thus ‘Momenta’ was
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36 16 commissioned for local adaptation and delivery. The Momenta programme incorporates
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38 17 evidence-based behaviour change techniques and is designed to be delivered by fitness
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40 18 professionals in a leisure environment.²⁴ Developed by the MEND childhood weight
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42 19 management programme²⁷ designers, this 12-week programme aims to facilitate weight loss
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44 20 by engaging participants in 12 key behaviours broadly encompassing psychology, diet and
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46 21 physical activity (supplementary file 1). Briefly, Momenta sessions explored topics using
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48 22 interactive and experiential learning techniques including brainstorming, group activities and
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50 23 discussion, quizzes and games. At the end of each session, participants set goals focusing on
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52 24 one of the 12 key behaviours. At the beginning of each session, the group discussed the
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1 previous weeks' goals by exchanging stories and brainstorming challenges. All interventions
2 were free to service users.

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10 The local Leisure Trust was commissioned to deliver a pilot Momenta programme.
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12 Commissioners and providers had ideas about alternative delivery options and due to an
13 established academic relationship, asked the study team for advice about robust evaluation
14 that would allow for feedback in real time and at the end of the pilot. Stakeholder meetings
15 were held with Public Health staff (n=2), Leisure Trust managers (n=3), delivery staff (n=2)
16 and Momenta programme developers (n=2). As part of the prototyping process, members of
17 the evaluation team (CDR, EO) provided guidance on evaluation design and light touch
18 advice about tools to explore preliminary effectiveness. The evaluation was thus co-
19 produced to ensure a robust framework, whilst meeting strategic local needs. For example,
20 commissioners were concerned about meeting recruitment targets for an existing specialist
21 weight management service used mainly for pre-bariatric patients and Momenta was initially
22 commissioned for patients with BMI 25.0-29.9 kg/m², although this was later amended.
23 Furthermore, commissioners were keen to consider accessibility of provision and wished to
24 explore offering free gym, swimming and fitness class membership. The evaluation was
25 designed to accommodate this.

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47 The programme was ultimately delivered at two leisure sites situated within the 20% and
48 50% most deprived neighbourhoods in the country. Six General Practice (GP) surgeries,
49 identified as the best referrers to the existing ERS, were asked to refer suitable patients to
50 Momenta. The programme manager and the public health improvement manager (LN)
51 attended practice meetings to articulate referral criteria and disseminate advertising materials.
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3 1 Attendance varied from two to all practice staff, meaning that in some surgeries knowledge
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5 2 of the programme was reliant on dissemination by those who attended.
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10 4 A mixed methods evaluation was agreed between the evaluation team and commissioners.
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12 5 Qualitative and quantitative components were conducted concurrently and had equal status.²⁸
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14 6 Prototyping allowed for iterative changes to be made to the implementation and delivery of the
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17 7 programme in real time and we reflect upon these in the results and discussion.
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21 9 Referrals by healthcare professionals (HCPs) were via a standardised form to the appropriate
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24 10 leisure site. Prior to programme commencement the Leisure Trust, in conjunction with the
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26 11 Momenta programme designer and members of the evaluation team, held a training day for
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28 12 delivery staff. Although staff were qualified to deliver Momenta, extra bespoke training
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31 13 (including role-play scenarios and problem-solving discussions) was delivered by the clinical
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33 14 psychologist who designed Momenta. The evaluation team (CDR, CH) trained delivery staff
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35 15 in international standard anthropometric techniques²⁹ and familiarised them with other
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38 16 evaluation measures.
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42 18 Programme providers allocated service users into one of three comparison groups:

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44 19 a) Combined Momenta plus fitness membership (Momenta-Fitness);
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47 20 b) Momenta;
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49 21 c) Fitness membership (Fitness only).

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51 22 Participants were allocated into groups in order of receipt (the first referral form received was
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54 23 allocated to Momenta-Fitness, the second form to Momenta, the third form to fitness only
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56 24 etc.). The provider then contacted participants by telephone to arrange attendance. If a
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58 25 participant was unable to attend the allocated group, (e.g. due to inconvenient session times)
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1 provider allocated them to a different group after discussion. Due to maximum recommended
2 Momenta group size, referrals were split into delivery cohorts of 15, with groups rolling
3 through March 2015 to April 2016.

4
5 Implementation effectiveness for the referral process was explored through semi-structured
6 interviews with referring HCPs (undertaken at referring surgeries) and focus groups with
7 service users (in leisure centres). All were conducted by LN during March-July 2015, as part
8 of her Public Health Master's degree (which contained qualitative methods training), mentored
9 by TF, an experienced qualitative researcher. LN was employed as a member of the
10 Northumberland public health team at the time of the evaluation. Questions are included in
11 supplementary file 2. Data were audio-recorded. Results are reported using the Consolidated
12 criteria for Reporting Qualitative research guidelines.³⁰

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14 Practice managers from all six referring surgeries were sent an email invitation for staff to
15 take part (n = 84), (General Practitioner = 53, Practice Nurse = 18, Health Care Assistant =
16 13). Individual correspondence was sent to those agreeing. LN informed participants about
17 her employment status and that the study aimed to understand implementation issues.
18 Interviews aimed to explore HCPs' referral experiences; raising weight issues; assessing
19 readiness to change; marketing and referral materials; and the referral process. Interview
20 questions were pilot tested with public health colleagues to assess timing and ensure validity.
21 One question (*Thinking about after you referred the patient, what happened next?*) was
22 omitted after piloting as it was realised HCPs would not have had patient feedback at that
23 point. Interviews lasted on average 26 minutes and were transcribed verbatim. Data were
24 analysed following each interview, with developing themes considered to determine whether

1 questions required refinement. Initial themes generated from the first two interviews did not
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1 questions required refinement. Initial themes generated from the first two interviews did not
2 change and thus questions remained constant, although prompts were added.

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4 During the initial assessment session for the first wave of referrals, all ($n = 39$) were given a
5 written invitation to participate in a series of focus groups at programme-end to explore
6 experiences. Emphasis was placed on the referral process, initial expectations and
7 experiences of participation; how weight issues were raised by HCPs; time from referral to
8 initial assessment; and facilitators and barriers to taking part. Focus groups lasted between 26
9 and 44 minutes.

10
11 Preliminary outcome data were collected to provide an initial indication of programme
12 success. These included anthropometric measurements to determine weight change. Well-
13 being measures were of specific interest to commissioners. Sociodemographic information
14 was also available as indicated.

