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Research Article

Behavioural weight management interventions for the treatment of obesity: network meta-analysis of trial and real-world individual participant data

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Abstract

Background: Behavioural weight management interventions are the primary treatment for obesity in the United Kingdom. These interventions focus on diet, physical activity and behaviour change, and are typically delivered over a period of 12 weeks. Although National Institute for Health and Care Excellence guidance makes recommendations on the content of behavioural weight management interventions, there are substantial variations in practice. As a result, what constitutes the most effective composition of behavioural weight management interventions is unclear.
Objective: To determine the effectiveness of different types of behavioural weight management interventions in achieving weight loss, using individual participant data from randomised controlled trials and real-world services.
Design: A network meta-analysis of individual participant data.
Setting: Behavioural weight management interventions delivered in the community.
Participants: Anonymous individual participant data of adults (> 18 years), living in the United Kingdom and attending behavioural weight management interventions in the real world (*n* = 76,201) and randomised controlled trial's (*n* = 4051).
Main outcome measure: Mean change in weight at 12 weeks.
Methods: Two-staged Bayesian network meta-analysis of individual participant data from included randomised controlled trials and real-world services was performed. Risk of bias was assessed for randomised controlled trials using Cochrane Risk of Bias 2.0. Prior to analysis, received data were checked, for consistency with the requests and cleaned for all anomalies.
Results: All behavioural weight management interventions resulted in weight loss compared to usual care. In the randomised controlled trials, the 52-week weightloss programme referrals for adults in primary care (WRAP) with participants attending intervention achieved the greatest weight reduction at 12 weeks (mean difference = −2.58 kg, 95% credible interval −3.19 to −1.96). However, when a male-only intervention (football fans in training) was included in a sensitivity analysis, it demonstrated the largest short-term weight loss (mean difference = −4.65 kg, credible interval −5.24 to −4.07). In the real-world services, several programmes achieved substantial weight loss, with greater programme attendance associated with improved outcomes.

Conclusions: The behavioural weight management intervention in both real-world services and randomised controlled trials are effective for weight loss, but there is a variation in the weight loss achieved at the end of active weight loss period depending upon the structure of intervention and participant engagement.
Future work: Dismantling the interventions into component parts will help determine which components or combination of components are associated with greater weight loss.
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Background

Behavioural weight management interventions (BWMIs) are the main funded treatment for obesity in the UK. They usually consist of 12 weekly group sessions delivered in a primary care or community setting with a focus on diet, physical activity and behaviour change.[1] The National Institute for Health and Care Excellence (NICE) guidance from 2014 provides a broad framework for these interventions and recommends that these interventions to be multicomponent – incorporating dietary modification, achievable weight loss goals and to be delivered by appropriately trained professionals.[2] However, in practice, the content of these interventions and how they are implemented across different providers vary substantially. Moreover, existing evidence on BWMIs is largely derived from randomised controlled trials (RCTs) comparing the interventions to usual care. While these studies have strong internal validity, their external validity may be limited as they do not tend to capture the complexities of real-world service (RWS) delivery.[2–4]

Further to this, a mapping exercise[5] and a systematic review[6] of weight management interventions cite incomplete descriptions of the interventions and variation in outcomes as barriers in identifying effective programmes. As a result, commissioners reported a lack of national guidance as one of the key barriers to commissioning weight management services leading to a variable provision of services across the UK.[5] There is a need for an evidence base that provides confidence to commissioners and moves the research forward to improve the guidelines.

Real-world services, which operate outside the controlled conditions of clinical trials, provide an opportunity to assess intervention effectiveness in routine practice. However, RWSs data are collected for non-research aims; the data could be suboptimal and inconsistent. To address some of these limitations, Heggie *et al.*[7] designed a template – STAR-LITE – for standardised reporting of adult BWMIs in the RWSs and RCTs. Further, to complement the STAR-LITE tool and to address variation in outcomes, to standardise reporting of BWMI, and to enable comparison of interventions to identify which are effective, Mackenzie *et al.*[8] developed a core outcome set for BWMIs for adults with overweight and obesity.

Aims and objectives

This paper continues the preparatory work performed in [BEhavioural Weight Management: COMponents of Effectiveness (BE:COME); mapping of individual components of behaviour weight management interventions using electronic survey, and component selection by expert consensus] for the BE:COME research study (https://fundingawards.nihr.ac.uk/award/NIHR129523). The aim of this paper is to determine the effectiveness of different multimodal BWMIs in achieving weight loss, using individual participant data (IPD) from RCTs and RWSs.

Methods

Included in the analysis were data from both RCTs and RWSs based on a set of inclusion criteria that were agreed upon a priori and reported in a previous paper (ref BEhavioural Weight Management: COMponents of Effectiveness (BE:COME); mapping of individual components of behaviour weight management interventions using electronic survey, and component selection by expert consensus of BE:COME). Access to the protocol for BE:COME can be found here https://fundingawards.nihr.ac.uk/award/NIHR129523. This meta-analysis was prospectively registered with Prospero (CRD42020183949). The results were reported according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidance.[9,10]

Eligibility criteria

Data from RCTs and RWSs on adults > 18 years with a body mass index (BMI) > 25, that would allow the assessment of effectiveness of BWMIs, were included.[2] All BWMIs were UK-based and were compliant with NICE guidance (multicomponent – diet, physical activity, behaviour change techniques, duration ≥ 3 months/12 weeks, weigh-ins at least every 2 weeks, dietary targets). BWMIs

were excluded if designed exclusively for a specific single medical condition (e.g. diabetes, pregnancy, post partum or families).

Only RCTs which were UK based, completed within the past 10 years and agreed to share IPD data, were included. A minimum of 40% completion rate of the active weight loss (AWL) sessions and a minimum 60% of participants' 12-week weights recorded were required.

For data from RWSs, only data from participants who had completed the programme prior to the coronavirus 2019 (COVID-19) pandemic (March 2020) were included. Only data sets containing ≥ 500 participants (data sets with fewer participants were included if they were iterations of the same service) were included.

Identifying studies

Search strategy and study selection

A purposive sampling strategy was used to identify RCTs, with electronic searches of trial databases ClinicalTrials.gov and clinicaltrialsregister.eu using the terms 'weight' OR 'obesity'.

For RWSs, brief information was circulated to all weight management services in Scotland and England by Public Health England (PHE) (via the regional hubs) and Health Scotland. The UK Association for the Study of Obesity e-mailed the same brief information to all members (with representation from across the UK) and a presentation was made at the British Dietetic Association Obesity Special Interest Group in November 2018. Interested providers then discussed participation with the research team and provided a letter stating their participation in principle. In principle, ethical approval determined some of the inclusion; as coronavirus disease research was dominating ethical applications in Scotland, Public Benefit and Privacy Panel approval was not possible and only English services were targeted.

Individual participant data collection process and data abstraction

The trial authors and RWSs were contacted. Data sharing and collaboration agreements were obtained from both RCTs and RWSs. All data from both RCTs and RWSs were transferred by secure file transfer to NHS Information Service Division (ISD) in Edinburgh who acted as a data safe haven and the analysis was performed there.

For each IPD data set supplied by the services, participants with age < 18 years or without a valid baseline weights were not correctly reported were excluded. The date of recording first weight (start date) and date of recording the last weight (end date) provided by the services allowed computation of the number of weeks attended. Further details about data transfer and collection are in *Appendix 1*, *Tables 4* and *5*.

Specification of outcomes and effect measures

The primary and secondary outcomes and definitions were derived from the outcome and instrument set developed by expert consensus (including patient and public involvement) for analysis by Mackenzie *et al.*[8] (COMET registration 1056) (see *Appendix 1*, *Table 3*). These were applied to assess weight loss, attendance and completion over 12 weeks of active intervention.

Risk of bias and quality appraisal

Within-study bias was assessed by two researchers using the Cochrane Risk of Bias tool 2 for RCTs.[11] Consistency between IPD and trial publications and any important baseline imbalance across the trials were examined. Two researchers independently examined received data from RWSs for missing, duplicated, or outlying values, and for internal consistency. (Missing information for weight at 12 weeks for both RCTs and RWSs is detailed in *Appendix 5*, and *Tables 8* and *9*)

Synthesis

A two-stage Bayesian IPD network meta-analysis (NMA) was conducted to estimate the mean change in weight (kilogram), when comparing different types of BWMI and usual care. In addition, NMA using RCT data were also conducted on other outcomes (see *Appendix 3*, *Figure 11* and *Appendix 6*, *Figures 12–14*):

- mean change in BMI
- percentage change in weight
- proportion of participants achieving ≥ 5% weight change
- proportion of participants achieving ≥ 10% weight change.

In the first stage, the IPD from each RCT were used to fit generalised linear regression models to estimate adjusted study-specific intervention effect. We examined potential baseline imbalances between treatment arms, specifically testing for differences in baseline weight, age, sex and height using a stepwise approach. The final model included only covariates that significantly contributed to explaining the variance in weight change; the final adjusted model accounted for baseline weight and treatment arm.

In the second stage, these adjusted estimates were synthesised in a NMA using fixed-effect model. The analysis also accounted for the correlation structure produced by trials with > 2 arms. Pooled estimates of intervention effects were calculated as mean differences (MDs) and odd ratios along with their corresponding 95% credible intervals (CrIs). These were ranked and the probability that each intervention is best was estimated for each outcome.

Consistency was assessed based on the difference between direct and indirect estimates using node-splitting approach.[12] The goodness of fit for the model to the data was assessed using posterior mean residual deviance and leverage plots.

Underlying assumptions

Key assumptions in a NMA are that the indirect comparisons made between two treatments are a feasible comparison and that the indirect comparisons are consistent with existing direct evidence. It is assumed that for all the treatments in the NMA, it is feasible to randomise them in a same trial and if they are not the treatment arm in a trial, are missing at random.[13]

The additional underlying assumption for NMA of RCTs was a homogeneous control arm, that is the control group in the trials were combined as usual care. An additional underlying assumption for the NMA of RWSs, which were single-arm studies, was a control arm with no change in weight to simulate a comparative scenario. This represents the change in weight from baseline following enrolment to the weight management programmes.

Dealing with missing data for weight measures at 12 weeks

All outcomes were measured at 12 weeks. Twelve-week outcomes cover the AWL phase; generally, interventions only run for 12 weeks, and longer-term weight loss maintenance is not funded.

Dropout and missing data from weight management interventions is not a random event; generally, people stop attending when they are not finding the programme effective, either initially or due to later weight regain. Data collection is often linked to reimbursement for the provider. Participants who did not have data for age and height were excluded from all analyses. Lack of a recorded weight was assumed to mean 'did not attend' and only sessions with recorded weights were counted as attended.

For RCTs, the information of weights for the participants was available for baseline and 12 weeks only. Assumption of baseline observation carried forward (BOCF) was used for imputing missing weight at 12 weeks and presented as the main analysis.

For the RWSs, the information regarding recording of weight was available for baseline and final weight was recorded at the last attended session which varied from individual levels. For RWSs, missing data were addressed with BOCF in the main analysis alongside a sensitivity analysis addressing the missing final weight with last observation carried forward (LOCF), that is when 12-week weight was missing, weight recorded any time before 12 weeks was used to impute for weight at 12 weeks.

Sensitivity analysis

For the RCTs NMA, the following additional sensitivity analyses were conducted.

- Analysis to explore the impact of including RCTs that potentially contribute to substantial heterogeneity within the network.
- Network meta-analysis using trial calibration method, where the estimates from RCTs were adapted to reflect a target population with similar characteristics to that of those who participated in the RWSs. The mean participant-level covariate information from the RWSs was used to adjust for participant-level covariables in the RCTs.[14] Specifically, the overall mean age, baseline weight, height and sex from the RWS populations were computed and used to centre the corresponding covariates in the RCT populations. A stepwise modelling approach, consistent with the main analysis, was then applied to estimate the main effects.

For RWSs, sensitivity analysis was conducted after imputing missing weights with the LOCF assumption.

Results were reported according to PRISMA guidance.[9]

Ethical approval

Favourable ethnical opinion was provided by Lancaster University (FHMREC reference: FHMREC20085).

Anonymisation

Full blinding was not possible in this study due to the nature of the data collected and the support required for data transfer. However, each intervention was provided with a unique site ID and the advisory group and management group only received results by study ID, with the principal investigator and research associate the only team members who had the ability to unblind the results.

Results

Description of studies

Randomised controlled trials

Of the trials identified, six trials agreed to share participant-level data. Therefore, the analysis included six UK-based multicentred RCTs totalling 4051 adult participants living with obesity or overweight (BMI > 25 kg/m^2). The mean age of the participants across the trials ranged from 46 to 64 years. For mixed-gender trials, the male percentage ranged from 30% to 74%, with one trial enrolling female-only participants and one trial aiming for male-only participants. The mean height ranged from 1.65 to 1.75 m and mean baseline weight ranged from 80.8 to 110 kg (*Table 1*).

These trials evaluated the effectiveness of BWMI targeting individuals living with overweight or obesity. The interventions included a web-based behavioural weight management programme with either remote (POWeR + R)[3] or face-to-face (POWeR + F)[3] nurse support, a task-based group programme tailored for disadvantaged communities [weight action plan (WAP)],[4] a programme engaging men through professional football clubs [football fans in training (FFIT)],[5] weightloss programme referrals for adults in primary care with participants attending either 12 (WRAP 12) or 52 (WRAP 52) weeks of sessions, personalised lifestyle coaching through trained volunteers in leisure centres, initiated at breast screening clinics (ActWELL)[6] and face-to-face lifestyle counselling sessions (BeWEL).[1] These interventions were compared with a range of control interventions including waiting lists, self-help weight management booklets, cancer prevention booklets with information about lifestyle modification and web-based information about healthy foods. These were combined as usual care (see *Appendix 4*, *Table 6*).

Real-world services

The participant-level data were shared on 19 programmes for 76,201 adult participants living with overweight or obesity (BMI > 25 kg/m^2). The mean age of participants attending the programmes ranged from 36 to 60 years and mean height ranged between 1.62 and 1.79 m. For mixed-gender programmes, percentage of male participants varied from 5% to 33% with majority of the services having higher female participation. There were two programmes (6 and 10) with male-only participants and one programme (5) with female participants only (*Table 2*). The participant attendance varied from 5.15 to 33 weeks, highlighting the fact that not all the participants stayed for 12 weeks in all the services. The programmes' interventions provided dietary and physical activity advice and targeted behaviour change through various behaviour change techniques over 12-week AWL period. The interventions differed in content and delivery mode (see *Appendix 4*, *Table 7*).

Risk-of-bias assessment for randomised controlled trials

Based on the publication, two trials[15,16] had an overall high risk of bias for not blinding the outcome assessment and for concerns due to higher numbers of participants missing from intervention arm of one study. Another study[17] did not report the results after imputing the missing data and was rated as having some concerns for the risk of bias (see *Appendix 2*, *Figures 8* and *9*).

Overall, IPD shared by RCTs were found to be consistent with published RCTs.

Network meta-analysis

Assessment of model fit

The deviance information criterion (DIC) and posterior mean distributions were of a better fit to the data for fixed-effects model in comparison to the random-effects model for the primary outcome of change in weight (see *Appendix 3*, *Figures 10* and *11*), and results are presented using fixed-effects model.

Randomised controlled trials

Eligible participant-level data were shared by six randomised trials, which formed a disconnected network (*Figure 1a*) with 10 interventions including the usual care intervention. One study[18] was disconnected from the network as the comparator arm could not be combined with the usual care group. The connected network (see *Figure 1b*) is a star-shaped network of five trials evaluating eight interventions including the usual care group. There are two loops in the network formed by the three-arm studies. However, one study within the connected network[17] evaluated intervention designed to target a specific population and was excluded from the primary analysis. The impact of this study was examined in the sensitivity analysis.

Real-world services

Participant-level data eligible for the analysis were shared by 19 services. After assuming a control group with no change in weight from baseline, to simulate a comparative scenario, NMA was performed. Network of RWSs (*Figure 2*) was a star-shaped network with no loops and included all 19 interventions.

The transitivity assumption held, though there were two male-only programmes and one female-only programme, but these were due to selection of participants and not for a specific population.

