Preventive Medicine 121 (2019) 128–135

Contents lists available at ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed

Improving child weight management uptake through enhanced National Child Measurement Programme parental feedback letters: A randomised controlled trial

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ARTICLE INFO

Keywords:
Behavioural insights
Childhood obesity
NCMP
Weight management
Uptake
Behaviour change
Prompts
Social norms

ABSTRACT

This single-blind, pragmatic, cluster randomised controlled trial aims to investigate uptake of children's weight management services in response to enhanced National Child Measurement Programme (NCMP) letters providing weight status feedback to parents in three English counties in 2015. Parents of 2642 overweight or very overweight (obese) children aged 10–11 years received an intervention or control letter informing them of their child's weight status. Intervention letters included (i) a visual tool to help weight status recognition, (ii) a social norms statement, and for very overweight children, (iii) a prepopulated booking form for weight management services. The primary outcome was weight management service enrolment. Additional outcome measures included attendance at and contact made with weight management services, and a number of self-report variables. A small effect was observed, with intervention parents being significantly more likely to enrol their children in weight management services (4.33% of Intervention group) than control parents (2.19% of Control group) in both unadjusted (OR = 2.08, $p = .008$) and adjusted analyses (AOR = 2.48, $p = .001$). A similar picture emerged for contact with services (4.80% Intervention vs. 2.41% Control; OR = 2.10, $p = .003$; AOR = 2.46, $p < .001$) and attendance at services, although group differences in the latter measure were not significant after corrections for multiple comparisons (1.89% Intervention vs. 1.02% Control; AOR = 2.11, $p = .047$). No effects were found on self-report variables. Theoretically informed weight status feedback letters appear to be an effective strategy to improve enrolment in paediatric weight management services.

1. Introduction

Children with obesity are at greater risk of developing diabetes, heart disease and some cancers over their lifespan (Biro and Wien, 2010). In 2016/17, Public Health England's (PHE) National Child Measurement Programme (NCMP), found that 22.6% of 4–5 year olds were overweight (OW) or had obesity (very overweight; VOW), rising to 34.3% of 10–11 year olds (NHS Digital Stats Team, 2017).

The NCMP informs parents of their child's weight status by letter to enable parents to understand their child's health status and encourage healthy lifestyle behaviours (PHE, 2017). Where available, families of OW and VOW children are also invited to attend weight management services (WMS). However, few studies have explored whether these letters facilitate behaviour change.

Studies from the UK (e.g., Falconer et al., 2014) and similar programmes in the US (e.g., Bailey-Davis et al., 2017) have found that

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https://doi.org/10.1016/j.ypmed.2019.01.023
Received 24 September 2018; Received in revised form 15 January 2019; Accepted 29 January 2019
Available online 13 February 2019
0091-7435/

parents often plan behavioural changes after receiving weight-feedback letters (Mooney et al., 2010). However, plans may not translate into action; in one study 72% of parents of OW/VOW children intended to change their child's lifestyle after NCMP feedback, but this dropped to 55% reporting behaviour change at follow-up (Park et al., 2014). Furthermore, only one third reported seeking further information/support for their child's weight, often consulting friends and the internet rather than the health professionals recommended in the NCMP letter (Falconer et al., 2014).

The low proportion of parents taking recommended action may be linked to the fact that few parents recognised excess weight in their child; even after receiving the NCMP weight feedback letter, correct recognition of OW and VOW was at 14% and 35% respectively (Falconer et al., 2014). Many studies have found that parents seldom identify excess weight in their children (e.g., Lundahl et al., 2014; Parkinson et al., 2017; Parry et al., 2008; Rietmeijer-Mentink et al., 2013), possibly due to rising obesity rates changing social norms surrounding weight (Hansen et al., 2014). Not recognising overweight in one's child is a proposed barrier to seeking health professional support (Kelleher et al., 2017). Therefore, improving parental recognition of their child's weight status may encourage families of OW/VOW children to act in response to NCMP letters.

Parents often assess their child's weight subjectively (e.g., visually comparing with other children) instead of using BMI and growth charts (Jones et al., 2011). Aligning weight-feedback with parents' assessment strategies (i.e., visually, and referring to social comparisons) could help improve recognition of overweight. For example, colour-coded BMI charts have helped paediatricians explain weight status to families, improving recognition of overweight (Perrin et al., 2010). The MapMe scale (Jones et al., 2017b) shows computer-generated images of children's body shapes across weight categories, thus clearly demonstrating what healthy weight, OW and VOW children look like in accordance with BMI charts. It could be easily incorporated into the letters and may give parents an objective, visual frame of reference to compare their child's weight against (instead of subjective comparisons against other children in their immediate environments).