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16 Age, gender and postcode (for index of multiple deprivation, IMD) were recorded by
17 referring HCPs on the referral form. Employment status, level of education, cohort wave and
18 programme group were recorded by leisure staff, who also measured weight and stature
19 (without shoes or bulky clothing) and waist circumference at baseline and programme end.

20 Measures were taken in at least duplicate, using standardised tools in accordance with
21 international standards²⁹ using SECA 761 scales, a Leicester portable stadiometer and
22 anthropometry tape. Body mass index was calculated and classified according to WHO
23 guidelines.³¹ The Warwick-Edinburgh Mental Well-being Scale,³² and the Hospital Anxiety
24 and Depression Scale (HADS)³³ were administered at each time-point. Attendance at
25 Momenta and leisure centre usage was monitored via swipe-card tracking. 52 weeks after

1 commencing the programme, service users were invited to attend a follow-up session, where
2 leisure staff repeated physiological and psychological measures. Programme providers
3 collected and collated quantitative data and provided an anonymised dataset to the evaluation
4 team for analysis.

6 **Patient and public involvement**

7 Patients and the public were not involved in the choice of evaluation topic, assisting in the
8 study design, advising on the project or in carrying out the evaluation.

10 **Data analyses**

12 Qualitative data were audio-recorded and transcribed by LN using a thematic process.³⁴ Data
13 were organised according to concepts, key themes and developing categories. Data coding
14 was discussed with TF, allowing comparison of data interpretation and subsequent coding
15 refinement. Evolving key themes were refined through the analysis process and subsequent
16 cross-sectional thematic labelling of data, thus generating deeper understanding. Where
17 possible, key phrases or expressions identified from interviews and focus groups were
18 retained within coding and thematic labelling. A public health colleague helped to verify
19 interpretations of the data and appropriateness of codes applied. Once initial interviews were
20 coded this framework was applied to remaining data. Notes taken during focus groups helped
21 to contextualise when developing themes and included information about dynamics within
22 groups, such as influence, disagreement, humour and peer exposure.

24 The anonymised quantitative dataset was analysed using PSAW Statistics V.22. Descriptive
25 statistics were calculated for age, gender, IMD, employment status, initial BMI, leisure site,

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3 1 level of education, and uptake and adherence. Distribution and normality of measures
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5 2 (weight, BMI, waist circumference, psychological wellbeing and attendance) were assessed
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7 3 using Shapiro Wilk tests and median and interquartile range (IQR) scores calculated for each
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9 4 group at baseline and 12 weeks (attendance, 12 weeks only). Using complete cases, Kruskal-
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11 5 Wallis H tests were used to explore preliminary between-group differences at baseline and at
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13 6 12 weeks and Wilcoxon-signed rank tests explored preliminary repeated measures differences
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15 7 between baseline and 12-week scores. Complete cases available at 52 weeks ($n = 37$) were
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17 8 considered similarly, but via separate analyses due to limited available data across
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19 9 comparison groups.
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32 11 **RESULTS**

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35 13 Between December 2014 and March 2016, the programme received 182 referrals and was
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37 14 delivered in four cohorts across leisure sites. Due to initial low levels of recruitment, the first
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39 15 cohort did not start until March 2015. Referrals were mainly female (83%) and 30.6% lived
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41 16 in the 20% most deprived areas (table 1).
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Table 1. Demographic characteristics of referrals who started the programme (n=153)

	Median	IQR	
Age (years)		53	24
Gender		n	%
Male		25	16.3%
Female		120	78.4%
Not stated		8	5.2%
Initial BMI category (kg/m²)			
25.0-29.9		40	26.1%
30.0-34.9		73	47.7%
35.0-39.9		27	17.6%
≥40.0		10	6.5%
Not stated		3	2.0%
Leisure site			
Leisure site 1 (IMD quintile 2)		69	45.1%
Leisure site 2 (IMD quintile 3)		83	54.2%
Not stated		1	0.7%
Index of multiple deprivation			
20% most deprived		42	27.5%
21-40%		33	21.6%
41-60%		17	11.1%
61-80%		20	13.1%
20% least deprived		35	22.9%
Not stated		6	3.9%
Employment status			
Employed full time		36	23.5%
Employed part time		24	15.7%
Retired		51	33.3%
Claiming incapacity benefit		5	3.3%
Claiming job seekers allowance		6	3.9%
Not stated		14	9.2%
Level of education			
Primary		15	9.8%
Secondary (O level/GCSE)		35	22.9%
Secondary (A level)		26	17.0%
Further education (HND)		24	15.7%
Bachelors or equivalent		21	13.7%
Masters or equivalent		5	3.3%
Not stated		27	17.6%

Age, gender and postcode (IMD calculated by the programme provider) recorded from the referral form.

Employment and level of education self-reported by participants during the first session. The provider did not follow up missing data.

BMI and leisure site recorded by the provider. Missing data not available for analysis and presumed to be data entry errors.

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6 2**Implementation effectiveness: reflections from referring healthcare professionals**7
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4 Five face-to-face semi-structured interviews took place with HCPs across five referring
5 surgeries: two GPs, two Practice Nurses and one Health Care Assistant. HCPs perceived that
6 four key themes influenced the effectiveness of programme implementation: (i) difficulties
7 raising weight with patients, (ii) how gender affected patient engagement, (iii) availability of
8 information and resources, and (iv) additional barriers constraining programme promotion.

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10 Raising the issue of weight with patients:

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12 Concerns about raising weight may have contributed to slow recruitment, with nurses and
13 healthcare assistants expressing unease, *'not really up to me... well I talk about it if they want
14 to.... Better if they [patients] bring it up.'* (Interview 2, Healthcare Assistant). GPs seemed
15 more comfortable raising weight with patients, but with the caveat that this is easier in the
16 context of a longer-term GP/patient relationship.

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*'the people I see I've known for a very long time... it's the rapport you have...if I'd
18 never met anyone before and they came in for a sore throat I'm not going to say
19 you're fat...If there was someone I'd known for a long time and it seemed
20 relevant...I'd mention it.'* (Interview 5, GP).