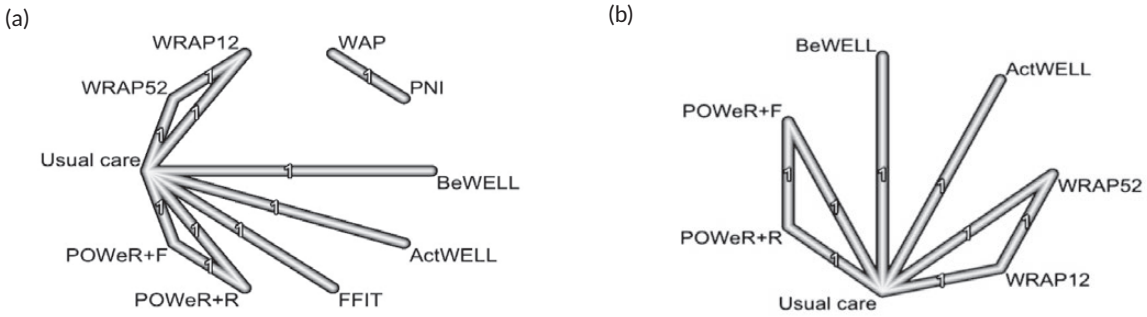

FIGURE 1 (a) Disconnected network of RCTs with six included studies; (b) network map of RCTs that were included in the main analysis nodes represent the weight loss intervention programmes used in the RCTs. PNI, practice nurse intervention. Numbers on the edges represent the number of studies with direct comparisons between the intervention. Intervention details are mentioned in *Appendix 4*, *Table 6*. The comparator arms where possible were assumed as usual care.

Change in weight (kilogram)

Network of randomised controlled trials

The connected network of RCTs compared seven treatments including usual care. All the BWMIs led to reduction in weight as compared to usual care. The 52-week WRAP intervention showed the maximum weight loss at 12 weeks (MD = −2.58, CrI −3.19 to −1.96), closely followed by 12-week WRAP[19] (MD = −2.26, CrI −2.88 to −1.65), POWeR + F (MD = −1.69, CrI −2.39 to −1.00) and POWeR + R (MD = −1.50, CrI −2.19 to −0.80) interventions. The BeWEL[16] (MD = −1.29, CrI −1.84 to −0.75) and ActWELL[15] (MD = −0.90, CrI −1.39 to −0.41) interventions showed the least weight loss when compared to usual care (*Figure 3*; see *Appendix 7*, *Table 11*). The surface under the ranking curve (see *Appendix 7*, *Figure 16*) depicts WRAP 52-week intervention to have the highest probability of performing better than other interventions in comparison.

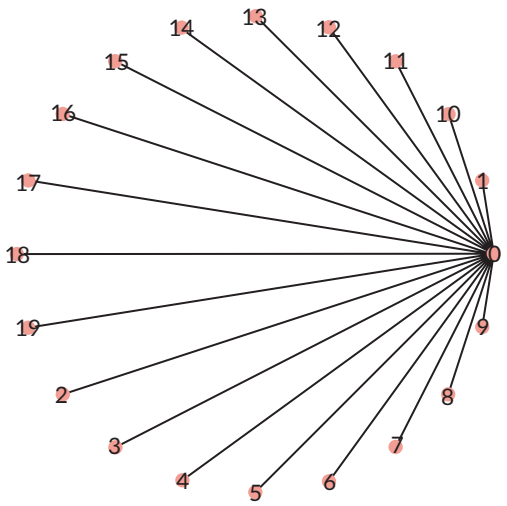

FIGURE 2 Star-shaped network of RWSs anchored to assumed control arm (0). Numbers represent weight loss interventions provided at 19 different centres that shared IPD. Details of the interventions are mentioned in *Appendix 4*, *Table 7*.

Network of real-world services

The network of RWSs, which included 19 interventions from 19 programmes, found participants in programme 1 (MD = −4.03, 95% CrI −4.12 to −3.94), followed by programme 4 (MD = −3.76, 95% CrI −3.93 to −3.59), programme 19 (MD = −3.55, 95% CrI −3.64 to −3.46), programme 15 (MD = −3.39, 95% CrI −3.78 to −3.00) and programme 12 (MD = −3.45, 95% CrI −3.78 to −3.12), which showed higher weight loss than other programmes. Programme 5 (MD = −0.03, 95% CrI −0.07 to 0.00), programme 6 (MD = −0.18, 95% CrI −0.33 to −0.04) and programme 7 (MD = −0.28, 95% CrI −0.40 to −0.15) were those with very low or no weight loss (*Figure 4*; see *Appendix 7*, *Table 12*).

Including the football fans in training trial (tailored for a specific group of male-only population) in the analysis

The sensitivity analysis by adding the FITT study[17] to the connected network of RCTs showed that the intervention FFIT was associated with the largest amount of weight loss (MD = −4.65, CrI −5.24 to −4.07) at 12 weeks. The change in weight estimates for remaining interventions in the network were similar to the main analysis. WRAP[19] 52 weeks [MD = −2.57 (−3.20 to −1.96)] led to maximum weight loss followed by WRAP 12 (MD = −2.26, 95% CrI −2.88 to −1.65) and POWeR[20] face to face (MD = −1.69, 95% CrI −2.39 to −0.99) and remote nurse interventions (MD = −1.50, 95% CrI −2.19 to −0.80). ActWELL[15] (MD = −0.90, 95% CrI −1.40 to −0.41) and BeWEL[11,16] (MD = −1.29, 95% CrI −1.84 to −0.74) showed least change in weight at 12 weeks when compared to the usual care (*Figure 5*; see *Appendix 7*, *Table 13*).

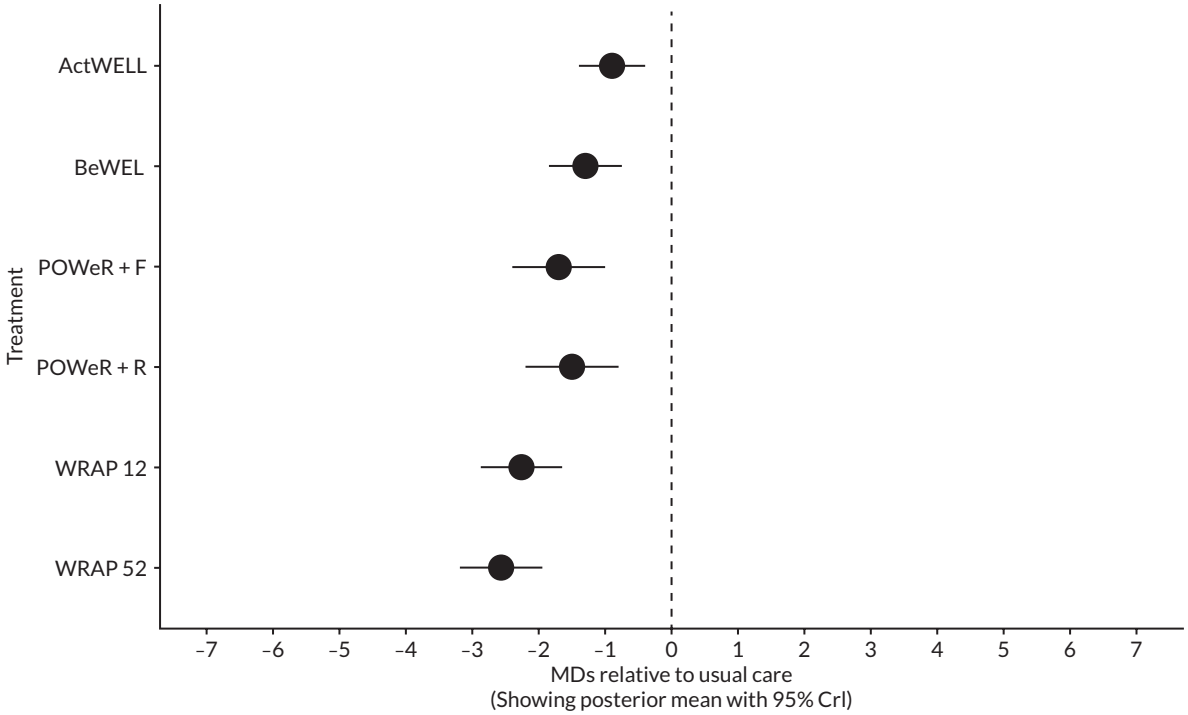

FIGURE 3 Forest plot showing the comparison of BWMI from RCTs vs. usual care for change in weight (kilogram) outcome.

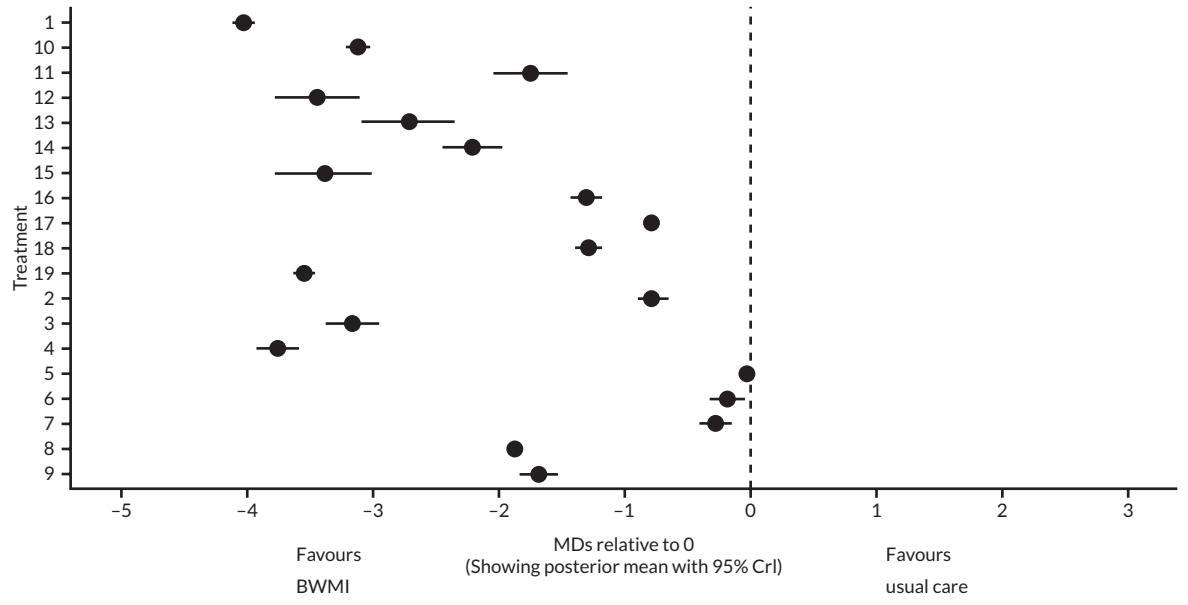

FIGURE 4 Forest plot for change in weight (kilogram) for interventions in RWS programmes. The numbers on the *y*-axis represent different RWS programme interventions for which IPD were shared (intervention details can be found in *Appendix 4*, *Table 7*).

Trial calibration using participant characteristics from real-world services

After centring and adjusting for the covariates using the RWS data, effect estimates for change in weight obtained from stage 1 were used in stage 2 to run NMA. The analysis found participants randomised to FFIT[17] intervention arm showed maximum weight loss (MD = −4.39, 95% CrI −5.43 to −3.35) followed by BeWEL[16] [−2.91 (−4.76 to −1.07)], WRAP[19] 52-week (MD = −2.75, 95% CrI −3.75 to −1.75), WRAP 12 weeks (MD = −2.75, 95% CrI −3.75 to −1.75) and POWeR+[20] with face-to-face nurse support interventions (MD = 2.42, 95% CrI −4.16 to −0.68). The interventions ActWELL[15] (MD = −1.36, 95% CrI −2.77 to 0.05) and POWeR[20] with remote nurse support (MD = −1.68, 95% CrI −3.52 to 0.17) did not show a meaningful change in weight when compared to the usual care interventions (*Figure 6*, right; see *Appendix 7*, *Table 15*).

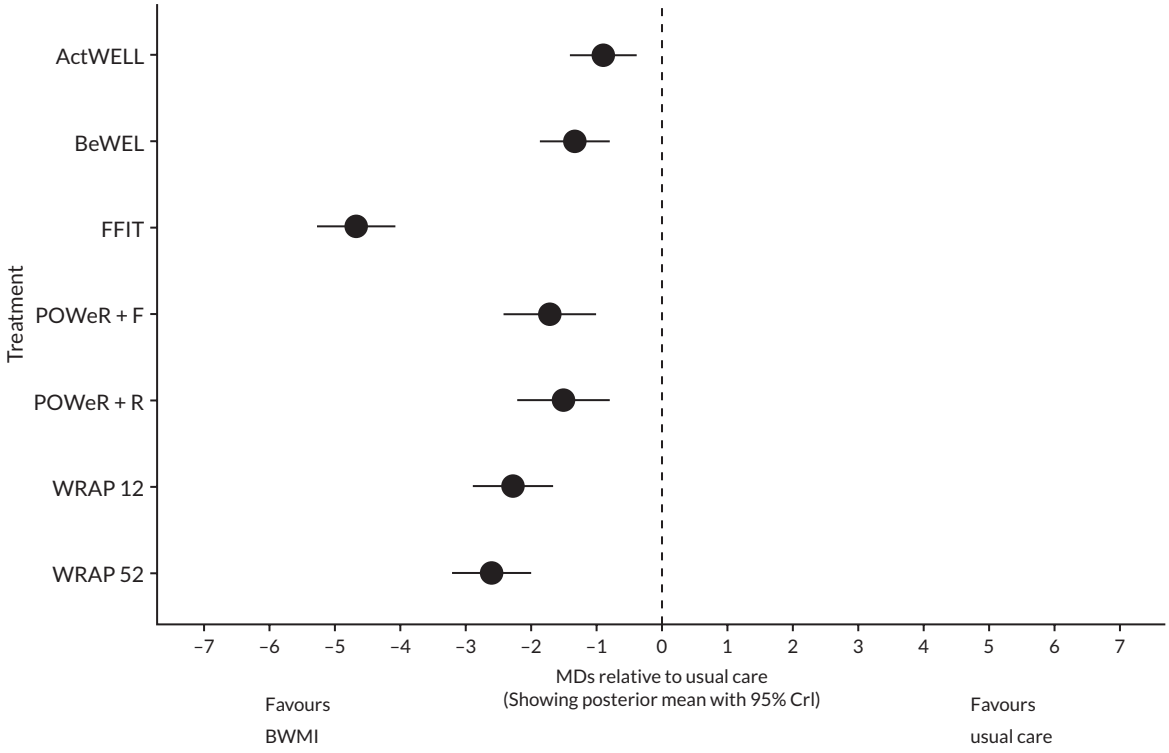

FIGURE 5 Forest plot showing the comparison of BWMI from RCTs vs. usual care for change in weight (kilogram) outcome including the FFIT trial (tailored for a specific group of male-only population) in the analysis.