Social norms information describing how a child's weight compares to others could also help correct weight perceptions. Other people's behaviour informs us of how we are expected to behave, and using social norms feedback has been an effective behaviour change strategy in GP prescribing behaviour (Hallsworth et al., 2016) and binge drinking (Perkins, 2002) for example. As the majority of children are a healthy weight, parents of OW/VOW children could be informed that their child's weight is less healthy than that of most other children to encourage actions to align with the prevailing social norm.

Reducing the required effort also increases the likelihood that a behaviour will be performed; even small changes, such as helping individuals to fill in financial aid forms, can impact complex behaviours such as university enrolment (Bettinger et al., 2012). Therefore, WMS uptake may increase if the effort of signing up is decreased by providing booking forms that have been pre-populated with the family's details.

Research in Screening and Brief Interventions and Referral to Treatment (SBIRT) shows that brief interventions (such as quick, opportunistic referrals by physicians) can significantly impact WMS attendance and family obesity prevention behaviours (e.g., Aveyard et al., 2016; Byrne et al., 2018). Research has also shown that making small changes to invitation letters can improve attendance at health check appointments (Sallis et al., 2016). Therefore, making these small adaptations to the NCMP weight-feedback letter could significantly impact families' weight management behaviours whilst incurring a relatively low cost.

2. The current study

This study tested the effects of the standard feedback letter in use at the time of the trial (Control) against an Intervention letter including; (i) social norms information, (ii) the MapMe tool and, for families of VOW children only, (iii) a pre-populated WMS booking form.

The Intervention letter was expected to increase the number of families contacting/enrolling/attending WMS (H1), and the percentage of parents correctly identifying their child's weight status as OW/VOW (H2a), acknowledging the associated health risks of excess weight for their child (H2b), acknowledging that their child's weight status was less healthy than that of other children (social weight norms; H2c) and reporting behavioural changes at home or accessing support (H2d).

3. Method

3.1. Participants and design

A single-blind, two-armed, pragmatic cluster randomised controlled trial was conducted in schools with Year 6 children[2] (aged 10–11 years) across three Local Government Areas (LGAs) in England (Leicester City, Leicester County and Rutland); a total of 283 eligible schools. Eligible participants were parents of OW and VOW children in Year 6 at these schools. LGAs consented to participate in the trial on behalf of schools prior to randomisation. Consent for the parental questionnaire was assumed by survey return. The National Research Ethics Service Committee North East –Tyne and Wear South granted ethical approval (19th December 2014), reference 14/LO/2202.

3.2. Randomisation and masking

PHE stratified eligible schools by number of pupils per school year in 2014/15 (schools were grouped into five sets representing class size; (i) 20 or less, (ii) 21–35, (iii) 36–50, (iv) 51–70, (v) 70 or more) and school location categories (schools were tabled according to their Office for National Statistics supergroup and deprivation decile. Supergroups were then combined where location types and deprivation levels were similar to create four groups; (i) Countryside, (ii) Multicultural City Life/Disadvantaged Urban Communities, (iii) Miscellaneous Built-Up Areas, and (iv) White Collar Urban/Professional City Life; ONS, 2015). Stratification occurred before measurements took place meaning that chance variation in numbers of OW/VOW children between trial arms could occur. Stratified schools were randomised using the random number generator in Excel. Schools, parents and measurement staff were blind to allocation.

3.3. Procedures

Head teachers in the intervention schools were informed that a new NCMP feedback letter would be trialled. All procedures followed standard NCMP protocols and were overseen by Leicestershire Partnership Trust (LPT), the body in charge of running the NCMP locally. School nurses collected weight and height measurements between 5th January and 29th May 2015 according to NCMP operational guidance (PHE, 2017). BMI centiles were calculated using the NCMP IT system and were used to determine weight categories based on UK90 clinical cut-offs (Freeman et al., 1995) of the 91st and 98th centiles for OW/VOW respectively. Feedback letters (control or intervention) were posted to parents by LPT within six weeks of measurement. Leicestershire Nutrition and Dietetic Service provided data on families' WMS engagement to LPT, who matched the data to NCMP records and provided anonymised data to PHE. Ethnicity information was removed for some children to preserve anonymity. A questionnaire (with FREEPOST envelope addressed to PHE) was sent to all parents four weeks after NCMP feedback.

[2] Although children aged 4–5 years are also measured as part of the NCMP, the local WMS in the LGAs included were only suitable for children over the age of 8 years. Therefore, only families of children aged 10–11 years were included.

3.4. Materials and measures

3.4.1. NCMP feedback letters

3.4.1.1. Control letters

Letters (supplementary file 1) followed the national template at the time and informed parents of their child's height, weight, measurement date and weight category. Parents were invited to enrol at local WMS and, for VOW children only, attend a one-to-one dietitian appointment via the same service. Letters included a local physical activity (PA) flyer, tips from the national Change4Life campaign run by PHE, and a WMS leaflet with contact details.