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22 Gender and engagement in the referral process:

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3 1 Gender was highlighted as influencing the referral process, women being more likely than
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5 2 men to seek support for weight. This may help explain the low rate of referral for males
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8 3 (17%):
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10 4 *'More women talk about it...men don't really talk about weight...I do mention weight*
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12 5 *to men if I'm doing a well man [sic] but it doesn't come up really...it's a woman*
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14 6 *thing...'* (Interview 3, Practice Nurse).
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20 8 Availability of information and resources:
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24 10 Several interviewees highlighted training needs around programme information and
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26 11 resources, (e.g., additional programme information would help to engage patients). For
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28 12 example, the GPs both discussed the longstanding ERS and stated they needed to become
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30 13 more familiar with Momenta, as they had with the ERS:
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33 14 *'when we get opportunities to do things in the practice we normally discuss it, let*
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35 15 *everyone know where appropriate forms and information is and it's in your*
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37 16 *head...that didn't happen with this and I don't know why that was.'* (Interview 5, GP).
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42 18 All HCPs interviewed felt the referral leaflet (provided by programme providers) was
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44 19 important in the process, either as a tool to promote the intervention or to convey information
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46 20 to patients:
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50 21 *'The leaflet was good, bright...explained the programme and patients like taking a*
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52 22 *leaflet away.'* (Interview 3, Practice Nurse)
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3 1 Additional Barriers to Engagement:
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9 3 Several sub-themes highlighted additional barriers to the referral process. The most
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11 4 prominent sub-themes were around initial BMI referral criteria (25.0-29.9 kg/m²) and delayed
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13 programme start. Both implementation factors were beyond the control of the referrers, but
14 5
15 consequently amended through iterative refinement during the prototyping process following
16 6
17 early data analysis. Both were reported by practice nurses as exacerbating each other:
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19 8 *'we were referring but then it didn't start so people were not sure what was*
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21 9 *happening [pause]...Think it was more people were needed to start...but you know if*
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23 10 *the BMI was higher then there would have been more.'* (Interview 3, Practice Nurse).
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30 12 In one case, a decision was taken to relax the referral criteria, *'...31.5 [kg/m²]...was just*
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32 13 *outside so I just referred him.'* (Interview 4, GP).
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37 15 Programme location was perceived by HCPs to overcome an existing barrier to the tier three
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39 16 weight management programme, as Momenta was *'round the corner for people,'* as opposed
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41 17 to *'a bit far away at the hospital.'* Cost barriers were also discussed, both with reference to
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43 18 the patient, *'in this sort of area...cost..., if you've got to pay it's a barrier.'* (Interview 4, GP),
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45 19 and to expected targets from Clinical Commissioning Groups (CCG),
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48 20 *'we are constantly told by the CCG that we must keep down on numbers and that if*
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50 21 *there are costs attached to this referral that would definitely impact... and that would*
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52 22 *be for all practices.'* (Interview 5, GP)
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1 **Implementation effectiveness: reflections from participants**

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3 Three focus groups in the leisure centres allowed programme participant voices to be heard:
4 three females and one male from Momenta (focus group 1), three males and three females from
5 Momenta-Fitness (focus group 2) and three females (one of whom emailed her views
6 separately) from Fitness-only. Across the groups, 12 participants reported having lost weight
7 and one reported weight gain. Three themes developed: (i) outcomes of the programme, (ii)
8 facilitators and barriers to engagement, and (iii) raising the issues of weight with HCPs.

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10 Outcomes of the programme:

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12 Focus group findings aligned closely with quantitative outcomes in terms of the physical and
13 psychological benefits of participation: *'[I've] lost a good bit of weight. It's been very
14 positive for me... I'm feeling a lot more active...'* (Momenta-Fitness, Participant 5).

15 Participants reported a sense of weight loss achievement, increased physical activity levels,
16 and positive mood states. In addition, elements of the Momenta programme were perceived
17 as facilitating engagement, including the *'group feeling... I looked forward to it,'* (Momenta-
18 Fitness, Participant 4), the *'information that we got every week... so very well planned.'*
19 (Momenta-Fitness, Participant 3) and the ongoing support e.g., *'she phoned me the other day
20 to see if I was coming,'* (Momenta-Fitness, Participant 4). Momenta participants reflected
21 back on, and identified and discussed lifestyle factors that related to their initial weight gain
22 (e.g., *'I did the usual thing... I started eating toffees,'* Momenta-Fitness, Participant 5),
23 demonstrating both self-awareness and an openness to discussing the topic.

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25 Facilitators and barriers to engagement:

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5 2 One participant reported being initially excluded but later allowed to take part, and others
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7 3 raised concerns that the initial BMI threshold for referral (25-29.9 kg/m²) was too low, '*was a*
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9 4 *little bit high, BMI...managed to get it down... [and then] the doctor put us forward,*'
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11 5 (Momenta, Participant 2). Data also indicated the importance of subsidised access,
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13 6 particularly important in the context of a deprived region such as this, e.g., '*I also joined*
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15 7 *Weight Watchers for short period of time but found the classes too expensive,*' (Fitness-only,
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17 8 Participant 3, emailed response).
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24 10 Raising the issue of weight with HCPs:
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28 12 Some data did suggest implementation was problematic, however, this focused exclusively
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30 13 on the referral process. Participants overwhelmingly felt that they had opened the
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32 14 conversation about weight, as opposed to discussions being initiated by HCPs (e.g., '*my*
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34 15 *glucose levels were quite high but nobody ever said that I was overweight,*' Momenta-
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36 16 Fitness, Participant 4). In addition, participants perceived limitations in HCPs' knowledge of
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38 17 intervention components ('*she [nurse] didn't know anything about it,*' Fitness-only,
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40 18 Participant 1), something with potential to impact on likelihood of referral, and
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42 19 participants' expectations of programme success.
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48 49 21 **Preliminary outcome domains** 50 51 22

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53 23 Of all referrals, 153 (84%) attended the baseline measurement session and 78 (51% of those
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55 24 who started) attended the 12-week measurement session. Uptake and adherence varied by
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57 25 programme group (table 2).
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1 **Table 2. Programme uptake, adherence and attendance.**