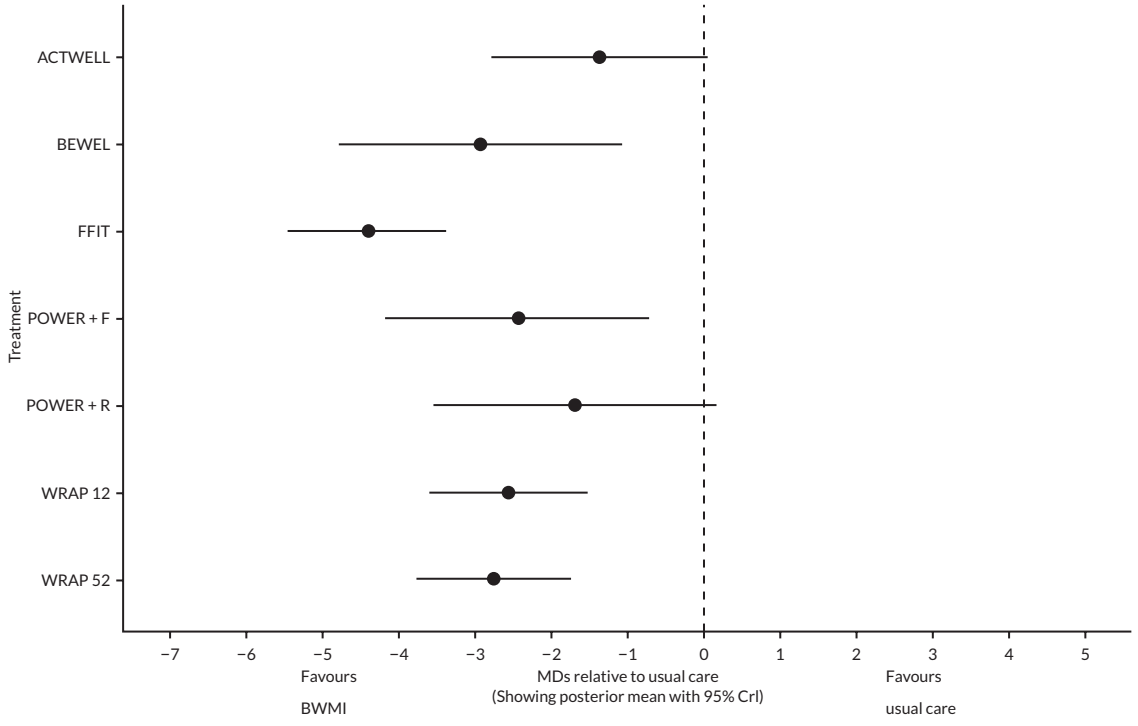

FIGURE 6 Forest plot showing the comparison of BWMI from RCTs vs. usual care for change in weight (kilogram) outcome using trial calibration method.

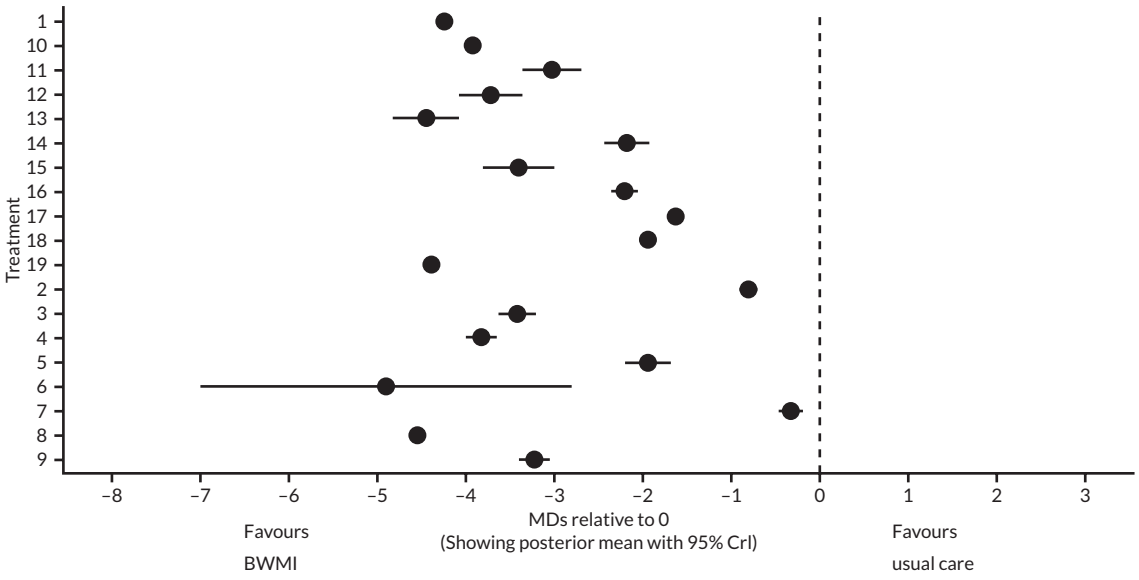

FIGURE 7 Forest plot change in weight (kilogram) at 12 weeks in RWS using the LOCF assumption.

Real-world services

Last observation carried forward was used for imputing 12 weeks weight for the primary outcome change for RWSs. The analysis showed intervention for programme 6 (which enrolled male participants only) to have the highest weight loss (MD = −4.90, 95% CrI −7.00 to −2.80) followed by interventions of programme 8 (−4.55, 95% CrI −4.59 to −4.51), programme 19 (MD = −4.39, 95% CrI −4.49 to −4.29) and programme 13 (MD = −4.44, 95% CrI −4.81 to −4.07). Intervention for programme 7 showed the least decrease in weight (MD = −0.32, 95% CrI −0.45 to −0.19) (*Figure 7*; see *Appendix 7*, *Table 17*).

Discussion

Behavioural weight management interventions are the main stay of weight loss management at the primary care level. The quest for finding the best-suited intervention is long ongoing globally. The first 12 weeks represent an AWL phase, and BWMIs are typically commissioned for this duration. It has been found that unsatisfactory weight loss in the early phase could be associated with poor outcomes and large weight loss in early phase is related to improved quality of life.[21] Existing studies have shown that even modest weight loss can yield significant health benefits, such as better blood pressure and glycaemic control. However, previous studies have also highlighted weight regain following initial weight loss as a major challenge.

The findings from the current study provide valuable insights into the effectiveness of BWMIs in achieving weight loss in both RCT and real-world setting and confirms that these interventions lead to weight loss. However, the magnitude of weight loss may vary depending upon various intervention-related factors like the content of intervention, participant engagement, mode of delivery. The analysis of individual participant-level data from RCTs revealed that participants randomised to 52-week WRAP intervention arm (weekly access to community weight loss sessions along with access to some digital tools for the duration of intervention) lost more weight at 12 weeks.

When a male football fans-only study[17] was included in a sensitivity analysis, participants receiving FFIT intervention had maximum weight loss at 12 weeks, although FFIT[17] intervention led to a greater weight loss than other interventions. However, the success of this intervention could be attributed to the nature of the intervention facilitating a better participant engagement and adherence. This finding from the analysis does signals towards having a tailored intervention in place to achieve better results.

Likewise, the analysis of RWSs showed several programmes demonstrating significant weight loss with higher attendance rates correlating with greater weight reduction – programme 1 displaying the highest weight loss, followed by programmes 4, 19, 15 and 12. The programmes displaying greater weight loss were not gender specific or designed for a single demographic group. However there were some differences in the socioeconomic status of the population served by these programmes, with programmes 12 and 15 including a greater proportion of participants from deprived socioeconomic background. Because of large missing information about the socioeconomic status of the participants, any inference about the influence of socioeconomic status cannot

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TABLE 1 Characteristics of included randomised controlled trials (RCTs)

Trial	Country	Arm	Participants randomised in each arm	Age (years) Mean (SD)	Male (%)	Height (metres) Mean (SD)	Deprivation quintile					Baseline weight (kg) Mean (SD)	Ethnicity				
							1	2	3	4	5		White (%)	Mixed (%)	Asian (%)	Black (%)	Other (%)
Anderson 2021[15]	UK	Two individual one-to-one sessions with nine support calls in 12 weeks with primary physical activity component-pedometer-based walking programme (ActWELL)	279	58.8 (5.21)	0%	1.62 (0.06)	7.52%	8.96%	13.62%	23.29%	45.87%	80.85 (13.31)	96.41				< 5
		Breast cancer prevention leaflet including the relevance of lifestyle factors	281	59.5 (5.65)	0%	1.62 (0.05)	5.33%	10.32%	13.87%	21.35%	48.04%	81.83 (12.79)	94.6				< 5
Anderson 2014[16]	UK	Three individual one-to-one sessions with nine support calls in 12 weeks along with self-monitoring of weight and physical activity focused on pedometer-based brisk walking (BeWEL)	163	63.5 (6.96)	73.6%	1.70 (0.08)	15.30%	20.20%	15.90%	23.90%	24.50%	90.16 (15.01)	100%				–
		Weight loss booklet	166	63.6 (6.74)	74.1%	1.70 (0.08)	17.69%	16.90%	19.90%	27.10%	18.70%	88.41 (14.96)	98.8%				–
Hunt 2014[17]	UK	Gender-sensitised intervention delivered in 90-minute weekly group sessions for 12 weeks with advice on healthy diet and physical activity (FFIT)	374	46.96 (8.07)	100%	1.76 (0.06)	17.37%	18.44%	16.57%	21.92%	23.79%	110.38 (17.82)	98.11%				
		Waitlist	373	47.15 (7.89)	100%	1.76 (0.06)	17.69%	16.62%	16.08%	22.25%	26.54%	108.65 (16.63)	98.62%				

Trial	Country	Arm	Participants randomised in each arm	Age (years) Mean (SD)	Male (%)	Height (metres) Mean (SD)	Deprivation quintile					Baseline weight (kg) Mean (SD)	Ethnicity				
							1	2	3	4	5		White (%)	Mixed (%)	Asian (%)	Black (%)	Other (%)
Little 2017[20]	UK	Web-based intervention 24 web-based sessions for 6 months with content, links to external content and e-mail reminders and receive personalised advice **Arm 1** – web-based intervention with a face-to-face nurse support (POWeR + F)	269	53.30 (12.89)	34.94%	1.67 (0.09)	NR	NR	NR	NR	NR	102.46 (16.88)	NR				NR
		Web-based intervention 24 web-based sessions for 6 months with content, links to external content and e-mail reminders and receive personalised advice **Arm 2** – Web-based intervention with remote nurse support (POWeR + R)	270	54.57 (12.85)	40.37%	1.68 (0.09)	NR	NR	NR	NR	NR	102.92 (18.26)	NR				NR
		Brief web-based information about healthy food swaps and eating five fruits and vegetables a day	279	52.60 (13.19)	33.69%	1.67 (0.09)	NR	NR	NR	NR	NR	104.49 (21.23)	NR				NR
McRobbie 2019[18]	UK London	Weekly group sessions for 8 weeks with task-based multimodal intervention providing clear and simple advice on diet, physical activity and self-monitoring (WAP)	221	46.61 (14.95)	60 (27.15%)	1.65 (0.09)	NR	NR	NR	NR	NR	96.033 (16.10)	50.7%	< 5	12.2	24	6.8
		Four sessions with practice nurse providing advice on diet, activity and self-monitoring (practice nurse intervention)	109	45.13 (14.21)	34 (31.19%)	1.66 (0.09)	NR	NR	NR	NR	NR	97.15 (16.63)	52.3%	< 5	14.7	23.8	7.3

continued

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DOI: 10.3310/GJJL0404

TABLE 1 Characteristics of included RCTs (*continued*)

Trial	Country	Arm	Participants randomised in each arm	Age (years) Mean (SD)	Male (%)	Height (metres) Mean (SD)	Deprivation quintile					Baseline weight (kg) Mean (SD)	Ethnicity				
							1	2	3	4	5		White (%)	Mixed (%)	Asian (%)	Black (%)	Other (%)
Ahern 2017[19]	UK England	Behavioural programme with vouchers to attend local weight watchers meeting once a week **Arm 1** – vouchers for attending the sessions for 12 weeks (WRAP 12)	528	54.15 (13.25)	171 (32%)	1.67 (0.09)	11.55%	14.20%	20.83%	25.75%	27.65%	96.68 (17.99)	90.9%				< 5
		Behavioural programme with vouchers to attend local weight watchers meeting once a week **Arm 2** – Vouchers for attending the sessions for 52 weeks (WRAP 52)	528	53.79 (13.96)	169 (32%)	1.67 (0.09)	13.25%	13.25%	20.26%	26.13%	26.70%	95.71 (16.46)					
		A booklet of self-help weight-management strategies	211	52.43 (14.07)	68 (32%)	1.67 (0.09)	11.37%	13.74%	23.69%	24.17%	27.01%	96.18 (16.42)	85.7%				7.6%

TABLE 2 Characteristics of Real World Services (RWSs)

RWS programme	Intervention	Participants	Age (years) Mean (SD)	Height (metres) Mean (SD)	Deprivation quintiles (1–5)	Sex (male) (%)	Mean weeks attended	Ethnicity	Baseline weight (kg) Mean (SD)
1	Face-to-face intervention with weekly sessions on diet and physical activity for 12 weeks	7460	45.86 (14.28)	1.63 (0.08)	1 = 27.6%	9.23	10	White: 76.2%	99.69 (19.41)
					2 = 11.4%			Black: 7.7%	
					3 = 6.3%				
					4 ≤ 5%			SE Asian: 9.9%	
					5 ≤ 5%				
					Missing = 51.1%			Other: < 5%	
2	Face-to-face group-based intervention with weekly sessions on diet and physical activity for 12 weeks	2285	49.90 (14.18)	1.63 (0.08)	1 = 53.7%	10.10	32	White: 78.8%	98.21 (19.26)
					2 = 25.0%			Black: 7.9%	
					3 = 13.7%			SE Asian: 7.7%	
					4 ≤ 5%				
					5 ≤ 5%			Other: < 5%	
3	Face-to-face intervention with physical activity and dietary advice	1281	46.50 (13.65)	1.62 (0.07)	1 = 52.0%	5.15	10.09	White: 60.1%	93.69 (17.31)
					2 = 22.9%			Black: 15.2%	
					3 = 13.8%			SE Asian: 15.6%	
					4 = 4.9%			Mixed: 6.4%	
					5 ≤ 5%			Other: < 5%	
					Missing ≤ 5%			Missing: < 5%	
4	Group-based, in-person intervention with focus on dietary advice in 12 weekly sessions followed by 9 monthly sessions	4543	55.30 (14.95)	1.65 (0.09)	1 = 39.2%	24.20	11.74	White = 42.6%	103.35 (21.86)
					2 = 41.6%			Other ≤ 5%	
					3 = 16.0%				
					4 = N/A				

continued

This article should be referenced as follows: Jaiswal N, Gregg R, Hawkins N, Sharif-Hurst S, Avenell A, Ells L *et al.* Behavioural weight management interventions for the treatment of obesity: network meta-analysis of trial and real-world individual participant data. *Health Technol Assess* 2026;30(23):45–86. https://doi.org/10.3310/GJJL0404

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TABLE 2 Characteristics of RWD (*continued*)

RWS programme	Intervention	Participants	Age (years) Mean (SD)	Height (metres) Mean (SD)	Deprivation quintiles (1–5)	Sex (male) (%)	Mean weeks attended	Ethnicity	Baseline weight (kg) Mean (SD)
					5 = N/A			Missing = 56.4%	
5	Group-based intervention in 12 weekly sessions with a focus on physical activity	646	47.30 (14.08)	1.62 (0.09)	1 = 47.5%	0.00	18.81	White: 50.5%	95.60 (19.31)
					2 = 37.8%				
					3 = 10.4%			Asian: 10.4%	
					4 = N/A				
					5 ≤ 5%			Other: 7%	
								Missing: 23.4%	
6	Group-based intervention in 12 weekly sessions with a focus on physical activity	454	53.80 (11.52)	1.77 (0.07)	1 = 45.4%	100.00	16.43	White: 58.8%	113.71 (22.27)
					2 = 35.2%				
					3 = 14.2%				
					4 = N/A				
					5 = N/A			Other: 8.2%	
					Missing = 5.3%			Missing: 32.9%	
7	Group-based intervention in 12 weekly sessions with a focus on physical activity	370	51.90 (15.12)	1.65 (0.10)	1 = 49.2%	23.80	19.68	White: 9.4%	100.29 (22.96)
					2 = 39.5%				
					3 = 8.9%				
					4 = N/A				
					5 ≤ 5%			Other: 9.3%	
					Missing = 0.0%			Missing: 80.3%	
8	Web-based intervention running over 12 weeks	17,511	45.21	1.66	1 = 8.4%	33.10	6.67	Missing: 100%	93.04 (20.5)
					2 = 13.5%				
					3 = 16.4%				
					4 = 18.3%				
					5 = 18.6%				