3.4.1.2. Intervention letters

Intervention letters (supplementary files 2,3) included the same weight-feedback information, PA options flyer and Change4Life tips as control letters but additionally included three key components.

3.4.1.2.1. Body image scales. MapMe body image scales (developed by Jones et al., 2017b) were included as colour-printed, sex-specific pictorial scales showing computer-generated images of children at known weight statuses for children aged 10–11 years, ranging from underweight (UW) to VOW. The scales correspond to the UK90 BMI centiles used by the NCMP. The scales did not specifically indicate where the child would be placed on the scale, however the weight category labels on the scale matched the weight categories described in the letter.

3.4.1.2.2. Social norms message. A social norms statement was included to facilitate recognition that as most children are not OW/VOW (NHS Digital Stats Team, 2017), their child was heavier than the majority of children of a similar age living in the same LGA. Statements included the child's name and LGA.

3.4.1.2.3. Behavioural prompts

Letters to parents of VOW children included a personalised statement informing them that their child had been reserved a place at WMS and a pre-populated booking form (with child's name and address) with freepost envelope (supplementary file 4).

The letters are coded according to the Behaviour Change Technique Taxonomy V1 (BCT-T V1; Michie et al., 2013); see Table 1.

In total, 12 versions of the intervention letter were developed, representing both weight categories, both sexes and each of the three LGAs.

3.4.1.3. Parent Questionnaire

The questionnaire was adapted from earlier studies (Falconer et al., 2014; Park et al., 2014; Park et al., 2013). Questions investigated recognition of child overweight (H2a), acknowledgement of physical health and mental wellbeing risks to the child (H2b), perceptions of the child's weight in comparison to other children (H2c), and self-reported behaviour change (child's physical activity levels or diet, seeking external support, accessing self-help resources; H2d). Supplementary file 5 contains the questionnaire and supplementary file 6 contains variable calculation information.

3.4.1.4. Demographic Measures and Weight Management Service data. Demographic measures (child age, child sex, clinical weight status, LGA, Index of Multiple Deprivation (IMD; ranging from Quintile 1 most deprived to Quintile 5 least deprived) and urban/rural classification of home residence) were collected as part of the routine NCMP process. Engagement (contact/enrolment/attendance) with WMS was collected by Leicestershire Nutrition and Dietetic Services as per usual procedure.

3.5. Outcomes

Three measures of WMS "uptake" were measured, including enrolment (primary outcome; H1), contact made, and attendance (secondary outcomes; H1). Enrolment (as opposed to attendance) was selected as the primary outcome as local services do not always have spaces available, meaning that families asking to attend are sometimes put on waiting lists. Further secondary outcomes were the questionnaire variables described above.

3.6. Analyses

Power was calculated using Stata version 12.0 (College Station TX: Stata Corp) to determine the minimum detectable difference in WMS enrolment between the intervention and control arms, given estimated numbers of OW/VOW families and baseline WMS uptake rates from LPT's 2013/14 data. A minimum detectable increase in uptake of 1.39% in the intervention group compared to the control group would be required to obtain statistical significance at 90% power (supplementary file 6).

Main analyses were conducted using Stata version 13.1 (College Station TX: StataCorp). Chi-square and *t*-tests compared baseline characteristics between the two arms. For all outcomes, mixed-effects logistic regression models (binary/ordinal for some questionnaire outcomes) explored intervention effects. Bonferroni corrections resulted in adjusted alpha levels of 0.016 recurring for behavioural outcomes and 0.005 recurring for questionnaire outcomes. Adjusted models were also calculated including sex, clinical weight status, LGA, IMD, urban/rural location of residence classification, and ethnicity. Schools were included in models as a random effect. Intraclass correlation coefficients (ICCs) > 0.05 (representing a small to medium effect) were considered sufficient evidence that mixed effects models were appropriate.

Post-hoc exploratory analyses investigated intervention effects by weight category separately. Splitting the data resulted in small sample sizes, affecting model convergence in mixed-effects regressions. Therefore chi-square tests explored data trends.

Complete case analyses were conducted. The control group was used as the reference group for all analyses.

4. Results

Two-hundred and eighty three schools were randomised to the

Table 1
Characterisation of letter components (Control and Intervention) according to the Behaviour Change Technique Taxonomy Version 1 (BCT-T V1).