Uptake (week 1), adherence and retention (both week 12)	Momenta-Fitness		Momenta only		Fitness only	
Number referred		58		59		65
Uptake* (n, %)		54 (93.1%)		50 (84.7%)		49 (75.4%)
Uptake retention** (n, %)		35 (64.8%)		27 (54.0%)		16 (32.7%)
Uptake adherence^ (n, %)		34 (63.0%)		26 (52.0%)		8 (50.0%)
Overall retention*** (n, %)		35 (60.3%)		27 (45.8%)		16 (24.6%)
Overall adherence^^ (n, %)		34 (58.6%)		26 (44.1%)		8 (12.3%)
Momenta session attendance	Momenta-Fitness		Momenta only		Fitness only	
	n	Median (IQR)	n	Median (IQR)		
Uptake	54	9.0 (7.3)	50	9.0 (8.0)		
Dropouts	19	3.0 (3.0)	23	3.0 (5.0)		N/A
Completers^^^	35	10.0 (2.0)	27	11.0 (1.3)		
Exercise session attendance	Momenta-Fitness		Momenta only		Fitness only	
	n	Median (IQR)	n	Median (IQR)	n	Median (IQR)
Uptake	54	7.0 (16.3)	50	0.0 (4.5)	49	0.0 (1.5)
Dropouts	19	0.0 (1.0)	23	0.0 (0.0)	33	0.0 (0.0)
Completers^^^	35	10.0 (14.0)	26	0.0 (5.0)	16	4.5 (18.0)

*Uptake** participant attended baseline assessment; *Uptake retention*** % of participants who attended the 12-week assessment out of those who attended the baseline assessment; *Uptake adherence^* % of participants who attended the baseline assessment who also attended ≥ 8 Momenta sessions (Momenta-Fitness and Momenta only) or gym sessions (fitness only); *Overall retention**** % of all those referred who attended both baseline and 12-week assessment; *Overall adherence^^* % of all those referred who attended \geq eight Momenta sessions (Momenta-Fitness and Momenta only) or exercise sessions (fitness only); *Completers^^^* those who completed the 12-week assessment

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4 Physiological and psychological data were not normally distributed. Quantitative data are
5 presented as exploratory, due to the small sample size and are presented here for information
6 and general description. No differences were found between programme groups either at
7 baseline or at 12 weeks, for any measures. Despite the small sample size, within-group
8 changes between baseline and 12 weeks were evident for weight, BMI and waist
9 circumference for Momenta-Fitness, and Momenta (Table 3). Follow-up analysis at 52-weeks
10 (available sub-sample) suggested changes were maintained for Momenta-Fitness ($n=18$)
11 only.

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1 **Table 3. Weight, BMI and waist circumference change.**

End of programme results	Median (IQR) Baseline	Median (IQR) 12 weeks	z	Median (IQR) Change
Weight (kg)				
Momenta-Fitness (n=35)	88.9 (80.5 - 100.0)	88.0 (77.2 - 95.8)	-4.531	-2.9 (-5.1 - -1.6)
Momenta only (n=26)	87.8 (74.5 - 77.0)	83.3 (74.5 - 92.5)	-4.344	-2.9 (-5.0 - -2.0)
Fitness only (n=15)	76.2 (71.6 - 86.9)	76.6 (70.4 - 84.6)	-0.879	0.0 (-3.2 - 1.0)
BMI (kg/m²)				
Momenta-Fitness (n=35)	32.0 (30.3 - 35.7)	31.3 (29.2 - 35.3)	-4.494	-1.1 (-1.9 - -0.6)
Momenta only (n=26)	32.0 (30.0 - 34.5)	31.3 (28.6 - 33.6)	-4.356	-1.2 (-1.6 - -0.8)
Fitness only (n=14)	29.2 (27.3 - 33.0)	29.7 (27.0 - 33.3)	-0.454	0.1 (-1.2 - +0.4)
Waist circumference (cm)				
Momenta-fitness (n=35)	106.0 (98.0 - 115.0)	99.0 (93.0 - 110.0)	-4.996	-7.0 (-9.5 - -5.0)
Momenta only (n=25)	108.0 (99.5 - 114.5)	101.0 (93.8 - 111.5)	-4.166	-5.0 (-7.3 - -2.5)
Fitness only (n=11)	90.0 (87.0 - 95.0)	91.0 (90.0 - 96.0)	0.358	1.0 (-3.0 - 3.0)
52-week follow-up	Median (IQR) Baseline	Median (IQR) 52 weeks	z	Median (IQR) Change
Weight (kg)				
Momenta-Fitness (n=18)	95.2 (87.1 - 101.4)	91.4 (82.7 - 95.9)	-3.006	-4.8 (-6.2 - -1.5)
Momenta only (n=16)	84.7 (72.3 - 95.2)	82.7 (73.2 - 94.6)	-1.533	-0.7 (-7.6 - 0.8)
*Fitness only (n=3)	73.4 (69.5 - 80.2)	70.3 (66.0 - 87.0)		0.9 (-7.4 - 6.9)
BMI (kg/m²)				
Momenta-Fitness (n=18)	32.0 (30.49 - 35.1)	30.8 (28.7 - 34.0)	-3.157	-1.7 (-2.0 - -0.6)
Momenta only (n=16)	31.7 (29.3 - 33.9)	31.1 (26.7 - 33.6)	-1.603	-0.3 (-2.3 - 0.3)
*Fitness only (n=3)	27.6 (27.5 - 30.5)	27.8 (24.8 - 33.2)		0.3 (24.8 - 33.2)
Waist circumference (cm)				
Momenta-Fitness (n=18)	109.0 (101.0 - 114.8)	100.5 (94.8 - 107.3)	-3.221	-6.0 (-13.3 - -1.75)
Momenta only (n=16)	106.0 (94.5 - 115.8)	103.5 (98.5 - 113.3)	-0.780	-2.5 (-9.0 - -10.0)
*Fitness only (n=3)	89.0 (87.0 - 95.0)	90.0 (90.0 - 101.0)		3.0 (90.0 - 101.0)

* Fitness only n=3 therefore median and range reported and no statistical test completed.

3
4 Differences in mental wellbeing, depression and anxiety were not apparent between groups,
5 however improvements in mental wellbeing, and reductions in depression and anxiety were
6 suggested between baseline and 12 weeks for Momenta-Fitness, and Momenta groups only
7 (Table 4), although the magnitude of change was similar for all groups. Sub-sample analysis
8 at 52-weeks demonstrated potential for improvements for wellbeing and depression to be
9 maintained for Momenta-Fitness (n=18), and wellbeing and anxiety for Momenta (n=16).

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Table 4. Wellbeing, anxiety and depression measures change.