RWS programme	Intervention	Participants	Age (years) Mean (SD)	Height (metres) Mean (SD)	Deprivation quintiles (1–5)	Sex (male) (%)	Mean weeks attended	Ethnicity	Baseline weight (kg) Mean (SD)
					Missing = 24.9%				
9	Twelve weekly group sessions with a focus on both physical activity and diet	1737	57.20 (13.83)	1.66 (0.09)	1 = 19.6%	25.80	7	White: 76.6%	100.32 (19.98)
					2 = 23.0%				
					3 = 24.8%				
					4 = 20.7%				
					5 = 11.4%			Other: < 5%	
								Missing = 22.4%	
10	Group-based intervention for 14 weeks with focus on physical activity and diet and providing additional support	11,243	36.86 (9.53)	1.79 (0.07)	1 = 21.6%	100.00	8		115.02 (21.22)
					2 = 20.1%				
					3 = 19.9%				
					4 = 19.2%			**Missing: 99.9%**	
					5 = 14.7%				
11	Group-based intervention running over 12 weekly sessions with focus on both physical activity and dietary advice	394	52.95 (14.38)	1.65 (0.09)	1 = N/A	20.05	7.8	White = 94.9%	93.30 (19.09)
					2 = 97.0%				
					3 = N/A				
					4 = N/A				
					5 ≤ 5%			South Asian = 5.1%	
12	Group-based intervention running over 12 weekly sessions with focus on both physical activity and dietary advice	454	53.87 (14.61)	1.67 (0.08)	1 = N/A	24.01	13.7	White = 99.6%	91.69 (13.53)
					2 = 100.0%				
					3 = N/A				

continued

This article should be referenced as follows: Jaiswal N, Gregg R, Hawkins N, Sharif-Hurst S, Avenell A, Ells L *et al.* Behavioural weight management interventions for the treatment of obesity: network meta-analysis of trial and real-world individual participant data. *Health Technol Assess* 2026;**30**(23):45–86. https://doi.org/10.3310/GJJL0404

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Health Technology Assessment 2026 Vol. 30 No. 23

TABLE 2 Characteristics of RWD (*continued*)

RWS programme	Intervention	Participants	Age (years) Mean (SD)	Height (metres) Mean (SD)	Deprivation quintiles (1–5)	Sex (male) (%)	Mean weeks attended	Ethnicity	Baseline weight (kg) Mean (SD)
					4 = N/A				
					5 = N/A				
13	Group-based intervention running over 12 weekly sessions with focus on both physical activity and dietary advice	316	58.71 (13.69)	1.67 (0.09)	1 = N/A	31.64	11.3	**White = 98.41%**	95.86 (18.87)
					2 = 100.0%				
					3 = N/A				
					4 = N/A				
					5 = N/A				
14	Group-based intervention running over 12 weekly sessions with focus on both physical activity and dietary advice	764	57.48 (14.67)	1.65 (0.09)	1 = N/A	22.60	8	White = 99.6%	99.53 (21.10)
					2 ≤ 5%				
					3 = 27.4%				
					4 = 54.1%				
					5 = N/A				
					Missing = 18.5%				
15	Group-based intervention running over 12 weekly sessions with focus on both physical activity and dietary advise	512	45.06 (13.98)	1.66 (0.09)	1 = N/A	17.40	8.8	White = 99.8%	96.50 (22.00)
					2 = 100%				
					3 = N/A				
					4 = N/A				
					5 = N/A				
16	Intervention providing dietary and physical activity advice over 12 weekly sessions	3377	59.40 (14.61)	1.66 (0.15)	1 = 15.4%	30.90	6.6	White: 93.1%	106.65 (23.08)
					2 = 25.7%				
					3 = 22.0%				

RWS programme	Intervention	Participants	Age (years) Mean (SD)	Height (metres) Mean (SD)	Deprivation quintiles (1–5)	Sex (male) (%)	Mean weeks attended	Ethnicity	Baseline weight (kg) Mean (SD)
					4 = 17.3%				
					5 = 18.2%				
								Other: 5.7%	
17	Intervention providing dietary and physical activity advice over 12 weekly sessions	9125	57.10 (15.41)	1.65 (0.35)	1 = 11.9%	22.68	5.1	White: 76.6%	95.52 (21.19)
					2 = 20.4%				
					3 = 23.7%				
					4 = 21.6%				
					5 = 21.0%				
								Other: 17.9%	
18	Interventions providing dietary advise and physical activity over 12 weekly sessions	3731	51.77 (15.38)	1.67 (2.25)	1 = 12.9%	23.96	5.7	White: 90.4%	103.72 (24.12)
					2 = 22.5%				
					3 = 23.3%				
					4 = 21.0%				
					5 = 19.2%				
								Other: 7.5%	
19	Web-based indefinite programme with a focus on dietary advice	10,000	45.90 (10.71)	1.66 (0.267)	1 ≤ 5%	14.55	9.2	Missing = 100%	87.81 (18.83)
					2 = 7.5%				
					3 = 10.1%				
					4 = 11.6%				
					5 = 12.9%				
					Missing = 53.7%				

This article should be referenced as follows: Jaiswal N, Gregg R, Hawkins N, Sharif-Hurst S, Avenell A, Ells L *et al.* Behavioural weight management interventions for the treatment of obesity: network meta-analysis of trial and real-world individual participant data. *Health Technol Assess* 2026;30(23):45–86. https://doi.org/10.3310/GJJL0404

be informed from the analysis. Similarly, it is difficult to comment on the influence of ethnicity due to higher rates of missing information.

The findings from the current study also signal towards attendance as being a critical factor influencing the effectiveness of BWMI. It can be argued that attendance in a programme reflects motivation of the participants.[22] Therefore, interventions considering the participants' needs may have fewer dropouts and demonstrate better outcomes. The programmes associated with greater weight loss had a greater proportion of participants completing the programme (attending > 80% of the sessions). The sensitivity analysis for RWS data incorporating the LOCF assumption showed that programme 6, a male-only programme, led to greater weight loss. This difference in the results from the two assumptions explains the influence of programme attendance and thereby emphasises the need for exploring strategies to enhance retention. This is also evident from the analysis of RCTs where FFIT[17] intervention, with a lower dropout rate than the other RCTs, performed better than other interventions.

A sensitivity analysis was attempted to imitate RCTs with real-world participant characteristics like age, sex, height and baseline weight. FFIT[17] intervention performed better than other interventions confirming the findings from the NMA of RCTs. It is noteworthy that the predicted effect of BeWEL[16] intervention imroved significantly when real-world participant characteristics were inducted. To our knowledge, this is the first attempt to analyse individual participant-level data from the RCTs and RWSs on BWMIs. The NMA attempts to fill the evidence gaps, such as small sample size, highlighted in NICE guidance[2] by including over 80,000 adults living with overweight and obesity in the analysis.

Previous NMA[23] used published aggregate-level data and were broader in including RCTs. However, due to the inclusion criteria of having to share the individual participant-level data, there were RCTs which were not included in the NMA and therefore some interventions could not be evaluated.[24] In addition, missing data, particularly relating to the socioeconomic status and ethnicity, also limited the ability of the analysis to explore their impact on intervention effectiveness. This study used BOCF and LOCF to examine the effects of dropouts and provided predictions for two extremes of attendance. The use of multiple imputation approaches may provide more precise estimates. This analysis is focused on the AWL phase and not on the maintenance phase, under the premise that 'participants have to lose weight initially to then maintain weight loss' and therefore did not allow for any inferences on long-term weight management outcomes, which is a crucial factor in sustainable weight management.

The final weight measures in RWSs were not always recorded at 12 weeks and the analysis was therefore based on assumptions requiring a cautious interpretation. Due to the nature of real-word data, control or comparator arms do not exist. Therefore, it has to be assumed in order to compare the change in weight measures for these programmes; this risk is that the analysis may be not free from confounding.

The implications of the findings from the current study are considerable for future design and implementation of BWMIs. As the findings point towards a relationship between attendance and weight loss outcomes, strategies should be prioritised for better participant engagement for future studies. The impact of BE:COME is the network of RWSs involved in research with the potential to continue in the form of pragmatic trials that evaluate any effective components, realist evaluation of effective interventions and the development of methods for collecting longer-term outcomes.

Further work will examine the effectiveness of individual components of BWMIs such as multimodal referral, co-designing and tailoring.

Conclusion

The BWMI in the RWSs and RCTs show promising results when it comes to AWL at 12 weeks. However, participant engagement and adherence remain a key challenge to be addressed in future studies in addition to exploring the long-term sustainability of BWMIs.

Equality, diversity and inclusion

Individuals were not recruited for this research; however, the inclusion criteria for the IPD data from RCTs and RWSs were kept broad to include a diversity of services from across the UK.

The main determinant of diversity are the criteria chosen by the included trials and RWSs. Typically weight management services are accessed more by a female population, age range 40–60 and of a white British ethnic background.

Twenty-six per cent of adults in the UK are living with obesity, with the prevalence being highest in lower socioeconomic groups. This research is identifying effective components of weight management, and, in doing so, will assist in increasing access to these services, as mentioned in the 2019 NHS long-term plan.

Additional information

CRediT contribution statement

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Patient data statement

This work uses data provided by the public and collected by Local Authorities as part of their care and support. Using public data is vital to improve health and care for everyone. There is huge potential to make better use of information from people's patient records, to understand more about disease, develop new treatments, monitor safety and plan NHS services. Patient data should be kept safe and secure, to protect everyone's privacy, and it is important that there are safeguards to make sure that those are stored and used responsibly. Everyone should be able to find out about how patient data are used. #datasaveslives You can find out more about the background to this citation here: https://understandingpatientdata.org.uk/data-citation

Data-sharing statement

All data requests should be submitted to RDM@lancaster.ac.uk. Access to anonymised data may be granted following review.

Ethics statement

This research was conducted accordance with the World Medical Association Declaration of Helsinki. Ethical approval was provided by Faculty of Health and Medicine Research Ethics Committee (FHMREC), Lancaster University on 26/01/21 (FHMREC reference: FHMREC20085). It was determined via the online criteria check that, due to the nature of the data request, NHS REC approval was not required.

Information governance statement

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Disclosure of interests

Full disclosure of interests: Completed ICMJE forms for all authors, including all related interests, are available in the toolkit on the NIHR Journals Library report publication page at https://doi.org/10.3310/GJJL0404.

Primary conflicts of interest: Louisa Ells is specialist academic advisor to the Office of Health Improvement and Disparities.

Sharon Anne Simpson was on the NIHR Health Technology Assessment Clinical Evaluations and Trials Committee, the Commissioning Panel for the NIHR Policy Research Programme and the Chief Scientist Office HIPS committee. She is also President of the UK Society of Behavioural Medicine, a Society which has an interest in these findings.

Jennifer Logue is an employee of AstraZeneca with an honorary contract at Lancaster University. AstraZeneca has no involvement in the funding, design or outputs of this research. She was a member of the NIHR Health Technology Assessment Clinical Evaluations and Trials Committee from 2016 to 2020.

Ruth Mackenzie has no conflicts of interests to declare.

Rebecca Gregg has no conflicts of interests to declare.

Nishant Jaiswal has no conflicts of interests to declare.

Alison Avenell has no conflicts of interests to declare.

Sahar Sharif has no conflict of interest to declare.

Olivia Wu reports COVID-19 Reviewing 1 June 2020–30 September 2020; Systematic Reviews NIHR Cochrane Incentive Awards (no dates provided); HTA Remit and Competitiveness Group 1 February 2020–31 December 2021; HTA General Committee 1 August 2016–30 November 2019; HTA Post-Funding Committee teleconference (POC members to attend) 1 February 2020–31 December 2021; HTA Funding Committee Policy Group (formerly CSG) 1 February 2020–31 December 2021; HTA Clinical Evaluation and Trials Committee 1 November 2020–30 November 2023; HTA Programme Oversight Committee (no dates provided); ESP – Evidence Synthesis Programme Grants Committee (no dates provided); ESP – NIHR Incentive Awards Committee (no dates provided); ESP – Evidence Synthesis Programme Advisory Group 1 July 2015–1 June 2021; TARs Contract Retender 2020 Committee (no dates provided).

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Members of the BE:COME study group

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RWSs – Optional authorship on the results paper(s) (up to two people per service). Published 'on behalf of the study group'

– collaborators not identified unless they wish to be, following review of all the evidence.

List of abbreviations

AWL	active weight loss
BMI	body mass index
BOCF	baseline observation carried forward
BWMI	behavioural weight management intervention
COVID-19	coronavirus disease 2019
DSA	data-sharing agreement
FFIT	football fans in training
IPD	individual participant data
ISD	Information Service Division
LOCF	last observation carried forward
NICE	National Institute for Health and Care Excellence
NMA	network meta-analysis
POWER + F	program with either face-to-face
POWER + R	program with either remote
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RCT	randomised controlled trial
RWS	real-world service
WAP	weight action plan
WRAP 12	Weight Watchers referrals with participants attending either 12
WRAP 52	Weight Watchers referrals with participants attending either 52

References

1. Read S, Logue J. Variations in weight management services in Scotland: a national survey of weight management provision. *J Public Health (Oxf)* 2016;**38**:e325–35. https://doi.org/10.1093/PUBMED/FDV132
2. National Institute for Health and Care Excellence. *Weight Management: Lifestyle Services for Overweight or Obese Adults*. NICE; n.d. URL: www.nice.org.uk/guidance/ph53/evidence (accessed 23 August 2023).
3. Hartmann-Boyce J, Johns D, Aveyard P, Onakpoya I, Jebb SA, Phillips D, *et al*. *How Components of Behavioural Weight Management Programmes Affect Weight Change Review 1b. 2013*. n.d. URL: www.nice.org.uk/guidance/ng246/evidence/ph53-evidence-review-1b-how-components-of-behavioural-weight-management-programmes-affect-weight-change-pdf-431707934 (accessed 12 September 2023).
4. 10 Gaps in the Evidence. *Weight Management: Lifestyle Services for Overweight or Obese Adults*. NICE; n.d. URL: www.nice.org.uk/guidance/ph53/chapter/10-Gaps-in-the-evidence (accessed 11 September 2023).
5. GOV.UK. *Weight Management Services: National Mapping*. n.d. URL: www.gov.uk/government/publications/weight-management-services-national-mapping (accessed 23 August 2023).
6. Sutcliffe K, Richardson M, Rees R, Burchett H, Melendez-Torres GJ, Stansfield C, *et al*. *What Are the Critical Features of Successful Tier 2 Weight Management Programmes for Adults? A Systematic Review to Identify the Programme Characteristics, and Combinations of Characteristics, That Are Associated with Successful Weight Loss*. London: EPPI-Centre, Social Science Research Unit, UCL Institute of Education, University College London; 2016.
7. Heggie L, Mackenzie RM, Ells LJ, Simpson SA, Logue J. Tackling reporting issues and variation in behavioural weight management interventions: design and piloting of the standardized reporting of adult behavioural weight management interventions to aid evaluation (STAR-LITE) template. *Clin Obes* 2020;**10**:e12390. https://doi.org/10.1111/cob.12390
8. Mackenzie RM, Ells LJ, Simpson SA, Logue J. Core outcome set for behavioural weight management interventions for adults with overweight and obesity: standardised reporting of lifestyle weight management interventions to aid evaluation (STAR-LITE). *Obes Rev* 2020;**21**:e12961. https://doi.org/10.1111/obr.12961
9. Hutton B, Salanti G, Caldwell DM, Chaimani A, Schmid CH, Cameron C, *et al*. The PRISMA extension statement for reporting of systematic reviews incorporating network meta-analyses of health care interventions: checklist and explanations. *Ann Intern Med* 2015;**162**:777–84. https://doi.org/10.7326/M14-2385
10. Stewart LA, Clarke M, Rovers M, Riley RD, Simmonds M, Stewart G, Tierney JF; PRISMA-IPD Development Group. Preferred reporting items for a systematic

review and meta-analysis of individual participant data. *JAMA* 2015;**313**:1657–65. https://doi.org/10.1001/jama.2015.3656