Component	Intervention (OW)	Intervention (VOW)	Control
MapMe scales	5.1 Information about health consequences 6.2 Social comparison 13.2 Framing/reframing	5.1 Information about health consequences 6.2 Social comparison 13.2 Framing/reframing	Not present
Social norms statement	6.2 Social comparison	6.2 Social comparison	Not present
Pre-populated booking form	Not present	12.5 Adding objects to the environment	Not present
WMS referral (Note that this component was emphasised to a greater extent in intervention letters for VOW children, where recipients were informed that a place had been reserved for them instead of simply suggesting attendance.)	7.1 Prompt/cue 3.2 Social support (practical)	7.1 Prompt/cue 3.2 Social support (practical)	7.1 Prompt/cue 3.2 Social support (practical)

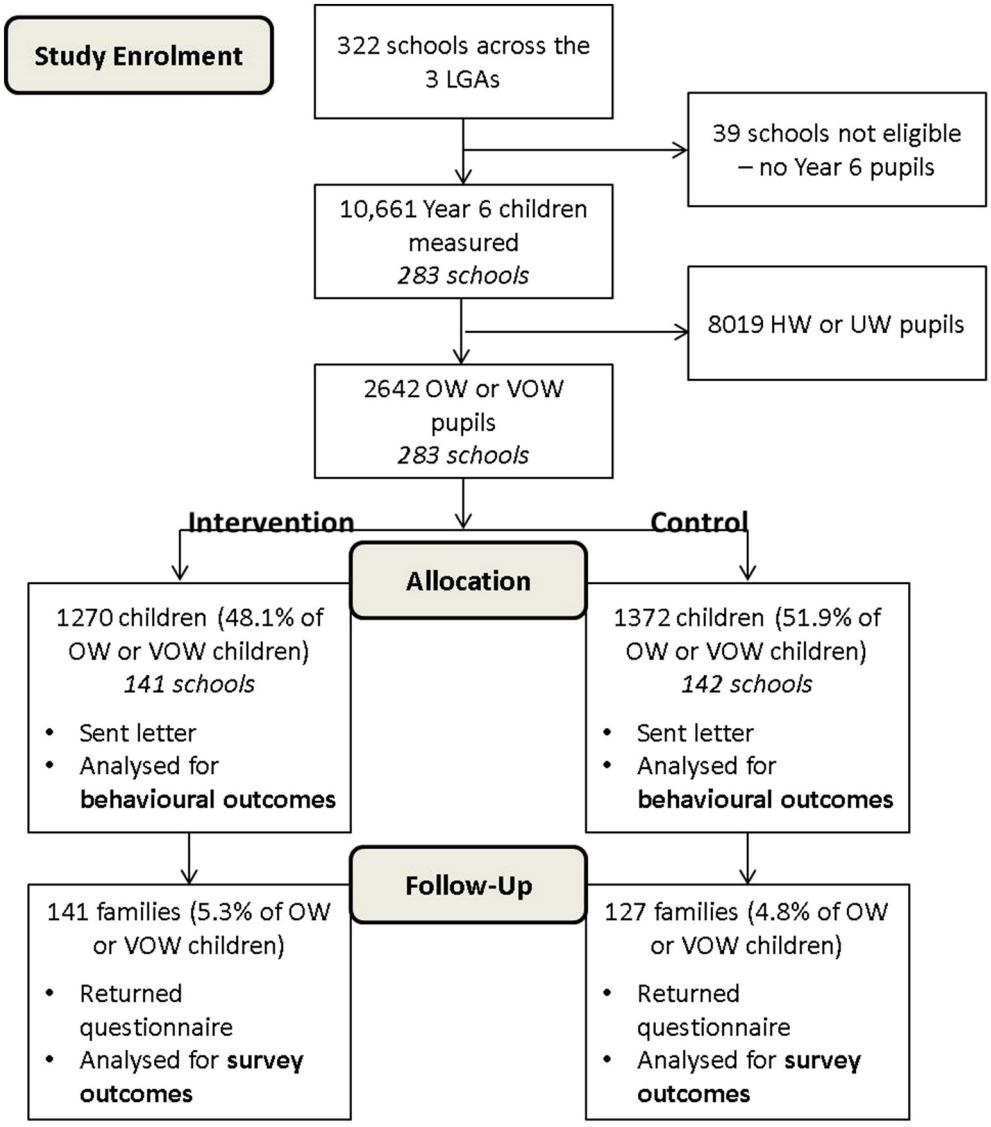

Fig. 1. Trial procedure and participant retention. Leicester City, Leicester County and Rutland, 2015.
LGA = Local Government Area. HW = Healthy Weight, UW = Underweight, OW = Overweight, VOW = Very Overweight. WMS = Weight Management Services. Year 6 is the school year group for 10–11 year old children; it is this year group that is measured during the NCMP process. "Behavioural outcomes" refers to the three WMS outcome measures: enrolment, attendance and contact with WMS.

intervention (n = 141) or control arms (n = 142). Two-thousand-six-hundred-and-forty-two children were identified as OW or VOW, of which 1270 (48.07%) were sent the Intervention letter and 1372 (51.93%) were sent the control letter. Two-hundred-and-sixty-eight (10.14%) parents completed and returned the questionnaire (Fig. 1).