End of programme results	Median (IQR) Baseline	Median (IQR) 12 weeks	z	Median (IQR) Change
Mental wellbeing scale				
Momenta-Fitness (n=29)	46.0 (40.0 - 51.5)	53.0 (40.0 - 51.5)	3.810	5.0 (1.5 - 12.0)
Momenta only (n=23)	49.0 (39.0 - 58.0)	55.0 (51.0 - 63.0)	2.818	6.0 (-1.0 - 10.0)
Fitness only (n=13)	47.0 (40.5 - 59.5)	46.0 (42.0 - 63.5)	0.157	0.0 (-4.0 - 5.0)
Anxiety scale				
Momenta-Fitness (n=28)	5.5 (4.0 - 9.8)	4.5 (2.0 - 7.0)	-3.027	-1.0 (-3.0 - 1.0)
Momenta only (n=23)	8.0 (6.0 - 10.0)	4.0 (2.5 - 9.0)	-2.329	-1.0 (-3.0 - 0.0)
Fitness only (n=13)	8.0 (3.5 - 10.0)	6.0 (4.0 - 9.0)	-0.499	-1.0 (-2.0 - 2.0)
Depression scale				
Momenta-Fitness (n=28)	5.5 (3.3 - 8.0)	2.0 (1.0 - 6.0)	-3.214	-2.5 (-4.8 - -0.3)
Momenta only (n=23)	5.0 (3.0 - 7.5)	3.0 (1.0 - 5.0)	-3.049	-1.0 (-4.5 - 1.0)
Fitness only (n=13)	4.0 (2.0 - 8.5)	2.0 (2.0 - 7.0)	-1.226	-2.0 (-4.5 - 0.0)
52-week follow-up	Median (IQR) Baseline	Median (IQR) 52 weeks	z	Median (IQR) Change
Mental wellbeing scale				
Momenta-Fitness (n=15)	44.0 (39.0 - 52.0)	55.0 (48.0 - 59.0)	2.984	5.0 (3.0 - 15.0)
Momenta only (n=13)	58.0 (47.5 - 59.0)	56.0 (54.0 - 63.5)	2.282	4.0 (0.5 - 6.5)
*Fitness only (n=3)	47.0 (34.0 - 64.0)	58.0 (45.0 - 60.0)		-2.0 (-6.0 - 26.0)
Anxiety scale				
Momenta-Fitness (n=15)	6.0 (2.0 - 10.0)	2.0 (1.0 - 7.0)	-1.785	-3.0 (-6.0 - 0.0)
Momenta only (n=15)	7.0 (4.0 - 9.0)	5.0 (1.0 - 8.0)	-1.990	-3.0 (-4.0 - 0.0)
*Fitness only (n=3)	9.0 (5.0 - 10.0)	2.0 (1.0 - 8.0)		-3.0 (-8.00 - -2.0)
Depression scale				
Momenta-Fitness (n=15)	7.0 (3.3 - 11.3)	3.5 (1.0 - 6.0)	-2.908	-3.5 (-6.3 - -0.8)
Momenta only (n=15)	4.0 (1.0 - 6.0)	3.0 (1.0 - 4.0)	-0.762	0.0 (-2.0 - 1.0)
*Fitness only (n=3)	3.0 (0.0 - 8.0)	2.0 (1.0 - 8.0)		1.0 (-8.0 - 5.0)

* Fitness only n=3 therefore median and range reported and no statistical test completed.

Overall, the results suggested those who participated in the two groups incorporating Momenta, had enhanced physical and psychological health indicators from baseline, whereas those who had only free fitness membership did not. From the small follow-up sample, there is scope to suggest that the combination of Momenta and fitness membership may produce favourable outcomes at 52 weeks.

1 **Iterative refinements throughout the evaluation process**

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3 Here we list a number of implementation adjustments which were made throughout the
4 evaluation process, facilitated via the prototyping framework. Real-time advice from
5 Commissioners was considered during early stages of implementation, regarding the nature
6 of comparison offers (e.g. fitness access) and thus initial design and outcome measurements
7 were adapted prior to referrals being made. To better-target recruitment and change the
8 process of engagement at referral point, entry criteria were altered ($BMI \geq 30 \text{ kg/m}^2$) mid-way
9 through programme delivery. On-site implementation of the service offer was adapted in
10 response to delivery staff feedback: increased resource was made available, for example
11 additional staffing to support delivery for the first wave of referrals. Furthermore, staff were
12 given additional time for Momenta session preparation and session delivery times were
13 extended. Follow-up activities (i.e., text or telephone contact) were implemented by staff
14 during the process, to encourage adherence.

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16 **DISCUSSION**

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18 We explored ‘prototyping’, as a cost-effective and time-efficient approach to public health
19 evaluation, via an ‘off-the-shelf’ weight management programme implemented in a local
20 context of mixed and high deprivation.

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22 Experiences of both referrers and referrals highlighted that HCPs needed to be better-
23 informed and more confident raising weight-related conversations. Whilst patient-led action
24 is desirable, staff reluctance to raise weight issues may mean that opportunities for
25 engagement of less knowledgeable or motivated patients will be missed. The problematic

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1 positioning of GPs within obesity care has been highlighted previously,³⁵ with a range of
2 strategies to change HCPs' behaviour resulting in little or no change to patients' weight. A
3 practical training need is highlighted for those working at the patient-practitioner interface,
4 however communication with patients about weight may well be hindered by the 'stigma'
5 attached to obesity.³⁶ This has wider implications for patient outcomes and requires further
6 exploration through the implementation process. Additionally, HPCs need better
7 understanding of referral-based public health programmes offered. Despite efforts of
8 programme and public health managers, awareness was reportedly low for some referring
9 professionals. We suggest consideration of resource-efficient ways to signpost both HPCs
10 and patients themselves as part of the implementation process.