11. Sterne JAC, Savović J, Page MJ, Elbers RG, Blencowe NS, Boutron I, *et al*. RoB 2: a revised tool for assessing risk of bias in randomised trials. *BMJ* 2019;**366**:l4898. https://doi.org/10.1136/bmj.l4898
12. Donegan S, Williamson P, D'Alessandro U, Tudur Smith C. Assessing key assumptions of network meta-analysis: a review of methods. *Res Synth Methods* 2013;**4**:291–323. https://doi.org/10.1002/jrsm.1085
13. Lu G, Ades AE. Assessing evidence inconsistency in mixed treatment comparisons. *J Am Stat Assoc* 2006;**101**:447–59. https://doi.org/10.1198/016214505000001302
14. Li X, Li S, Luedtke A. Estimating the efficiency gain of covariate-adjusted analyses in future clinical trials using external data. *J R Stat Soc Ser B Stat Methodol* 2023;**85**:356–77. https://doi.org/10.1093/jrsssb/qkad007
15. Anderson AS, Chong HY, Craigie AM, Donnan PT, Gallant S, Hickman A, *et al*. A novel approach to increasing community capacity for weight management a volunteer-delivered programme (ActWELL) initiated within breast screening clinics: a randomised controlled trial. *Int J Behav Nutr Phys Act* 2021;**18**:34. https://doi.org/10.1186/s12966-021-01099-7
16. Anderson AS, Craigie AM, Caswell S, Treweek S, Stead M, Macleod M, *et al*. The impact of a bodyweight and physical activity intervention (BeWEL) initiated through a national colorectal cancer screening programme: randomised controlled trial. *BMJ* 2014;**348**:g1823. https://doi.org/10.1136/bmj.g1823
17. Hunt K, Wyke S, Gray CM, Anderson AS, Brady A, Bunn C, *et al*. A gender-sensitised weight loss and healthy living programme for overweight and obese men delivered by Scottish Premier League football clubs (FFIT): a pragmatic randomised controlled trial. *Lancet (London, England)* 2014;**383**:1211–21. https://doi.org/10.1016/S0140-6736(13)62420-4
18. McRobbie H, Hajek P, Peerbux S, Kahan BC, Eldridge S, Trépel D, *et al*. Randomised controlled trial and economic evaluation of a task-based weight management group programme. *BMC Public Health* 2019;**19**:365. https://doi.org/10.1186/s12889-019-6679-3
19. Ahern AL, Wheeler GM, Aveyard P, Boyland EJ, Halford JCG, Mander AP, *et al*. Extended and standard duration weight-loss programme referrals for adults in primary care (WRAP): a randomised controlled trial. *Lancet (London, England)* 2017;**389**:2214–25. https://doi.org/10.1016/S0140-6736(17)30647-5
20. Little P, Stuart B, Hobbs FR, Kelly J, Smith ER, Bradbury KJ, *et al*. Randomised controlled trial and economic analysis of an internet-based weight management programme: POWeR+ (Positive Online Weight Reduction). *Health Technol Assess* 2017;**21**:1–62. https://doi.org/10.3310/hta21040
21. Carels RA, Cacciapaglia HM, Douglass OM, Rydin S, O'Brien WH. The early identification of poor treatment outcome in a women's weight loss program. *Eat Behav* 2003;**4**:265–82. https://doi.org/10.1016/s1471-0153(03)00029-1
22. GOV.UK. *Uptake and Retention in Group Based Weight Management Services*. n.d. URL: www.gov.uk/government/publications/uptake-and-retention-in-group-based-weight-management-services (accessed 17 October 2023).
23. Hartmann-Boyce J, Johns DJ, Jebb SA, Aveyard P; Behavioural Weight Management Review Group. Effect of behavioural techniques and delivery mode on effectiveness of weight management: systematic review, meta-analysis and meta-regression. *Obes Rev* 2014;**15**:598–609. https://doi.org/10.1111/obr.12165
24. Nanchahal K, Power T, Holdsworth E, Hession M, Sorhaindo A, Griffiths U, *et al*. A pragmatic randomised controlled trial in primary care of the Camden Weight Loss (CAMWEL) programme. *BMJ Open* 2012;**2**:e000793. https://doi.org/10.1136/bmjopen-2011-000793
25. McGuinness LA, Higgins JPT. Risk-of-bias VISualization (robvis): an R package and Shiny web app for visualizing risk-of-bias assessments. *Res Synth Methods* 2021;**12**:55–61. https://doi.org/10.1002/jrsm.1411

Appendix 1

Data requests and data handling

A signed collaboration agreement was required before services and RCTs could proceed with participation. The RWS agreement covered the blinding of the analysis, the return of the results to each individual intervention and that no programme would be identifiable within any publication. While participating interventions had the option to be listed on any publication, due to the potential for poor outcomes that could lead to commercial concerns, there was the option to not be listed. The RCT agreement ensured proper standards of use and anonymisation for individuals in the data.

Data requests were discussed during the contract period; this was an iterative process that allowed the researchers to determine if the service had access to suitable data and could meet the requirements of the research which included the completion of an intervention description template. *Appendix 1*, *Tables 4* and *5* outline the required format for the data set from participating RWSs and RCTs. Services were asked to prepare the data (which in the case of RWSs had mostly not previously been used in research before) to meet the requirements of the data request; this was also an iterative process and, as anticipated, services required more support to prepare their data then RCTs in the form of online meetings and e-mail. Services were compensated for the time taken to do this as outlined in the data-sharing agreement (DSA). Payment was made once data have been transferred and checked for correctness.

Services were paid £1789 per real-world weight management intervention to cover the costs of data preparation and transfer, completion of the intervention description template and availability to respond to queries. While they were not NHS interventions, this was based on 10 days of band 8 Agenda for Change salary as this is the appropriate NHS grade for a senior data analyst or dietetic service lead. RWSs signed a contract detailing the DSA, and financial compensation for preparing data.

Data handling

All data from the interventions were transferred by secure file transfer to NHS ISD in Edinburgh who acted as a data safe haven. Analysis was performed on their server, accessed via a virtual private network.

Data were initially checked that services had followed the specific format requested. If this was not the case, the data were deleted, and arrangements were made to resend the amended data set.

We requested data for all participants be included, even if excluded from original trial analyses. Two researchers independently examined received data for missing, duplicated, or outlying values, and for internal consistency.

A signed collaboration agreement was required before services and RCTs could proceed with participation. The RWS agreement covered the blinding of the analysis, the return of the results to each individual intervention and that no programme would be identifiable within any publication. While participating interventions had the option to be listed on any publication, due to the potential for poor outcomes that could lead to commercial concerns, there was the option to not be listed. The RCT agreement ensured proper standards of use and anonymisation for individuals in the data.

Real-world data for this project had not been used for research before. RWSs were therefore financially compensated for their participation. Services were paid £1789 per real-world weight management intervention to cover the costs of data preparation and transfer, completion of the intervention description template and availability to respond to queries. While they were not NHS interventions, this was based on 10 days of band 8 Agenda for Change salary as this is the appropriate NHS grade for a senior data analyst or dietetic service lead. RWSs signed a contract detailing the DSA, and financial compensation for preparing data.

TABLE 3 Primary and secondary outcomes and definitions

Primary outcome	Mean change weight in kilogram change for all participants attending > 1 AWL session (LOCF and BOCF)
Secondary outcomes	Mean % weight change (LOCF and BOCF)
	% achieving ≥ 5% (all participants attending > 1 AWL session) (LOCF and BOCF)
	% achieving ≥ 10% weight loss (all participants attending > 1 AWL session) (LOCF and BOCF)
	Mean change in weight in kilogram for all participants completing the programme (80% of core sessions[a]) (LOCF)
	Mean change in weight in kilogram for all participants completing the programme (80% of core sessions[a]) (LOCF)
	% achieving ≥ 5% [all participants completing the programme (80% of core sessions[a])] (LOCF)
	% achieving ≥ 10% weight loss [all participants completing the programme (80% of core sessions[a])] (LOCF)
	Attendance (mean *n* of weeks attended during core sessions)
	Completion (% of participants who attended at 80% of core sessions[a]) from total attending at least 1 AWL session

a Defined as having a weight recorded on or after 80% of the total core intervention duration has elapsed.

TABLE 4 Individual participant data set request from participating interventions (RCTs)

Data item	Instructions
BE:COME data set request RCTs	
Individual unique ID	Site ID (xx) followed by five-digit consecutive number (yyyyy) in format xxyyyyy
Age	At referral/start of programme Years to one decimal place
Gender	Gender at start of programme (or sex depending on available data) coded as Male/Female/Other
Height	Metres to two decimal places
Deprivation	By Lower Layer Super Output Area derived from postcode; SIMD in Scotland
Ethnicity	2011 UK Census categories
Weight at first AWL session	Kilogram to one decimal place code as WNR if unavailable
Date of attendance at first AWL session where weight was measured	Code as DNA if did not attend
Weight at final attendance at an AWL session	Kilogram to one decimal place Code as WNR if unavailable
Date of final attendance at AWL session where weight was recorded	Code as DNA if did not attend any sessions Will equal start date if only attended one session
Only for interventions where duration is > 3 months	
Weight at AWL session closest to maximum of 12 weeks after starting the intervention	Kilogram to one decimal place Code as WNR if unavailable
Date of attendance at AWL session closest to maximum of 12 weeks after starting the intervention	Code as DNA12 if did not attend any sessions

DNA, did not attend; SIMD, Scottish Index of Multiple Deprivation; WNR, weight not recorded.

TABLE 5 Individual participant data set request from participating interventions (RWSs)

BE:COME data set request Real-World Services v2.0 1 November 2020		
Included cohort	All participants who attend (in person/virtual) at least one active weight management session all participants must be attending the same version of the programme	
Format	CSV/Excel file with one participant per row	
Data item	**Variable name**	**Instructions**
Individual unique ID	BECOME_ID	Site ID (xx) followed by five-digit consecutive number (yyyyy) in format xxyyyyy
Age	AGE_SOP	At referral/start of programme Years to one decimal place
Gender	Gender_SOP	Gender at start of programme (or sex depending on available data) coded as Male/Female/Other
Height	HEIGHT_SOP	Metres to two decimal places

TABLE 5 Individual participant data set request from participating interventions (RWSs) (*continued*)

Deprivation quintile	DEP_CAT	By Lower Layer Super Output Area IMD derived from postcode; SIMD in Scotland (please specify) (1 = most deprived 5 = least deprived) There are government tools to calculate this based on postcode. You can submit a list of postcodes on Excel and get IMD. If you are a national provider covering > 1 UK nation, please provide data for England only. England: https://imd-by-postcode.opendatacommunities.org/imd/2019 (Please provide the value in column F 'Index of Multiple Deprivation Decile', labelled as such) Wales: https://statswales.gov.wales/Catalogue/Community-Safety-and-Social-Inclusion/Welsh-Index-of-Multiple-Deprivation (Postcode to WIMD rank lookup) (Please provide the value in column G 'WIMD 2019 Quintile', labelled as such) Scotland: www.gov.scot/publications/scottish-index-of-multiple-deprivation-2020v2-postcode-look-up/ (Please provide the value in column 'SIMD 2020v2 quintile', labelled as such)
Ethnicity	ETHNICITY_CAT	2011 UK Census categories
Date of attendance at first AWL session where weight would have been recorded	DATE_FIRST_AWL	Code as DNA if did not attend
Weight at first AWL session (as identified by trial team) where weight would have been recorded	WEIGHT_FIRST_AWL	Kilogram to one decimal place, coded as WNR if unavailable
Date of final attendance at AWL session where weight would have been recorded	DATE_FINAL_AWL	Code as DNA if did not attend any sessions Will equal start date if only attended one session
Weight at final attendance at an AWL session (as identified by trial team) where weight would have been recorded	WEIGHT_FINAL_AWL	Kilogram to one decimal place Code as WNR if unavailable
Only for interventions where duration is > 3 months		
Date of attendance at AWL session closest to maximum of 12 weeks after starting the intervention	DATE_12WKS_AWL	Code as DNA12 if did not attend any sessions
Weight at AWL session closest to maximum of 12 weeks after starting the intervention	WEIGHT_12WKS_AWL	Kilogram to one decimal place Code as WNR if unavailable
Only for interventions with mix of paying and local authority/NHS-funded participants		
Payer status	PAYERSTATUS	1. Self-funded 2. NHS/local authority/public health funded

DNA, did not attend; SIMD, Scottish Index of Multiple Deprivation; WNR, weight not recorded.

Appendix 2

Risk-of-bias assessment

The summary risk-of-bias graph (*Figure 8*) showing 30% of the included RCTs at high risk of bias and *Figure 9* showing the risk-of-bias assessment[25] of individual studies for each of the domain.

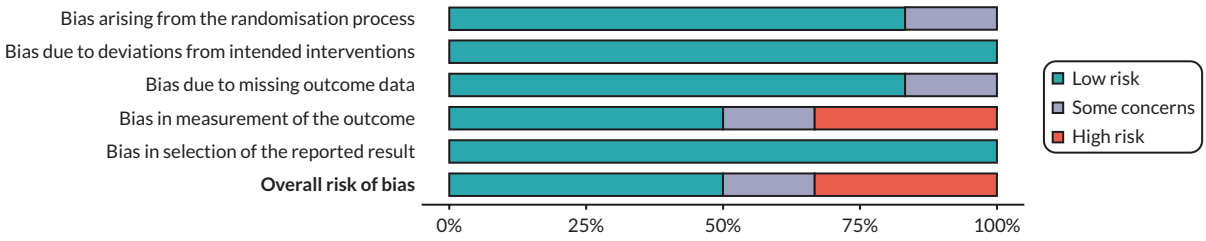
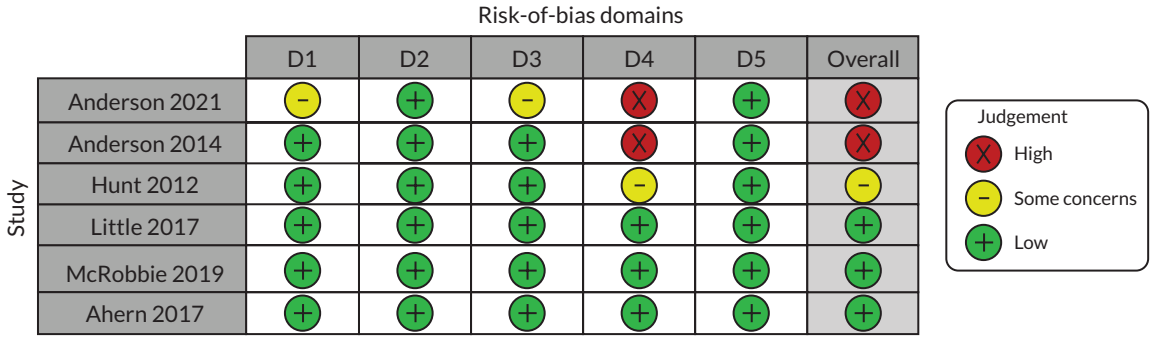


FIGURE 8 Summary risk-of-bias assessment for RCTs.



Domains:
D1: Bias arising from the randomisation process.
D2: Bias due to deviations from intended intervention.
D3: Bias due to missing outcome data.
D4: Bias in measurement of the outcome.
D5: Bias in selection of the reported result.

FIGURE 9 Risk-of-bias assessment for individual RCT included in the analysis.

Appendix 3

Assessment of model fit

Though convergence was satisfactory for both fixed- and random-effects model, fixed-effects model provided a better fit. We compared the posterior means and DIC and constructed the leverage plots for the primary outcome – change in weight (kilogram) and found no significant differences between the two models.

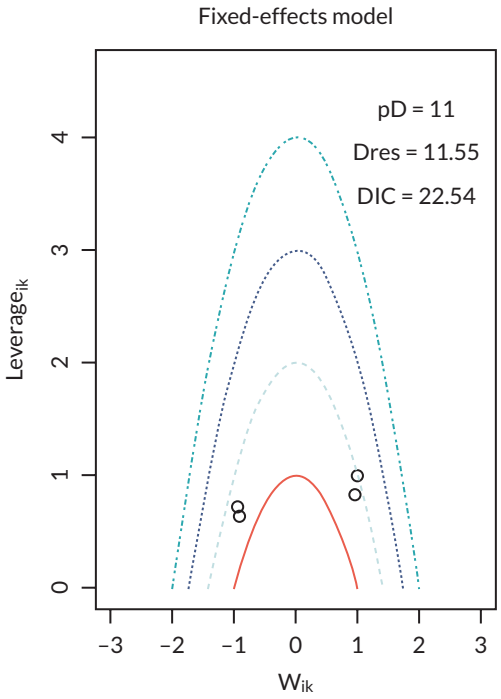


FIGURE 10 Leverage plot with DIC and posterior means for fixed.