Participant distributions across LGA, urban/rural, IMD and ethnicity varied significantly between the trial arms (Table 2) due to stratification and randomisation occurring pre-measurements (when the actual distribution of OW/VOW children across demographic groups was unknown).

Survey response rates varied by ethnicity (highest rates amongst parents of Asian children and lowest rates amongst parents of Black and Unknown ethnicity children; χ^2 (5, 2642) = 12.20, p = .033), weight status (higher rates amongst parents of OW children compared to VOW children; χ^2 (1, 2642) = 3.93, p = .047) and IMD quintiles (highest rates for parents in IMD Quintiles 1 and 3, lowest rates for parents in Quintile 5; χ^2 (5, 2642) = 25.00, p < .001; Table 2).

4.1. Impact of intervention on uptake of weight management services

All ICC values exceeded 0.05 (Table 3), indicating that a mixed model approach was appropriate. Significantly more children enrolled in WMS in the intervention group (n = 55; 4.33%) than the control group (n = 30; 2.19%), both in unadjusted (OR = 2.08, p = .008,) and adjusted (AOR = 2.48, p = .001) models. Similarly, significantly more families in the intervention group contacted WMS (n = 61; 4.80%) compared to the control group (n = 33; 2.41%) in both unadjusted (OR = 2.10, p = .003) and adjusted (AOR = 2.46, p < .001) models. Finally, more children in the intervention group attended WMS (n = 24, 1.89%) compared to children in the control group (n = 14, 1.02%) however this was not significant after Bonferroni adjustments (OR = 1.98, p = .079; AOR = 2.11, p = .047).

4.2. Self-reported behavioural and attitudinal changes

No intervention effects were detected on recognition of child's weight status (H2a), recognition of obesity-related health risks (H2b), perception of child's weight status compared to social norms (H2c) or

Table 2
Distribution of child characteristics between study arms and between survey responders and non-responders across demographic measures. Leicester City, Leicester County and Rutland in 2015.

	n = 2642	Control n = 1372 children, 142 schools (% of group)	Intervention n = 1270 children, 141 schools (% of group)	p-Value	% Survey response rate	p-Value
Sex	Female	632 (46.06)	587 (46.22)	0.936	8.9	0.058
	Male	740 (53.94)	683 (53.78)		11.2	
Clinical weight status	Overweight	768 (55.98)	698 (54.96)	0.600	11.2	0.047
	Very overweight	604 (44.02)	572 (45.04)		8.4	
Local authority	Leicester city	577 (42.06)	478 (37.64)	0.001	9.8	0.702
	Leicestershire County	755 (55.03)	774 (60.94)		10.7	
	Rutland County	40 (2.92)	18 (1.42)		8.6	
IMD quintile (home)	1	35 (2.55)	29 (2.28)	< 0.001	15.4	< 0.001
	2	74 (5.39)	98 (7.72)		8.8	
	3	492 (35.86)	381 (30.00)		15.8	
	4	615 (44.83)	509 (40.08)		9.9	
	5	156 (11.37)	253 (19.92)		7.3	
Urban/rural (home)	Rural town & fringe	78 (5.69)	148 (11.65)	< 0.001	Not calculated	Not calculated
	Rural village and dispersed	213 (15.52)	152 (11.97)			
	Urban city and town	1081 (78.79)	970 (76.38)			
Ethnicity (ONS[a] categories)	White	858 (62.54)	858 (67.56)	0.028	9.4	0.033
	Black	74 (5.39)	65 (5.12)		6.5	
	Asian	307 (22.38)	250 (19.69)		13.8	
	Mixed	89 (6.49)	59 (4.65)		9.5	
	Other	23 (1.68)	12 (0.94)		8.6	
	Unknown[b]	21 (1.53)	26 (2.05)		6.4	
School level characteristics						
IMD quintile (school)	1	17 (11.97)	20 (14.18)	0.400		
	2	24 (16.90)	20 (14.18)			
	3	26 (18.31)	16 (11.35)			
	4	34 (23.94)	43 (30.50)			
	5	41 (28.87)	42 (29.79)			
Urban/rural (school)	Hamlet and isolated dwelling	3 (2.11)	2 (1.42)	0.642		
	Town and fringe	23 (16.20)	16 (11.35)			
	Urban	84 (59.15)	90 (63.83)			
	Village	32 (22.54)	33 (23.40)			

IMD Quintiles range from 1 = Most Deprived to 5 = Least Deprived.
[a] ONS = Office for National Statistics.
[b] Some ethnicity data was omitted in very small clusters to maintain child confidentiality.