11
12 This programme was delivered across a social gradient in a region with low health indices
13 and areas of high deprivation. Some issues in relation to inequalities and service access for
14 future community-based weight management programmes were highlighted. Only 17% of
15 referrals to Momenta were males. Gender bias in weight management referral has been
16 reported elsewhere,³⁷⁻³⁸ and interviews showed that practitioners struggled to raise the topic
17 of weight with male patients. Alternative referral strategies have been employed in other
18 settings in an attempt to overcome this.³⁹ Marketing in other community spaces, or targeted
19 postal referrals could be explored in future implementation. The initial decision to restrict
20 referral to overweight-only substantially impacted on referral rates, with HCPs and referrals
21 indicating they felt limited until this restriction was reversed. Had this continued, worsening
22 health inequalities may have been an unintended consequence, something to be actively
23 avoided within public health programmes⁴⁰. The roles of, and interactions between, those
24 operating in the 'system' (i.e. the context within which the intervention operates) must be
25 considered at the point of implementation to minimise any impact from unintended

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3 1 consequences.⁵ In practical terms, this may be through continued dialogue with
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5 2 commissioners, referring professionals and referrals themselves, something which
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7 3 prototyping evaluation allows.
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12 5 Quantitative data should be interpreted as exploratory, due to the relatively small number of
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14 6 complete cases, however lessons can be learned from these data both in terms of preliminary
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16 7 outcomes and engagement/dropout. Participation in Momenta and Momenta-Fitness resulted
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18 8 in 12-week weight loss for those who completed the programme. Free fitness membership
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20 9 without the weight-management programme was poorly engaged with and did not lead to
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22 10 weight change. A small sub-sample who attended follow-up demonstrated that after one year,
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24 11 weight reductions equivalent to ~4% could be maintained for Momenta-Fitness. We caution
25
26 12 that while this might be best interpreted as hypothesis-generating for future evaluations,
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28 13 given these effects emerged despite an underpowered sample it is worth briefly considering
29
30 14 potential mechanisms here. Providing free access to fitness facilities alongside the behaviour
31
32 15 change programme may allow for continuous and self-driven behaviour change⁴¹ and
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34 16 sustaining optimal changes in adiposity over 12 months in those who remained engaged.⁴²
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36 17 Swipe card monitoring during the initial 12-week period indicated that fitness sessions were
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38 18 accessed an average 10 occasions for this group, whereas no access was apparent for
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40 19 Momenta, despite Momenta sessions being held in leisure centres. This could be important
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42 20 for community providers making decisions about delivery location. Both Momenta groups
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44 21 reported improved wellbeing, and reduced anxiety and depression at 12-weeks. The changes
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46 22 observed, though small, could be argued to approach being functionally and clinically
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48 23 meaningful, with a minimal important difference of 1.5 points previously identified for the
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50 24 HADS, for example⁴³. The behavioural intervention may drive this effect. This is consistent
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52 25 with previous work reporting co-varying changes in weight loss, depression, and quality of
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3 1 life in weight management services.⁴⁴ It is unclear whether the primary mechanism was
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5 2 weight loss, or the wider social benefits of participation. Both were valued in the qualitative
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7 3 data. Our preliminary evidence of maintained improvements in wellbeing for these groups at
8
9 4 52 weeks is particularly relevant given previously evidenced associations between poor
10
11 5 mental health, and obesity and overweight status.⁴⁵ Long-term follow-up rates will need to be
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13 6 considered in future similar programmes and we suggest year-long follow-up (at least) is
14
15 7 included as a key programme component from the outset. Consideration should be given to
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17 8 how providers can maintain contact with participants after programme end to increase
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19 9 likelihood of successful follow-up. Potential ‘light touch’ support after 12 weeks may be
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21 10 helpful and other means of obtaining follow-up data should be explored where service users
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23 11 disengage. Reasons for disengagement might also be usefully explored in future work.
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31 13 Given that no systematic problems emerged with service-user’s experiences of the
32
33 14 programme itself, our findings lend support to a streamlined approach to involvement of all
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35 15 stakeholders in programme implementation. We suggest that prototyping demonstrates
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37 16 opportunities for off-the-shelf programmes to be pragmatically moulded to local context, in
38
39 17 real-time. Many of the iterative changes made were staff-driven. This demonstrates that real-
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41 18 time consideration of feedback from on-site delivery teams can be important to the
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43 19 implementation process. Some of the adjustments required commissioning action, as they had
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45 20 resource implications; others needed advice from the evaluation team. Interestingly changes
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47 21 made throughout the process generally focused on both staff and participant experience.
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54 23 Emergence of some negative experiences of referral suggests, however, that prototyping can
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56 24 be problematic without networks or channels for ensuring key outcomes are widely
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58 25 communicated to relevant stakeholders. Overall, the evaluation demonstrated that a balance is
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3 1 needed to allow quick and efficient adaptation of off-the-shelf programmes, but with focused
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5 2 professional user engagement in the early stages of development. The prototyping approach
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7 3 had particular utility given that project resources were limited and meant that issues were
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9 4 identified and acted upon rapidly. While the programme may have progressed similarly
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11 5 without this, prototyping provided a greater structure for, and confidence in, on-going
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13 6 refinements. This was achieved via the support provided by academics, public health
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15 7 practitioners and providers. Fundamentally, adopting a prototyping approach enabled the
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17 8 delivery of a new service to an in-need population, alongside the generation of initial
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19 9 evidence of local effectiveness. A minimum of 1 kg weight-loss at 3 months, and 0.7 kg at
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21 10 12-months have been suggested as thresholds to influence decisions over commissioning of
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23 11 weight-loss services.⁴⁶ Our preliminary data suggests that Momenta may have potential to
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25 12 meet or even exceed these thresholds, showing particular promise when implemented in
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27 13 conjunction with free fitness provision.
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35 15 Demonstrating preliminary effectiveness is of limited use, however, unless a successful
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37 16 programme in one area may be adapted and implemented to suit a different context, for
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39 17 example through sharing local-level knowledge, interactions and behaviours of individuals
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41 18 within different parts of that system.⁴⁷ The process for scaling-up of effective health
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43 19 interventions to broader policy and practice takes years⁴⁸ and certainly within the obesity
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45 20 literature, has been dominated by initiatives that consider effectiveness but not
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47 21 implementation across specific settings.⁴⁹⁻⁵⁰ We recommend prototyping might be built into
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49 22 larger public health evaluations providing that the original programme has a sound theoretical
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51 23 basis, and iterative refinement is engaged with by all stakeholders from the outset.
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3 1 **CONCLUSION**
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5 2 The Momenta programme was experienced positively by those who attended. Issues with the
6
7 3 referral process need to be explored further, however other refinements were feasible during
8
9 4 delivery. Promising preliminary outcome data for completers of ‘Momenta’, particularly in
10
11 5 conjunction with a free fitness offer, implies potential for the scheme within future
12
13 6 commissioning. This evaluation extends the literature by exploring prototyping for a complex
14
15 7 problem, community weight-management, in a challenging setting, demonstrating
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17 8 streamlined implementation of an ‘off-the-shelf’ weight management programme. This
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19 9 resource-effective approach is highly relevant in the context of health inequalities and public
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21 10 health sector funding constraints.
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20
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22 initiating the evaluation. She was subsequently employed as a research assistant at Durham
23 University, however was not involved in any data collection or entry, only accessing an
24 anonymised database submitted to the University. LN was a Public Health Improvement