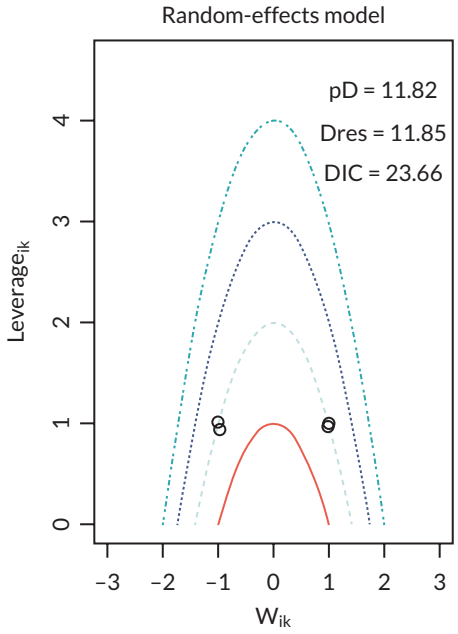


FIGURE 11 Leverage plot with DIC and posterior means for random-effects model.

Appendix 4 Intervention details

TABLE 6 Characteristics of interventions (RCTs)

Study	Group	Provider	Content	Delivery		Setting	Intervention timing (duration)
				Mode	Format		
ActWELL	Usual care		Cancer prevention leaflet				
	Intervention	Volunteer lifestyle coaches (nurses/teachers/church work)	Energy deficit diet, physical activity advice/education (walking with pedometers)	Individual	Face to face	Community	12 months
BeWEL	Usual care		Weight loss booklet	Individual	Face to face	Community	12 months
	Intervention	Lifestyle counsellor/psychologist	Energy deficit diet, dietary advice/education, physical activity advice/education advice (walking with pedometers)	Individual	Face to face	Community	12 months
FFIT	Usual care		Waiting list				
	Intervention	Community coaching staff	Dietary advice/education, physical activity + monetary incentive	Group	Face to face	Community	12 weeks active + 9 months maintenance
WRAP	Usual care	Unclear	Nutrition education (brief advice and self-help)	Individual	Printed booklet of self-help weight management strategies	Community	1
	12-week BWMP	Group Leader of the commercial programme	Physical exercise advice and dietary advice/education	Group	Face to face and online	Community	12 weeks
	52-week BWMP	Group Leader of the commercial programme	Physical exercise advice and dietary advice/education	Group	Face to face and online	Community	52 weeks
POWeR	Usual care		Set of two printable web-based pages with brief structured advice				
	Power + F: web-based intervention and face-to-face nurse support	Web based with nurse support	Dietary advice/education, physical activity advice/education	Individual	Online and face to face	Community	6 months
	Power + R: web-based intervention and remote support	Web based	Dietary advice/education, physical activity advice/education	Individual	Online	Community	6 months
SWAP	Practice nurse intervention (PNI)	Nurses	Dietary advice/education, physical activity advice/education		Face to face	Community	8 weeks
	WAP	Trained advisors	Task-based multimodal group intervention Dietary advice/education, physical activity advice/education	Group	Face to face	Community	8 weeks

TABLE 7 Characteristics of interventions (RWS)

Study	Intervention type	Provider/staff	Content	Delivery		Setting	Intervention timing (duration)
				Mode	Format		
1	Diet, exercise and BCT	Commercial partners	Dietary advice/education, physical activity advice/education	Group	Face to face	Community	12 weeks
2	Diet, exercise and BCT	Commercial partners	Dietary advice/education, physical activity advice/education	Group	Face to face	Community	12 weeks
3	Diet, exercise and BCT	Commercial partners	Dietary advice/education, physical activity advice/education		Face to face	Community	NI
4	Diet, exercise and BCT	Single practitioner	Dietary advice/education, physical activity advice/education + added extras/incentives	Group	Face to face	Community	12 weeks + 9 months
5	Diet, exercise and BCT	Multidisciplinary team (MDT)	Dietary advice/education, physical activity advice/education + added extras/incentives	Group	Face to face	Community	12 weeks
6	Diet, exercise and BCT	MDT	Dietary advise/education, physical activity advice/education + added extras/incentives	Group	Face to face	Community	12 weeks
7	Diet, exercise and BCT	MDT	Dietary advice/education, physical activity advice/education + added extras/incentives	Group	Face to face	Community	12 weeks
8	Diet, exercise and BCT	Single practitioner	Dietary advice/education, physical activity advice/education	Individual	Online	Community	12 weeks
9	Diet, exercise and BCT	Single practitioner	Dietary advice/education, physical activity advice/education + added extras/incentives	Group	Face to face	Community	12 weeks
10	Diet, exercise and BCT	Single practitioner	Dietary advice/education, physical activity advice/education + added extras/incentives	Group	Face to face	Community	14 weeks with roll on to unlimited access to the paid programme at their club
11	Diet, exercise and BCT	Single practitioner	Dietary advice/education, physical activity advice/education + added extras/incentives	Group	Face to face	Community	24 weeks
12	Diet, exercise and BCT	Single practitioner	Dietary advice/education, physical activity advice/education + added extras/incentives	Group	Face to face	Community	24 weeks
13	Diet, exercise and BCT	Single practitioner	Dietary advice/education, physical activity advice/education + added extras/incentives	Group	Face to face	Community	24 weeks
14	Diet, exercise and BCT	Single practitioner	Dietary advice/education, physical activity advice/education + added extras/incentives	Group	Face to face	Community	24 weeks
15	Diet, exercise and BCT	MDT	Dietary advice/education, physical activity advice/education + added extras/incentives	Group	Face to face	Community	24 weeks

continued

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DOI: 10.3310/GJJL0404

TABLE 7 Characteristics of interventions (RWS) (*continued*)

Study	Intervention type	Provider/staff	Content	Delivery		Setting	Intervention timing (duration)
				Mode	Format		
16	Diet, exercise and BCT	Single practitioner	Dietary advice/education, physical activity advice/education	Individual	Face to face	Community	12 weeks
17	Diet, exercise and BCT	Printed material provided by a range of partners	Dietary advice/education, physical activity advice/education + added extras/incentives	Individual	Face to face	Community	12 weeks
18	Diet, exercise and BCT	Single practitioner	Dietary advice/education, physical activity advice/education + added extras/incentives	Individual	Phone based	Community	12 weeks
19	Diet, exercise and BCT	Single practitioner	Dietary advice/education, physical activity advice/education	Individual	Online	Community	4–6 months

BCT, behaviour change technique.

Appendix 5 Missing data

TABLE 8 Missing data for weight measures at 12 weeks and baseline weights in RCTs

RCTs	Total participants	% missing
ActWELL	560	14.11
BeWELL	329	< 5
FFIT	747	9.50
PHWRAP	1267	20.76
POWeR	818	46.33
SWAP	330	38.79

TABLE 9 Missing data for weight measures at 12 weeks in RWS

RWS programme	Total participants	% missing final weights recorded between 9 and 14 weeks
1	7460	32.76
2	2285	< 5
3	1281	52.54
4	4543	31.9
5	646	69.8
6	454	85.18
7	370	< 5
8	17,511	84.19
9	1737	72.9
10	11,243	41.8
11	394	51.78
12	454	14.10
13	394	41.11
14	764	44.25
15	512	37.11
16	3377	68.71
17	9125	81.57
18	3731	77.52
19	10,000	31.22

Appendix 6

TABLE 10 Table showing percentage weight change and number of participants losing more than 5% and 10% weights in each RWS

Programme ID	Percentage (SD) weight change (LOCF)	Percentage (SD) weight change (BOCF)	Percentage of participants achieving > 5% weight loss	Percentage of participants achieving > 10% weight loss	Percentage of participants attending 80% of the sessions
1	−4.10 (3.66)	−3.90 (3.82)	37.1	6.5	66.6
2	−0.85 (2.71)	−0.83 (2.62)	8.5	< 5	99.4
3	−3.40 (3.82)	−3.10 (3.64)	27.3	< 5	46.1
4	−3.84 (4.05)	−3.78 (4.05)	21.6	4.1	68.1
5	−2.08 (2.93)	−0.04 (0.41)	10.2	< 5	30.2
6	−5.07 (15.84)	−0.17 (−1.12)	21.4	2.4	14.8
7	−0.32 (1.18)	−0.37 (1.23)	< 5	0	95.7
8	−4.59 (3.48)	−1.86 (3.31)	60.7	< 5	15.81
9	−3.28 (3.06)	−1.71 (3.380)	26.1	< 5	37.1
10	−3.91 (3.59)	−3.09 (3.49)	29.7	7.1	58.2
11	−2.46 (2.83)	−1.83 (2.99)	27.2	< 5	48.2
12	−3.85 (3.50)	−2.02 (3.14)	45.8	3.1	85.9
13	−3.32 (3.44)	−2.75 (3.26)	42.7	5.4	58.9
14	−2.39 (3.68)	−2.29 (3.53)	26	< 5	55.8
15	−3.36 (4.46)	−3.35 (4.42)	39.8	9.8	62.9
16	−2.20 (2.97)	−1.30 (2.76)	14	< 5	31.3
17	−1.56 (3.38)	−0.78 (2.24)	8.3	< 5	18.4
18	−1.95 (2.95)	−1.29 (2.68)	10.8	< 5	26.5
19	−4.30 (4.11)	−3.60 (4.22)	38.6	8.6	68.7

Additional analysis for randomised controlled trials

In addition to primary outcome, additional NMA using RCT data were performed for outcomes associated with weight loss.

Change in body mass index (kg/m^2)

The network of RCTs was also analysed for change in BMI and it also resonated with results of change in weight. Twelve-week WRAP intervention showed the highest decrease in BMI (MD = −0.80, 95% CrI −1.01 to −0.58) followed by POWeR[20] face-to-face nurse (MD = −0.60, 95% CrI −0.85 to −0.36) and POWeR[20] with remote nurse interventions (MD = −0.52, 95% CrI −0.77 to −0.27). BeWEL[16] (MD = −0.45, 95% CrI −0.64 to −0.26) and ActWEL[15] (MD = −0.34, 95% CrI −0.52 to −0.16) also showed a significant decrease in BMI, whereas mean change in BMI was not significant in the arm receiving WRAP[19] 52-week intervention (MD = −0.11, 95% CrI −0.27 to 0.05) when compared to usual care (*Figure 12*).

Mean percentage change in weight

Mean percentage of weight loss was highest in the arm receiving POWeR[20] face-to-face nurse intervention (MD = −3.00, 95% CrI −3.75 to −2.24), WRAP[19] 12-week (MD = −2.95, 95% CrI −3.54 to −2.35) and WRAP 52-week (MD = −2.64, 95% CrI −3.21 to −2.07) intervention when

compared to usual care. The ActWELL[15] (MD = −0.89, 95% CrI −1.48 to −0.31) and BeWEL[16] (MD = −1.56, 95% CrI −2.17 to −0.94) interventions showed least percentage of weight loss from baseline weight when compared to usual care (*Figure 13*; see *Table 13*).

Number of participants with > 5% weight loss

Comparing the number of participants with more than 5% weight loss, WRAP[19] 52-week intervention arm had maximum number of participants losing more than 5% weight (OR = 10.32, 95% CrI 6.57 to 16.72), The interventions arms where participants lost over 5% weight compared to usual care were WRAP 12-week (OR = 5.75, 95% CrI 3.60 to 9.60), POWeR[20] + F (OR = 4.67, 95% CrI 2.67 to 8.65), POWeR + R (OR = 4.26, 95% CrI 2.41 to 7.94) and BeWEL[16] (OR = 3.74, 95% CrI 1.82 to 8.38). Number of participants with more than 5% weight loss was not significant in ActWELL[15] (OR = 1.03, 95% CrI 0.67 to 1.60) when compared to usual care (*Figure 14*; see *Appendix 7*, *Table 14*).

Number of participants with > 10% weight loss

Weight Watchers referrals with participants attending either[19] 12-week intervention arm had maximum number of participants losing over 10% of weight (OR = 8.14, 95% CrI 2.85 to 34.1). The intervention arms where participants lost over 10% weight were WRAP[19] 52-week (OR = 5.73, 95% CrI 1.98 to 24.10), POWeR + R[20] (OR = 4.19, 95% CrI 1.75 to 11.80), POWeR + F (OR = 3.26, 95% CrI 1.45 to 10.30) when compared against usual care. Number of participants with more than 10% weight loss were not significant in BeWEL[16] (OR = 3.98, 95% CrI 0.431 to 122.0) and ActWELL[15] (OR = 0.74, 95% CrI 0.24 to 2.19) when compared to usual care (*Figure 15*; see *Appendix 7*, *Table 14*).

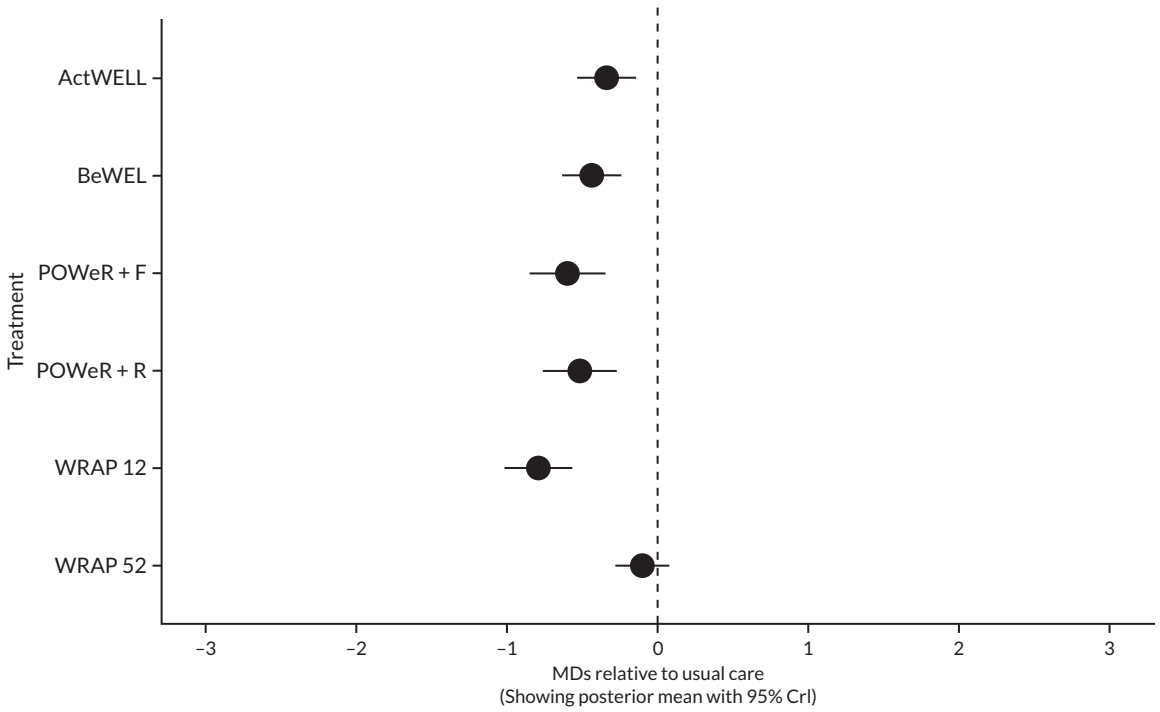

FIGURE 12 Forest plot showing comparison of BWMI from RCTs with usual care: change in BMI (kg/m^2). Mean percentage change in weight.