Table 3
Impact of intervention on enrolment, contact, and attendance at weight management services (Control as reference group). Leicester City, Leicester County and Rutland in 2015.

	Unadjusted					Adjusted				
	n	OR	95% CI	p	ICC	n	AOR	95% CI	p	ICC
Primary outcome										
Enrolment	2642 children 283 schools	2.08	1.21,3.55	0.008	0.185	2532 children 283 schools	2.48	1.46,4.21	0.001	0.120
Secondary outcomes										
Contact	2642 children 283 schools	2.10	1.28,3.46	0.003	0.148	2532 children 283 schools	2.46	1.52,3.98	< 0.001	0.064
Attendance	2642 children 283 schools	1.98	0.92,4.26	0.079	0.240	2443 children 267 schools	2.11	1.01,4.41	0.047	0.126

OR = odds ratio.
AOR = adjusted odds ratio (analyses adjusted for sex, clinical weight status, LGA, IMD, urban/rural classification derived from location of residence, and ethnicity).
CI = confidence intervals.
ICC = interclass correlation.
P = Bonferroni adjusted alpha level 0.016.

self-reported behaviour changes (H2d; Table 4).

4.3. Exploratory analyses: intervention effects by weight category

Exploratory, post-hoc analyses were conducted to determine whether the intervention effects differed by weight category, given that families of VOW children additionally received the pre-populated booking form.

No intervention effects were observed in the OW group (Table 5) however in the VOW group, significantly more intervention families contacted WMS (n = 51, 8.92%) compared to the control group (n = 22, 3.64%, X2(1) = 14.03, p < .001), significantly more intervention group children were enrolled in WMS (n = 46, 8.04%) than the control group (n = 19, 3.15%, X2(1) = 13.49, p < .001) and significantly more intervention group children attended WMS (n = 21, 3.67%) compared to children in the control group (n = 8, 1.32%,

Table 4
Impact of the intervention on secondary questionnaire outcomes (Control as reference group). Leicester City, Leicester County and Rutland in 2015.

	Outcome	Control *n* (%)	Intervention *n* (%)	*n*	Odds ratio (95% confidence interval)	*n*	Adjusted odds ratio[a] (95% confidence interval)	*p*-Value Unadjusted (Adjusted)
1	Recognition	*n* = 125	*n* = 136	261 children 135 schools		252 children 134 schools		
	Correctly identified weight status of child	65 (52.00)	78 (57.35)		1.00		1.00	0.388
	Incorrectly identified weight status of child	60 (48.00)	58 (42.65)		1.25 (0.75, 2.07)		1.85 (0.90, 3.78)	(0.092)
2	Perception of child's weight status as a physical health risk	*n* = 126	*n* = 136	262 children 136 schools		253 children 135 schools		
	No, it is not a health risk	35 (27.78)	39 (28.68)		1.00		1.00	0.872
	Yes, it is a health risk	62 (49.21)	61 (44.85)		0.96 (0.56, 1.64)		0.93 (0.52, 1.65)	(0.787)
	Don't know	29 (23.02)	36 (26.47)					
3	Perception of child's weight status as a wellbeing risk	*n* = 126	*n* = 136	262 children 137 schools		251 children 131 schools		
	No, it is not a health risk	37 (29.37)	37 (27.16)		1.00	1.00		0.699
					1.11 (0.65, 1.91)	1.12 (0.63, 1.98)		(0.694)
	Yes, it is a health risk	60 (47.62)	64 (47.06)					
	Don't know	29 (23.02)	35 (25.74)					
4	Perception of child's relative weight status/social norms	*n* = 123	*n* = 134	257 children 135 schools		255 children 135 schools		
	About the same weight as other children	40 (32.52)	49 (36.57)		1.00		1.00	0.997
	Less healthy weight than other children	58 (47.15)	61 (45.52)		1.00 (0.63, 1.58)		0.93 (0.56, 1.54)	(0.772)
	Healthier weight than other children	25 (20.33)	24 (17.91)					
5	Important others' perception of child's relative weight status	*n* = 109	*n* = 129	238 children 134 schools		236 children 134 schools		
	Less healthy weight than other children	63 (57.80)	70 (54.26)		1.00		1.00	0.401
	About the same weight as other children	30 (27.52)	32 (24.81)		0.81 (0.49, 1.33)		0.71 (0.41, 1.23)	(0.224)
	Healthier weight than other children	16 (14.68)	27 (20.93)					
6	Change in PA	*n* = 126[b]	*n* = 137	263 children 137 schools		261 children 137 schools		
	No	44 (34.92)	52 (37.96)		1.00		1.00	0.722
	No, but intend to	26 (20.63)	17 (12.41)		1.10 (0.66, 1.83)		1.43 (0.86, 2.37)	(0.168)
	Yes	56 (44.44)	68 (49.64)					
7	Change in diet	*n* = 126	*n* = 138	264 children 137 schools	1.00 0.87 (0.54, 1.39)	262 children 137 schools	1.00 1.03 (0.62, 1.69)	0.555 (0.916)
	No	40 (31.75)	52 (37.68)					
	No, but intend to	22 (17.46)	18 (13.04)					
	Yes	64 (50.79)	68 (49.28)					
8	External support	*n* = 122	*n* = 133	255 children 136 schools	1.00 0.66 (0.35, 1.26)	253 children 136 schools	1.00 0.85 (0.46, 1.58)	0.210 (0.612)
	No	82 (67.21)	100 (75.19)					
	No, but intend to	17 (13.93)	17 (12.78)					
	Yes	23 (18.85)	16 (12.03)					
9	Self help	*n* = 122	*n* = 137	259 children 137 schools	1.00 0.83 (0.43, 1.58)	257 children 137 schools	1.00 0.88 (0.43, 1.80)	0.564 (0.733)
	No	19 (15.57)	20 (14.60)					
	No, but intend to	0 (0.00)	6 (4.38)					
	Yes	103 (84.43)	111 (81.02)					