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3 1 Manager within the Public Health Team and had responsibility for commissioning the
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5 2 Momenta programme. The qualitative evaluation component was submitted in partial
6
7 3 fulfilment of her Master's in Public Health at Newcastle University.
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13 5 **Participant consent:** Consent was obtained for face-to-face interviews and focus groups.
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15 6 Service users were informed in writing of the nature of the quantitative service evaluation and
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17 7 how to withdraw from it. The presented data are anonymised with risk of identification low.
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24 9 **Ethics approval:** Ethical advice was sought from the local Research Manager of North of
25
26 10 England Commissioning Support, and this project was classed as a service evaluation in line
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28 11 with National Research Ethics Service guidance.
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34 13 **Data availability statement:** No additional data are available because this was a service
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36 14 evaluation.
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SUPPLEMENTARY FILE 1. Momenta session content

Week	Key topic	Week	Key topic
Getting started session	Motivation for weight loss Weight loss goals Differences from other weight management programmes Monitoring		
Week 1	Snacking Fatty, sugary snacks Calories from snacking Healthy snack choices Healthy eating patterns	Week 7	Fats Reducing fat Different types of fat Lower-fat cooking techniques Hidden fats
Week 2	Heart rate Cardiovascular exercise and health Cardiovascular exercise and weight management Recommended amounts of CV activity Heart rate and exercise	Week 8	Internal triggers Introduction to internal triggers Identifying internal triggers Managing internal triggers
Week 3	Food as fuel A balanced diet and health Planning meals Fibre	Week 9	Active lifestyles Physical activity and health Physical activity and weight management Different types of physical activity
Week 4	External triggers Introduction to external triggers External triggers and over-eating Managing triggers	Week 10	Meals Positive meal environment Shopping Food labels
Week 5	Strength Resistance activity and health Resistance activity and weight management	Week 11	Sugars Sugary foods and drinks and weight loss Alcohol Added sugars Sugary drinks and appetite regulation
Week 6	Breakfast Eating breakfast Retraining appetite Barriers to eating breakfast Developing new breakfast habits Beyond marketing	Week 12	Eating out Challenges when eating away from home Management and coping strategies Moving forwards

SUPPLEMENTARY FILE 2.**Healthcare professionals' semi-structured interview guide**

Semi Structured Interview Set the interviewee at ease; explain purpose of the interview; offer a better understanding of what the referral process requires to aid tier 2 weight management to be delivered in Northumberland; explanation about how the interview will be recorded; reaffirmation of consent; and how the information will be analysed and stored; rules of confidentiality / anonymity etc.

Questions:

1. Thinking about raising the weight issue, tell me about your experience of discussing weight with patients.

Prompts

- *How does it feel to raise weight as an issue?*
- *Are patients open to discussing weight problems?*
- *Do you find a difference between genders when discussing weight?*
- *What helps you, such as the NHS Health Check Programme, to raise the issue of weight?*
- *What else would help to raise the issue or weight in appointments?*

2. Greater retention is often achieved when patients are ready to change, tell me how you work with / assess patient's readiness to change.

Prompts

- *Have you had training around the cycle of change?*
- *Do you use any specific tools or resources to assess the patient?*
- *What would help you to assess the patient's readiness to change?*

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3. Thinking the information and resources available to you during the referral, do you feel you had enough information and resources to encourage patient take up of the programme?

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Prompts

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- *Did you have enough background information?*
 - *Were the referral forms suitable / capture all the information required?*
 - *Were the patient leaflets / resources suitable?*
 - *Were there questions or issues raised that couldn't be answered?*
 - *Was the process easy to use?*
 - *What else could help you to make referrals to weight management programmes?*

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4. Thinking about after you referred the patient, what happened next? (excluded after pilot)

Prompts

- *Did you get feedback from the weight management programme on the progress of your patient?*
- *Did your patients achieve weight loss?*
- *Did your patient come back and talk about their experience?*

5. What things are most likely to prevent you from making the referral a weight management programme, either commercial or Public Health funded?

Prompts

- *Are there barriers that you perceive, such as cost to the patient?*
- *Are you concerned with raising the weight issue?*
- *Is it a time factor if the patient has an appointment for anything other than a weight issue?*
- *What would help you to overcome the barriers that prevent you from making the referral?*

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6. Is there anything else that you would like to tell me about your expectations and experiences of the weight management programme?

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Focus Group Topic Guide

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Set group at ease; explain purpose of the focus group; offer a better understanding of what works for people in terms of tier 2 weight management and what doesn't, aiding development of an effective programme for Northumberland residents; explanation about how the focus group will be recorded; reaffirmation of consent; and how the information will be analysed and stored; rules of confidentiality / anonymity etc.

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1. Tell me a bit about what sort of weight management activity you have taken part in, in the past.

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Prompts

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- *What influence have others had on your weight management?*
 - *Do you have any particular likes/dislikes of physical activity/managing weight/nutrition*
 - *Has there been anything else that has influenced your management of weight?*

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2. So thinking about the weight management programme you have undertaken, how did you find out about it?

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Prompts

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- *Who / what motivated you to attend?*
 - *What made you decide that this is the right time to look at managing your weight?*
 - *Did the time of year make a difference?*

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3 3. Thinking about your experience of when you were referred to the weight management programme,
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5 how did you find the process?
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Prompts

- *What type of health professional referred you? (GP / Practice Nurse)*
- *Did you specifically attend Primary Care to discuss your weight?*
- *How was weight raised?*
- *What did the referrer explain to you about the programme? Did you get enough information?*
- *How long was it from your referral from Primary Care to the first assessment in the weight management programme; was this what you expected? Were you still motivated?*

4. How did you feel about being referred?

- *Prompts*
- *How confident did you feel about taking part in the programme?*
- *Was there anything that you were particularly looking forward to?*
- *Was there anything that you were worried about?*

5. What did you hope to achieve by taking part in the weight management programme?

Prompts

- *What were your expectations when you start attending the scheme?*
- *Have there been changes to your health that you expected happen as a result of participation?*
- *How quickly did you expect to see these changes? And did this happen?*

6. Thinking about after you were referred, what happened next?

Prompts

- 1 • *How long after referral did it take to be contacted by the Active Northumberland?*
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- 3 • *What information did you receive prior to the initial consultation?*
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- 5 • *How comfortable did you feel coming to the initial consultation?*
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10 7. What influenced you most to attend the weight management programme?