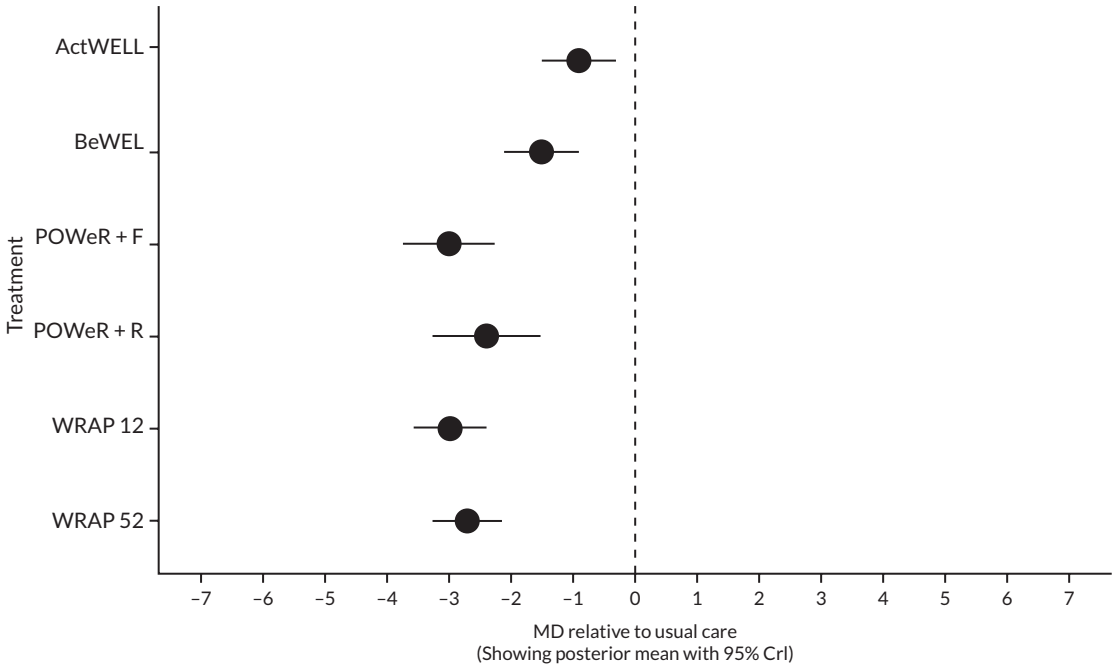

FIGURE 13 Forest plot showing comparison of BWMI from RCTs with usual care: mean percentage change in weight.

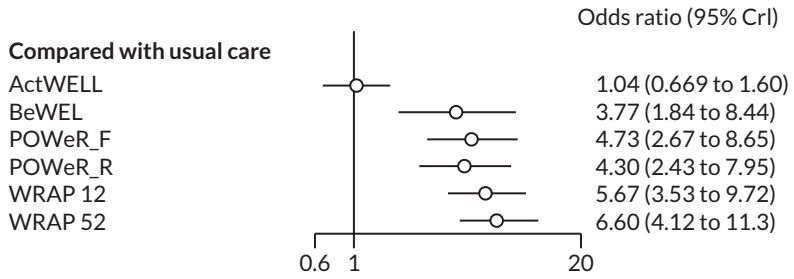

FIGURE 14 Forest plot showing comparison of BWMI from RCTs with usual care: number of participants with more than 5% weight loss.

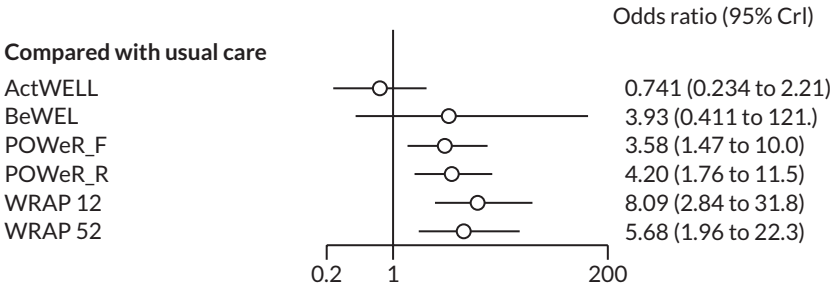

FIGURE 15 Forest plot showing comparison of BWMI from RCTs with usual care – number of participants with more than 10% weight loss.

Appendix 7

TABLE 11 League table with NMA estimates for mean change in weight (kilogram)

WRAP 52						
−0.31 (−0.78 to 0.15)	WRAP 12					
−0.88 (−1.81 to 0.04)	−0.57 (−1.50 to 0.36)	POWeR + F				
−1.08 (−2.01 to −0.15)	−0.77 (−1.69 to 0.16)	−0.20 (−0.90 to 0.50)	POWeR + R			
−1.28 (−2.11 to −0.46)	−0.97 (−1.79 to −0.14)	−0.40 (−1.29 to 0.48)	−0.20 (−1.09 to 0.68)	BeWEL		
−1.68 (−2.46 to −0.89)	−1.36 (−2.15 to −0.57)	−0.80 (−1.65 to 0.06)	−0.60 (−1.45 to 0.25)	−0.40 (−1.13 to 0.34)	ActWELL	
−2.58 (−3.19 to −1.96)	−2.26 (−2.88 to −1.65)	−1.69 (−2.39 to −1.00)	−1.50 (−2.19 to −0.80)	−1.29 (−1.84 to −0.74)	−0.90 (−1.39 to −0.40)	Usual care

Comparisons should be read from left to right. The effectiveness estimate is located at the intersection of the column and row. Mean change in weight effect estimate is presented in mean difference in kilograms with the 95% CrI, MD below 0 favours the column – defining treatment (weight loss).

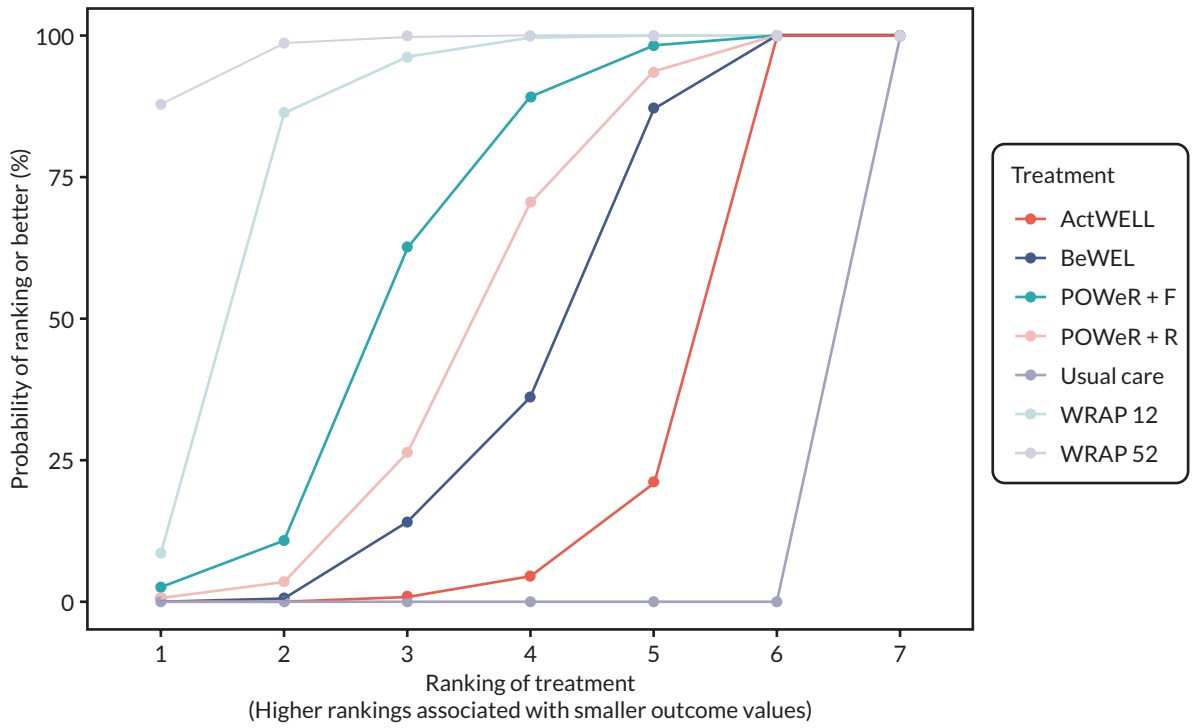

FIGURE 16 Surface under cumulative ranking curve for BWMI for weight loss outcomes.

TABLE 12 League table with NMA estimates for mean change in weight (kilogram) for RWS

Prog 1										
−0.27 (−0.46 to −0.08)	Prog 4									
−0.48 (−0.60 to −0.35)	−0.21 (−0.40 to −0.02)	Prog 19								
−0.58 (−0.93 to −0.24)	−0.31 (−0.68 to 0.06)	−0.10 (−0.45 to 0.24)	Prog 12							
−0.64 (−1.04 to −0.24)	−0.37 (−0.80 to 0.06)	−0.16 (−0.56 to 0.24)	−0.06 (−0.57 to 0.45)	Prog 15						
−0.86 (−1.08 to −0.64)	−0.59 (−0.86 to −0.32)	−0.38 (−0.60 to −0.16)	−0.28 (−0.67 to 0.11)	−0.22 (−0.66 to 0.22)	Prog 3					
−0.91 (−1.04 to −0.78)	−0.64 (−0.84 to −0.44)	−0.43 (−0.56 to −0.30)	−0.33 (−0.68 to 0.02)	−0.27 (−0.67 to 0.13)	−0.05 (−0.28 to 0.18)	Prog 10				
−1.31 (−1.69 to −0.93)	−1.04 (−1.45 to −0.63)	−0.83 (−1.21 to −0.45)	−0.73 (−1.23 to −0.23)	−0.67 (−1.21 to −0.13)	−0.45 (−0.88 to −0.02)	−0.40 (−0.79 to −0.02)	Prog 13			
−1.82 (−2.07 to −1.57)	−1.55 (−1.84 to −1.26)	−1.34 (−1.59 to −1.09)	−1.24 (−1.65 to −0.83)	−1.18 (−1.64 to −0.72)	−0.96 (−1.27 to −0.65)	−0.91 (−1.16 to −−0.66)	−0.51 (−0.95 to −0.07)	Prog 14		
−2.15 (−2.25 to −2.05)	−1.88 (−2.06 to −1.70)	−1.67 (−1.77 to −1.57)	−1.57 (−1.91 to −1.23)	−1.51 (−1.90 to -1.12)	−1.29 (−1.50 to −1.08)	−1.24 (−1.35 to −1.13)	−0.84 (−1.21 to −0.46)	−0.33 (−0.57 to −0.09)	Prog 8	
−2.28 (−2.59 to −1.97)	−2.01 (−2.35 to −1.67)	−1.80 (−2.11 to −1.49)	−1.70 (−2.14 to −1.25)	−1.64 (−2.13 to −1.15)	−1.42 (−1.78 to −1.06)	−1.37 (−1.68 to −1.06)	−0.97 (−1.44 to −0.49)	−0.46 (−0.84 to −0.08)	−0.13 (−0.43 to 0.17)	
−2.35 (−2.52 to −2.18)	−2.08 (−2.31 to −1.85)	−1.87 (−2.04 to −1.70)	−1.77 (−2.13 to −1.40)	−1.71 (−2.13 to −1.29)	−1.49 (−1.74 to −1.23)	−1.44 (−1.62 to −1.26)	−1.04 (−1.44 to −0.64)	−0.53 (−0.81 to −0.25)	−0.20 (−0.36 to −0.04)	
−2.72 (−2.87 to −2.57)	−2.45 (−2.66 to −2.24)	−2.24 (−2.39 to −2.09)	−2.14 (−2.49 to −1.79)	−2.08 (−2.49 to −1.67)	−1.86 (−2.10 to −1.62)	−1.81 (−1.96 to −1.66)	−1.41 (−1.80 to −1.02)	−0.90 (−1.16 to −0.64)	−0.57 (−0.70 to −0.44)	
−2.75 (−2.89 to −2.61)	−2.48 (−2.68 to −2.28)	−2.27 (−2.41 to −2.13)	−2.17 (−2.52 to −1.82)	−2.11 (−2.52 to −1.70)	−1.89 (−2.12 to −1.66)	−1.84 (−1.98 to −1.70)	−1.44 (−1.83 to −1.05)	−0.93 (−1.19 to −0.67)	−0.60 (−0.72 to −0.48)	
−3.25 (−3.39 to −3.11)	−2.98 (−3.18 to −2.78)	−2.77 (−2.91 to −2.63)	−2.67 (−3.02 to −2.32)	−2.61 (−3.01 to −2.20)	−2.39 (−2.62 to −2.15)	−2.34 (−2.48 to −2.19)	−1.94 (−2.32 to −1.55)	−1.43 (−1.69 to −1.17)	−1.10 (−1.22 to −0.98)	
−3.25 (−3.35 to −3.15)	−2.98 (−3.15 to −2.81)	−2.77 (−2.87 to −2.67)	−2.67 (−3.01 to −2.33)	−2.61 (−3.00 to −2.22)	−2.39 (−2.60 to −2.18)	−2.34 (−2.45 to −2.23)	−1.94 (−2.31 to −1.56)	−1.43 (−1.67 to −1.19)	−1.10 (−1.16 to −1.04)	
−3.75 (−3.91 to −3.60)	−3.49 (−3.70 to −3.27)	−3.28 (−3.43 to −3.12)	−3.17 (−3.53 to −2.82)	−3.11 (−3.53 to −2.70)	−2.89 (−3.14 to −2.65)	−2.84 (−3.01 to −2.68)	−2.44 (−2.84 to −2.05)	−1.93 (−2.20 to −1.67)	−1.60 (−1.74 to −1.47)	
−3.85 (−4.02 to −3.68)	−3.58 (−3.80 to −3.35)	−3.37 (−3.54 to −3.20)	−3.27 (−3.63 to −2.90)	−3.21 (−3.62 to −2.79)	−2.99 (−3.24 to −2.73)	−2.94 (−3.11 to −2.76)	−2.54 (−2.94 to −2.14)	−2.03 (−2.30 to −1.75)	−1.70 (−1.85 to −1.54)	
−4.00 (−4.09 to −3.90)	−3.73 (−3.90 to −3.55)	−3.52 (−3.61 to −3.42)	−3.42 (−3.75 to −3.08)	−3.36 (−3.75 to −2.96)	−3.14 (−3.34 to −2.93)	−3.09 (−3.19 to −2.98)	−2.69 (−3.06 to −2.31)	−2.18 (−2.41 to −1.94)	−1.85 (−1.90 to −1.79)	
−4.03 (−4.12 to −3.94)	−3.76 (−3.93 to −3.59)	−3.55 (−3.64 to −3.46)	−3.45 (−3.78 to −3.12)	−3.39 (−3.78 to −3.00)	−3.17 (−3.38 to −2.96)	−3.12 (−3.22 to −3.02)	−2.72 (−3.09 to −2.35)	−2.21 (−2.44 to −1.98)	−1.88 (−1.93 to −1.83)	

Comparisons should be read from left to right. The effectiveness estimate is located at the intersection of the column and row. Mean change in weight (bottom part of the table) effect estimate is presented in mean difference in kilograms with the 95% CrI, MD below 0 favours the column – defining treatment (weight loss).