Odds ratios shown for binary outcomes and proportional odds ratios shown for ordered categorical outcomes. For the latter the odds ratio can be interpreted as comparing the highest versus lowest and middle categories as well as comparing high highest and middle categories versus the lowest category. *P* = Bonferroni adjusted alpha level 0.005.

[a] Model adjusted for: (1) sex – female/male, (2) clinical weight status - overweight/very overweight, (3) IMD quintile home – 1 least deprived, 5 most deprived, (4) urban or rural home – urban city & town/rural village and dispersed/rural town and fringe, (5) local authority, (6) ethnicity.

[b] Variation in sample size across variables due to some incomplete questionnaires.

Table 5
Chi square analyses showing the impact of the Intervention vs. Control on Enrolment, Contact, and Attendance at Weight Management Services for Overweight and Very Overweight children separately. Leicester City, Leicester County and Rutland in 2015.

	Overweight (*n* = 1466)				Very overweight (*n* = 1176)			
	Uptake rate (%)		$X^2_{(1)}$	*p*	Uptake rate (%)		$X^2_{(1)}$	*p*
Primary outcome	Int.	Cont.			Int.	Cont.		
Enrolment	1.29	1.43	0.06	0.814	8.04	3.15	13.49	< 0.001
Secondary outcomes								
Contact	1.43	1.43	0.00	1.00	8.92	3.64	14.03	< 0.001
Attendance	0.43	0.78	0.74	0.390	3.67	1.32	6.73	0.009

X2(1) = 6.73, p = .009).

5. Discussion

This trial investigated the impact of enhancing the standard NCMP weight-feedback letters on WMS uptake amongst families of OW and VOW children. The intervention letter, which included a visual aid for interpreting child weight status, social norms information and, for families of VOW children only, a pre-populated WMS booking form, approximately doubled enrolment at WMS compared to the national template letter in place at the time of the trial, confirming H1. This is positive, both in terms of following NICE recommended actions for OW and VOW children (National Institute for Health and Care Excellence, 2013) and improving the cost-effectiveness of local services.

The trial also attempted to measure the theorised psychological mediators of the intervention, such as parents' recognition of their child's weight status and recognition of their child's weight as less healthy than that of other children's (i.e., social norms). It was theorised that the MapMe tool and the social norms message would help parents recognise excess weight in their children and reset perceptions of child weight norms. Our null results suggest that these letter components did not effectively change parents' beliefs. These components were included in intervention letters based on evidence that parents judge their child's weight status by comparisons with other children (e.g., Jones et al., 2011). However, these judgements of what constitutes an average weight are likely to be based on repeated experiences in daily life (Maximova et al., 2008), and may be resistant to the influence of a single message.

Alternatively, it is possible that the intervention did have a psychological impact, but one that eluded the questionnaire's detection. Recent studies using MapMe also found no effects on parents' recognition of their child's overweight (Jones et al., 2016; Jones et al., 2017a) however the scale was associated with positive weight outcomes in OW and VOW children 12 months post-intervention. The authors concluded that parents may recognise excess weight but be unwilling to 'label' their OW/VOW child as such in questionnaires. Alternatively, another psychological mediator that was not measured in questionnaires (such as increased salience of intervention letters) could have led to intervention effects.