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13 *Prompts*

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- 15 • *What did you expect from the staff?*
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- 18 • *How important to you were changes in health or weight?*
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- 21 • *Why were the influences raised important?*
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26 8. What things were most likely to prevent you from attending the programme?

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29 *Prompts*

- 30 • *Tell me about any worries you might have had about health issues.*
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- 33 • *Tell me about any other things, such as other commitments, that might have stopped you from*
- 34 *attending*
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- 38 • *Did any of these issues arise? How did you overcome these issues?*
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43 9. Now that you have completed the programme, tell me how did you felt about undertaking the weight
44 management programme?

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48 *Prompts*

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- 50 ○ *Did you achieve the health / weight outcomes you expected?*
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- 53 ○ *Why do you think it worked or not for you?*
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- 56 ○ *Do you feel you now have the tools to continue to make positive lifestyle choices?*
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- 58 ○ *Is there something that will prevent you to continue to make positive lifestyle choices?*
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10. Is there anything else that you would like to tell me about your expectations and experiences
of the weight management programme?

For peer review only

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COREQ GUIDELINES REPORTING CHECKLIST: Prototyping for public health in a local context: a streamlined evaluation of a community-based weight management programme (Momenta), Northumberland, UK

No	Item	Guide questions/description	Information	Reported in manuscript (Section, page no.)
Domain 1: Research team and reflexivity				
Personal Characteristics				
1	Interviewer/facilitator:	Which author/s conducted the interview or focus group?	LN	Qualitative evaluation component, page 10
2	Credentials	What were the researcher's credentials?	LN: part of her Public Health Masters degree	Qualitative evaluation component, page 10
3	Occupation	What was their occupation at the time of the study?	LN: Masters student and employed as a member of the Northumberland public health team at the time of the evaluation.	Qualitative evaluation component, page 10
4	Gender	Was the researcher male or female?	Female (referred to as her)	Qualitative evaluation component, page 10
5	Experience and training	What experience or training did the researcher have?	LN: Masters in Public Health (which contained qualitative methods training), mentored by TF, an experienced qualitative researcher.	Qualitative evaluation component, page 10
Relationship with participants				
6	Relationship established	Was a relationship established prior to study commencement?	No. Practice managers from all six referring surgeries were sent an invitation for staff to take part.	Qualitative evaluation component, page 10
7	Participant knowledge of the interviewer	What did the participants know about the researcher? <i>e.g. personal goals, reasons for doing the research</i>	LN informed HCP participants about her employment status and that the study aimed to understand implementation issues. Programme participants were invited to participate in a series of focus groups at programme-end to explore experiences	Qualitative evaluation component, page 10-11
8	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? <i>e.g. Bias, assumptions, reasons and interests in the research topic</i>	Not discussed	N/A

Domain 1: Study design				
Theoretical framework				
9	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? <i>e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis</i>	Qualitative data were audio-recorded and transcribed by LN using a thematic process	Data analysis, page 12
Participant selection				
10	Sampling	How were participants selected? <i>e.g. purposive, convenience, consecutive, snowball</i>	All HCPs involved were invited: Practice managers from all six referring surgeries were sent an invitation for staff to take part Programme participants: for the first wave of referrals, all (n = 39) were invited to participate in a series of focus groups.	Qualitative evaluation component, page 10-11
11	Method of approach	How were participants approached? <i>e.g. face-to-face, telephone, mail, email</i>	HCPs: by email Programme participants: written information handed out during the first session	Qualitative evaluation component, page 10-11
12	Sample size	How many participants were in the study?	5 HCPs 13 Intervention participants	Results, page 18 Results, page 18
13	Non-participation	How many people refused to participate or dropped out? Reasons?	HCPs: 84 invited, 5 participated. Programme participants: 39 invited, 13 participated Reasons for refusal not documented	Qualitative evaluation component, page 10-11 and Results, page 15 Results, page 18
Setting				
14	Setting of data collection	Where was the data collected? <i>e.g. home, clinic, workplace</i>	HCPs: in referring surgeries Programme participants: in the leisure centres	Results, page 15 Results, page 18
15	Presence of non-participants	Was anyone else present besides the participants and researchers?	Not stated	N/A
16	Description of sample	What are the important characteristics of the	HCPs: role reported	Results, page 15 Results, page 18

		sample? <i>e.g. demographic data, date</i>	Programme participants: programme group and weight loss status reported Date range for interviews reported	Qualitative evaluation component, page 10
	Data collection			
17	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Semi-structured interview guide used. Pilot tested. Guides provided as supplementary file	Qualitative evaluation component, page 10-11 Supplementary file 2
18	Repeat interviews	Were repeat interviews carried out? If yes, how many?	No not applicable to study design	N/A
19	Audio/visual recording	Did the research use audio or visual recording to collect the data?	Yes, the interviews were audio recorded	Data analysis, page 12
20	Field notes	Were field notes made during and/or after the interview or focus group?	Notes taken from focus groups helped to contextualise developing themes	Data analysis, page 12
21	Duration	What was the duration of the interviews or focus groups?	HCPs average length reported: 26 minutes Programme participants: range reported: 26-44 minutes	Qualitative evaluation component, page 10 Qualitative evaluation component, page 11
22	Data saturation	Was data saturation discussed?	No	N/A
23	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	No	N/A
	Domain 3: analysis and findings			
	Data analysis			
24	Number of data coders	How many data coders coded the data?	N=2 (LN and TF)	Data analysis, page 12
25	Description of the coding tree	Did authors provide a description of the coding tree?	Yes key themes described at beginning of HCP qualitative results section and at beginning of programme participant qualitative results section	Results, page 15 Results, page 18
26	Derivation of themes	Were themes identified in advance or derived from the data?	Identified from data	Data analysis, page 12

27	Software	What software, if applicable, was used to manage the data?	Not stated	N/A
28	Participant checking	Did participants provide feedback on the findings?	No	N/A
Reporting				
29	Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. participant number	Yes, participants identified using a participant label	Results, page 15-19
30	Data and findings consistent	Was there consistency between the data presented and the findings?	Themes were illustrated by participant quotations	Results, page 15-19
31	Clarity of major themes	Were major themes clearly presented in the findings?	Themes identified and presented under sub headings for both HCPs and programme participants	Results, page 15-19
32	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	For HCPs minor themes highlighted under additional barriers to engagement	Results, page 17