Prog 11									
−0.07 (−0.40 to 0.26)	Prog 9								
−0.44 (−0.76 to −0.12)	−0.37 (−0.56 to −0.18)	Prog 16							
−0.47 (−0.78 to −0.16)	−0.40 (−0.58 to −0.22)	−0.03 (−0.19 to 0.13)	Prog 18						
−0.97 (−1.28 to −0.65)	−0.90 (−1.08 to −0.71)	−0.53 (−0.69 to −0.37)	−0.50 (−0.65 to −0.35)	Prog 2					
−0.97 (−1.27 to −0.67)	−0.90 (−1.05 to −0.75)	−0.53 (−0.65 to −0.41)	−0.50 (−0.61 to −0.39)	−0.00 (−0.12 to 0.11)	Prog 17				
−1.48 (−1.80 to −1.16)	−1.40 (−1.60 to −1.21)	−1.04 (−1.21 to −0.86)	−1.00 (−1.17 to −0.84)	−0.51 (−0.67 to −0.34)	−0.51 (−0.64 to −0.37)	Prog 7			
−1.57 (−1.90 to −1.24)	−1.50 (−1.71 to −1.29)	−1.13 (−1.31 to −0.94)	−1.10 (−1.28 to −0.92)	−0.60 (−0.78 to −0.42)	−0.60 (−0.75 to −0.45)	−0.09 (−0.28 to 0.10)	Prog 6		
−1.72 (−2.01 to −1.42)	−1.65 (−1.80 to −1.49)	−1.28 (−1.40 to −1.15)	−1.25 (−1.36 to −1.13)	−0.75 (−0.86 to −0.64)	−0.75 (−0.80 to −0.70)	−0.24 (−0.37 to −0.11)	−0.15 (−0.30 to −0.00)	Prog 5	
−1.75 (−2.04 to −1.46)	−1.68 (−1.83 to −1.53)	−1.31 (−1.43 to −1.19)	−1.28 (−1.39 to −1.17)	−0.78 (−0.89 to −0.67)	−0.78 (−0.82 to −0.74)	−0.28 (−0.40 to −0.15)	−0.18 (−0.33 to −0.04)	−0.03 (−0.07 to −0.00)	Usual care

TABLE 13 League table with NMA estimates for mean percentage change in weight

FFIT							
−2.22 (−2.98 to −1.45)	WRAP 52						
−1.91 (−2.70 to −1.13)	0.30 (−0.18 to 0.79)	WRAP 12					
−1.86 (−2.77 to −0.95)	0.36 (−0.59 to 1.30)	0.05 (−0.91 to 1.01)	POWeR + F				
−2.40 (−3.40 to −1.39)	−0.18 (−1.22 to 0.86)	−0.48 (−1.54 to 0.57)	−0.54 (−1.48 to 0.41)	POWeR + R			
−3.30 (−4.10 to −2.50)	−1.08 (−1.92 to −0.25)	−1.39 (−2.24 to −0.54)	−1.44 (−2.41 to −0.47)	−0.90 (−1.97 to 0.16)	BeWEL		
−3.96 (−4.74 to −3.18)	−1.75 (−2.56 to −0.93)	−2.05 (−2.88 to −1.22)	−2.10 (−3.06 to −1.15)	−1.57 (−2.62 to −0.52)	−0.66 (−1.51 to 0.19)	ActWELL	
−4.86 (−5.37 to −4.34)	−2.64 (−3.21 to −2.07)	−2.95 (−3.54 to −2.35)	−3.00 (−3.75 to −2.24)	−2.46 (−3.33 to −1.59)	−1.56 (−2.17 to −0.94)	−0.89 (−1.48 to −0.31)	Usual care

Comparisons should be read from left to right. The effectiveness estimate is located at the intersection of the column and row.

TABLE 14 League table with NMA estimates for participants with more than 5% weight loss (bottom) and with weight loss more than 10% (top)

ActWELL	0.18 (0.01 to 2.2)	0.2 (0.04 to 0.84)	0.17 (0.04 to 0.71)	0.74 (0.24 to 2.19)	0.09 (0.01 to 0.42)	0.13 (0.02 to 0.6)
0.28 (0.11 to 0.65)	BeWEL	1.11 (0.09 to 38.08)	0.95 (0.08 to 31.5)	3.98 (0.43 to 122.44)	0.48 (0.04 to 16.96)	0.69 (0.05 to 24.73)
0.22 (0.1 to 0.45)	0.8 (0.31 to 2.17)	POWeR + F	0.86 (0.45 to 1.63)	3.6 (1.45 to 10.29)	0.44 (0.08 to 1.95)	0.63 (0.12 to 2.79)
0.24 (0.11 to 0.5)	0.88 (0.34 to 2.36)	1.1 (0.72 to 1.67)	POWeR + R	4.19 (1.75 to 11.83)	0.51 (0.1 to 2.25)	0.73 (0.14 to 3.23)
1.03 (0.67 to 1.6)	3.74 (1.82 to 8.38)	4.67 (2.67 to 8.65)	4.26 (2.41 to 7.94)	Usual care	0.12 (0.03 to 0.35)	0.17 (0.04 to 0.51)
0.18 (0.09 to 0.34)	0.65 (0.27 to 1.66)	0.81 (0.38 to 1.77)	0.74 (0.35 to 1.61)	0.17 (0.1 to 0.28)	WRAP 12	1.42 (0.92 to 2.22)
0.15 (0.08 to 0.29)	0.56 (0.23 to 1.43)	0.7 (0.33 to 1.52)	0.63 (0.3 to 1.38)	0.15 (0.09 to 0.24)	0.86 (0.67 to 1.1)	WRAP 52

Comparisons should be read from left to right. The effectiveness estimate is located at the intersection of the column and row. Effects estimate is presented as odds ratios with the 95% CrI, an OR above 1 favours the column – defining treatment.

TABLE 15 League table with NMA estimates for mean change in weight (kilogram) with covariate adjustments using RWSs data

FFIT							
−1.48 (−3.60 to 0.64)	BeWEL						
−1.64 (−3.08 to −0.20)	−0.16 (−2.26 to 1.93)	WRAP 52					
−1.84 (−3.30 to −0.39)	−0.36 (−2.47 to 1.74)	−0.20 (−0.96 to 0.56)	WRAP 12				
−1.97 (−4.00 to 0.05)	−0.49 (−3.02 to 2.05)	−0.33 (−2.34 to 1.68)	−0.13 (−2.15 to 1.89)	POWeR + F			
−2.71 (−4.82 to −0.60)	−1.23 (−3.84 to 1.38)	−1.07 (−3.17 to 1.03)	−0.87 (−2.97 to 1.24)	−0.74 (−2.55 to 1.06)	POWeR + R		
−3.03 (−4.78 to −1.28)	−1.55 (−3.87 to 0.77)	−1.39 (−3.12 to 0.34)	−1.19 (−2.93 to 0.55)	−1.06 (−3.31 to 1.19)	−0.31 (−2.63 to 2.00)	ActWELL	
−4.39 (−5.43 to −3.35)	−2.91 (−4.76 to −1.07)	−2.75 (−3.75 to −1.75)	−2.55 (−3.57 to −1.53)	−2.42 (−4.16 to −0.68)	−1.68 (−3.52 to 0.17)	−1.36 (−2.77 to 0.05)	Usual care

Comparisons should be read from left to right. The effectiveness estimate is located at the intersection of the column and row.

TABLE 16 League table with NMA estimates for mean change in weight (kilogram) including FFIT intervention

FFIT							
−2.08 (−2.92 to -1.23)	WRAP 52						
−2.39 (−3.24 to −1.54)	−0.31 (−0.78 to 0.15)	WRAP 12					
−2.96 (−3.87 to −2.05)	−0.88 (−1.81 to 0.05)	−0.57 (−1.50 to 0.36)	POWeR + F				
−3.15 (−4.07 to −2.24)	−1.08 (−2.01 to −0.15)	−0.77 (−1.69 to 0.16)	−0.20 (−0.90 to 0.51)	POWeR + R			
−3.36 (−4.16 to −2.56)	−1.28 (−2.10 to −0.46)	−0.97 (−1.79 to −0.15)	−0.40 (−1.28 to 0.49)	−0.20 (−1.09 to 0.69)	BeWEL		
−3.75 (−4.52 to −2.99)	-1.68 (−2.46 to −0.89)	−1.36 (−2.15 to −0.58)	−0.80 (−1.65 to 0.06)	−0.60 (−1.45 to 0.26)	−0.40 (−1.14 to 0.34)	ActWELL	
−4.65 (−5.24 to −4.07)	−2.58 (−3.19 to −1.96)	−2.26 (−2.88 to −1.65)	−1.70 (−2.39 to −1.00)	−1.50 (−2.19 to −0.80)	-1.29 (−1.84 to −0.75)	−0.90 (−1.39 to −0.41)	Usual care

Comparisons should be read from left to right. The effectiveness estimate is located at the intersection of the column and row.

TABLE 17 League table with NMA estimates for mean change in weight (kilogram) from RWS interventions

AProg 1	−0.43 (−0.62 to −0.24)	0.14 (0.01 to 0.27)	−0.53 (−0.89 to −0.17)	−0.86 (−1.27 to −0.45)	−0.83 (−1.05 to −0.61)	−0.34 (−0.47 to −0.21)	0.19 (−0.19 to 0.57)	−2.07 (−2.34 to −1.80)	0.30 (0.20 to 0.40)	−1.22 (−1.55 to −0.89)
	Prog 4	0.57 (0.37 to 0.77)	−0.10 (−0.49 to 0.29)	−0.43 (−0.86 to 0.00)	−0.40 (−0.67 to −0.14)	0.09 (−0.11 to 0.29)	0.62 (0.21 to 1.03)	−1.64 (−1.95 to −1.33)	0.73 (0.55 to 0.91)	−0.79 (−1.16 to −0.43)
		Prog 19	−0.67 (−1.04 to −0.30)	−1.00 (−1.41 to −0.59)	−0.97 (−1.20 to −0.74)	−0.48 (−0.62 to −0.34)	0.05 (−0.34 to 0.43)	−2.21 (−2.48 to −1.94)	0.16 (0.05 to 0.27)	−1.36 (−1.70 to −1.03)
			Prog 12	−0.33 (−0.86 to 0.20)	−0.30 (−0.71 to 0.11)	0.19 (−0.18 to 0.56)	0.72 (0.21 to 1.23)	−1.54 (−1.97 to −1.10)	0.83 (0.48 to 1.19)	−0.69 (−1.17 to −0.22)
				Prog 15	0.03 (−0.42 to 0.48)	0.52 (0.11 to 0.93)	1.05 (0.51 to 1.60)	−1.21 (−1.68 to −0.74)	1.16 (0.76 to 1.56)	−0.36 (−0.87 to 0.15)
					Prog 3	0.49 (0.26 to 0.72)	1.02 (0.59 to 1.44)	−1.24 (−1.57 to −0.91)	1.13 (0.92 to 1.34)	−0.39 (−0.77 to −0.01)
						Prog 10	0.53 (0.14 to 0.91)	−1.73 (−2.00 to −1.46)	0.64 (0.53 to 0.75)	−0.88 (−1.22 to −0.55)
							Prog 13	−2.26 (−2.71 to −1.81)	0.11 (−0.26 to 0.49)	−1.41 (−1.90 to −0.92)
								Prog 14	2.37 (2.11 to 2.63)	0.85 (0.44 to 1.26)
									Prog 8	−1.52 (−1.85 to −1.20)
										Prog 11

Comparisons should be read from left to right. The effectiveness estimate is located at the intersection of the column and row.

−1.03 (−1.22 to −0.84)	−2.05 (−2.22 to −1.88)	−2.31 (−2.46 to −2.16)	−3.45 (−3.59 to −3.31)	−2.62 (−2.74 to −2.50)	−3.93 (−4.09 to −3.77)	0.65 (−1.46 to 2.75)	−2.31 (−2.58 to −2.04)	−4.25 (−4.34 to −4.16)
−0.60 (−0.83 to −0.36)	−1.62 (−1.84 to −1.39)	−1.88 (−2.09 to −1.67)	−3.02 (−3.22 to −2.82)	−2.19 (−2.38 to −2.00)	−3.50 (−3.72 to −3.28)	1.08 (−1.03 to 3.19)	−1.88 (−2.19 to −1.57)	−3.82 (−3.99 to −3.65)
−1.17 (−1.36 to −0.97)	−2.19 (−2.36 to −2.01)	−2.45 (−2.60 to −2.30)	−3.59 (−3.74 to −3.44)	−2.76 (−2.89 to −2.63)	−4.07 (−4.23 to −3.91)	0.51 (−1.60 to 2.61)	−2.45 (−2.72 to −2.18)	−4.39 (−4.49 to −4.29)
−0.50 (−0.89 to −0.11)	−1.52 (−1.90 to −1.14)	−1.78 (−2.15 to -1.41)	−2.92 (−3.29 to −2.55)	−2.09 (−2.45 to −1.73)	−3.40 (−3.78 to −3.02)	1.18 (−0.95 to 3.31)	−1.78 (−2.21 to −1.34)	−3.72 (−4.07 to −3.37)
−0.17 (−0.60 to 0.27)	−1.19 (−1.61 to −0.76)	−1.45 (−1.87 to −1.03)	−2.59 (−3.00 to −2.18)	−1.76 (−2.17 to −1.35)	−3.07 (−3.49 to −2.65)	1.51 (−0.63 to 3.65)	−1.45 (−1.92 to −0.98)	−3.39 (−3.79 to −2.99)
−0.20 (−0.46 to 0.07)	−1.22 (−1.47 to −0.97)	−1.48 (−1.71 to −1.24)	−2.62 (−2.85 to −2.39)	−1.79 (−2.01 to −1.57)	−3.10 (−3.34 to −2.86)	1.48 (−0.63 to 3.59)	−1.48 (−1.81 to −1.15)	−3.42 (−3.62 to −3.22)
−0.69 (−0.88 to −0.49)	−1.71 (−1.88 to −1.53)	−1.97 (−2.12 to −1.82)	−3.11 (−3.26 to −2.96)	−2.28 (−2.41 to −2.15)	−3.59 (−3.75 to −3.43)	0.99 (−1.12 to 3.09)	−1.97 (−2.24 to −1.70)	−3.91 (−4.01 to −3.81)
−1.22 (−1.62 to −0.81)	−2.24 (−2.64 to −1.84)	−2.50 (−2.89 to −2.11)	−3.64 (−4.03 to −3.25)	−2.81 (−3.19 to −2.43)	−4.12 (−4.51 to −3.73)	0.46 (−1.68 to 2.60)	−2.50 (−2.95 to −2.05)	−4.44 (−4.81 to −4.07)
1.04 (0.74 to 1.35)	0.02 (−0.27 to 0.32)	−0.24 (−0.52 to 0.04)	−1.38 (−1.66 to −1.10)	−0.55 (−0.82 to −0.28)	−1.86 (−2.15 to −1.57)	2.72 (0.60 to 4.83)	−0.24 (−0.60 to 0.12)	−2.18 (−2.43 to −1.93)
−1.33 (−1.50 to −1.15)	−2.35 (−2.50 to −2.20)	−2.61 (−2.74 to −2.49)	−3.75 (−3.87 to −3.63)	−2.92 (−3.01 to −2.83)	−4.23 (−4.37 to −4.09)	0.35 (−1.76 to 2.45)	−2.61 (−2.87 to −2.35)	−4.55 (−4.59 to −4.51)
0.20 (−0.16 to 0.56)	−0.82 (−1.18 to −0.47)	−1.09 (−1.43 to −0.75)	−2.23 (−2.57 to −1.89)	−1.40 (−1.73 to −1.07)	−2.71 (−3.05 to −2.36)	1.87 (−0.26 to 4.00)	−1.09 (−1.50 to −0.68)	−3.03 (−3.35 to −2.71)
Prog 9	−1.02 (−1.24 to −0.80)	−1.28 (−1.49 to −1.08)	−2.42 (−2.62 to −2.22)	−1.59 (−1.78 to −1.41)	−2.90 (−3.12 to −2.69)	1.68 (−0.44 to 3.78)	−1.28 (−1.59 to −0.98)	−3.22 (−3.39 to −3.06)
	Prog 16	−0.26 (−0.45 to −0.08)	−1.40 (−1.58 to −1.22)	−0.57 (−0.74 to −0.41)	−1.88 (−2.08 to −1.69)	2.70 (0.59 to 4.80)	−0.26 (−0.56 to 0.03)	−2.20 (−2.35 to −2.06)
		Prog 18	−1.14 (−1.30 to −0.98)	−0.31 (−0.45 to −0.17)	−1.62 (−1.80 to −1.44)	2.96 (0.85 to 5.07)	0.00 (−0.28 to 0.28)	−1.94 (−2.06 to −1.82)
			Prog 2	0.83 (0.70 to 0.96)	−0.48 (−0.65 to −0.31)	4.10 (1.99 to 6.21)	1.14 (0.86 to 1.42)	−0.80 (−0.91 to −0.69)
				Prog 17	−1.31 (−1.46 to −1.16)	3.27 (1.16 to 5.37)	0.31 (0.04 to 0.58)	−1.63 (−1.71 to −1.55)
					Prog 7	4.58 (2.47 to 6.69)	1.62 (1.33 to 1.91)	−0.32 (−0.45 to −0.19)
						Prog 6	−2.96 (−5.07 to −0.84)	−4.90 (−7.00 to −2.80)
							Prog 5	−1.94 (−2.20 to −1.69)
								Usual care