A further possibility is that our findings were mainly driven by the inclusion of the pre-populated booking form (which was given to families of VOW children only). This intervention component arguably had the most direct link with the desired behaviour (i.e., a pre-populated WMS booking form emphasises and provides resources to aid WMS enrolment) whereas the MapMe tool and social norms messages targeted beliefs and attitudes. Exploratory analyses detected no intervention effects for families of OW children (who did not receive the form) but significant increased WMS uptake amongst intervention families of VOW children (who did receive the form). However, it is impossible to disentangle the effects of this specific intervention component from the effects of child weight category – it could be, for example, that families of VOW children were more receptive to all of the intervention components rather than the effect in this group being driven by the form alone. As the design of the current study prevents analysing the effectiveness of each intervention component individually and given the exploratory nature of these last analyses, future research should explore the unique impact of each component of this successful intervention in a factorial design.

To our knowledge, this is the first trial to investigate the impact of NCMP feedback letters on an objective behavioural outcome. Furthermore, the finding that simple changes to a letter can increase WMS uptake adds to existing literature showing that small, evidence-based modifications to letters can effectively change behaviour in other healthcare settings such as uptake of NHS Health Checks (Sallis et al., 2016) and inappropriate antibiotic prescribing by General Practitioners (Hallsworth et al., 2016). The findings of this study may be useful for informing future SBIRT strategies to facilitate behaviour change within screening and referral programmes.

One limitation is the 10.14% survey response rate, which possibly led to inadequately powered analyses and null findings on all survey variables. It is also worth noting that variations in response rates according to ethnicity, IMD and child weight status may limit the generalisability of these findings. Of particular note is the finding that response rates were lower amongst parents of VOW children compared to those of OW children. This study is not alone in finding that parents of heavier children are less likely to respond to surveys. A study investigating parents' attitudes to their child's weight after the NCMP letter found an overall survey response rate of 18.9% but noted that responses were significantly lower for families of children with obesity (Falconer et al., 2014). Response rates for families of OW/VOW children were approximately 15% (M.H. Park, personal communication, 15 August 2018). Similarly, a trial to test the MapMe tool found that only 8% of invited families participated (A. Jones, personal communication, 28 August 2018). This suggests that the response rate observed here was not unusual and that recruiting parents to studies on the topic of child overweight can be particularly challenging.

Secondly, despite the intervention almost doubling WMS enrolment (2.19% vs. 4.33%), the absolute increase was still small (2.14%). It is clear from this that many families are still not engaging with WMS upon receiving feedback. It is also worth noting that whilst the main analysis revealed intervention effects for enrolment and contact made with WMS, the effect on attendance was not significant after Bonferroni corrections were applied. Whilst WMS are free for families to attend, spaces are not always immediately available (although it should be noted that demand from families leads to additional services being commissioned). Future research should examine the long-term outcomes of interventions improving WMS enrolment, including whether enrolled families on waiting lists are able to access services at a later date and whether families continue to engage with WMS after initial attendance. Research from the US found that the majority of families did not complete WMS programmes (Hampl et al., 2011), thus highlighting the need for follow-up at later dates. Such long-term research would also facilitate an analysis of the cost-effectiveness of these interventions.

Future studies should also seek to examine the impacts of interventions for children with different levels of overweight. Here we reported some exploratory analyses examining the effect of the intervention for overweight and very overweight children separately but small sample sizes limited the analytical options available to us. It would also be useful to examine whether interventions can successfully engage families of children with severe obesity as these children have a particular need for engagement with WMS (Welbourn et al., 2018).

To conclude, this study demonstrates that it is possible to achieve small improvements in uptake of WMS through low-cost, behaviourally-informed changes to a feedback letter. Further research is needed to clarify the individual contributions of the letter components to the intervention's success especially given there are some small costs associated with inclusion of the MapMe body image scales. Following any adjustments made to NCMP feedback letters, BMI z-scores should be monitored to determine long term impact on child weight status.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2019.01.023.

Role of the funding source

This trial was funded by PHE who acted as the Chief Investigator for the project, drafted the proposal and conducted the research, analysis and report writing. Considerable staff time was given in kind from partners, in particular LPT and LNDS. The lead author had full access to all study data, vouches for data accuracy and completeness, and had final responsibility for the decision to submit for publication.

Trial registry

The trial is registered at the ISRCTN registry, number ISRCTN13304533.

Conflicts of interest

Authors have no conflicts of interest to report.

Acknowledgments

Clare Mills, Kajal Lad, Ateeqa Omar, Nasir Shaikh, Arvind Mistry, Leicestershire Partnership Trust.

Carrie Pailthorpe, Leicestershire County Council.

Aileen Smith and Lisa Sinfield, Leicestershire Nutrition and Dietetic Service.

Jasmine Murphy, Leicester City Council.

Jet Sanders, Michael Ratajczak, Elizabeth Castle PHE.

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