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NIHR | National Institute for Health Research

Lancaster University

FULL/LONG TITLE OF THE STUDY

BEhavioural Weight Management: COMponents of Effectiveness

SHORT STUDY TITLE / ACRONYM

BE:COME

PROTOCOL VERSION NUMBER AND DATE

Protocol version number	Date effective	Summary of changes
2.0 Master Protocol	**02/01/2024**	**Amalgamation of RWS v1.0 and RCT v1.1 Protocols for publication on NIHR website**

RESEARCH REFERENCE NUMBERS

FUNDERS Number: NIHR12953

PROSPERO Registration: CRD42020183949

FHM REC Number: FHMREC20008

This protocol has regard for the HRA guidance and order of content

Protocol (master v2.0) is an amalgamation of two protocols:

The rationale for two protocols is that this project was running in 2020 during the CVOD19 pandemic; at that point the NHS ethics committees were only reviewing pandemic-related research.

Therefore, the decision was taken to split the secondary analysis of randomised trial data from the real-world services. This was due to the plan for NHS data, which required NHS ethics and data access approvals.

However, as the pandemic continued much longer than initially predicted, it became impossible to receive NHS data approvals in the project timescale. Therefore, the study had to be limited to local authority and commercial programme data in England and not include the NHS data from Scotland and Wales (these were the same type of weight management programmes, but the situation was a result of different public health structures across the UK).

1. Protocol 1.0 submitted on 2/1/2021 covers real-world services (page 3 of this v2.0)

2. Protocol 1.1 submitted on 26/10/2020 covers randomised controlled trials (page 29 of this v2.0)

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FULL/LONG TITLE OF THE STUDY

BEhavioural Weight Management: COMponents of Effectiveness - Real World Services

SHORT STUDY TITLE / ACRONYM

BE:COME RWS

PROTOCOL VERSION NUMBER AND DATE

Protocol version number	Date effective	Summary of changes
1.0	**02/01/2021**	**First version**

RESEARCH REFERENCE NUMBERS

FUNDERS Number: NIHR12953

PROSPERO Registration: CRD42020183949

FHM REC Number: FHMREC20008

This protocol has regard for the HRA guidance and order of content

SIGNATURE PAGE

The undersigned confirm that the following protocol has been agreed and accepted and that the Chief Investigator agrees to conduct the study in compliance with the approved protocol and will adhere to the principles outlined in the Declaration of Helsinki, the Sponsor's SOPs, and other regulatory requirement.

I agree to ensure that the confidential information contained in this document will not be used for any other purpose other than the evaluation or conduct of the investigation without the prior written consent of the Sponsor

I also confirm that I will make the findings of the study publicly available through publication or other dissemination tools without any unnecessary delay and that an honest accurate and transparent account of the study will be given; and that any discrepancies from the study as planned in this protocol will be explained.

For and on behalf of the Study Sponsor:

Signature: Date:

..../...../.....

Name (please print):

.....

Position:

.....

Chief Investigator:

Signature: Date:

..../...../.....

Name: (please print):

.....

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KEY STUDY CONTACTS

Insert full details of the key study contacts including the following

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Funder(s)	National Institute for Health Research Evaluation, Trials and Studies Coordinating Centre University of Southampton Alpha House, Enterprise Road Southampton SO16 7NS Email: jess.vlieland-boddy@nihr.ac.uk Tel: 02380597462 Ext: 27462

STUDY SUMMARY

Study Title	BEhavioural Weight Management: COMponents of Effectiveness
Internal ref. no. (or short title)	BE:COME
Study Design	Network meta-analysis using individual participant data
Study Participants	All participants of up to 30 UK based behavioural weight management programmes
Planned Size of Sample (if applicable)	N/A
Follow up duration (if applicable)	12 weeks
Planned Study Period	01/12/2020 to 31/07/2023 (32 months)
Research Question/Aim(s)	Primary aim: To determine which individual components of behavioural weight management programmes are associated with greater attendance, intervention completion, and weight loss. Secondary aims 1. To investigate if the individual components are more effective when delivered on their own or in combination 2. To determine if the effects of individual/ groups of components vary depending on the sex, age, BMI, ethnicity, or socioeconomic status of participants, including specific key sub-groups known to have poorer weight loss outcomes within currently published interventions
Related studies	This work is linked to BEhavioural Weight Management: COMponents of Effectiveness Randomised Trials FHMREC20008 and this analysis shall follow on from that work.

FUNDING AND SUPPORT IN KIND

FUNDER(S) (Names and contact details of ALL organisations providing funding and/or support in kind for this study)	**FINANCIAL AND NON FINANCIALSUPPORT GIVEN**
National Institute of Health Research	**£505,026.12**

ROLE OF STUDY SPONSOR AND FUNDER

This study is sponsored by Lancaster University. The sponsor has no role or control in in study design, conduct, data analysis and interpretation, manuscript writing, and dissemination of results.

This study is funded by the National Institute for Health Research. The funder has no influence over trial design, conduct, data analysis and interpretation, manuscript writing, and dissemination of results. The research team will send reports regarding the progress of the trial to the funder at agreed intervals.

ROLES AND RESPONSIBILITIES OF STUDY MANAGEMENT COMMITEES/GROUPS & INDIVIDUALS

There are two main groups involved in the running of this study. Both are independent of the sponsor and both are chaired by the Chief-Investigator. As this is evidence synthesis there is no regulatory or funder requirement for independent oversight. Public and patient involvement is embedded within both committees.

Study Management Group:

Responsible for delivery of all study aims and objectives including final and interim reports to funder, day-to-day study management.

Membership: Joint Chief Investigators (chair); all co-investigators (including PPI co-investigator); postdoctoral research associated employed on the project.

Study Advisory Group:

Responsible for advising the study management group on selection of components for analysis, analytical plans, data interpretation, dissemination and implementation.

Membership: Joint Chief Investigators (chair); all co-investigators (including PPI co-investigator); postdoctoral research associated employed on the project; study advisors (expertise from evidence synthesis, dietetics, sports science, behaviour change, psychology, local authority commissioning, public health and 3 PPI advisors).

Meeting frequency: Broadly the management group will meet bi-monthly throughout the project and the advisory group three times across the project (months 10,18, & 29).

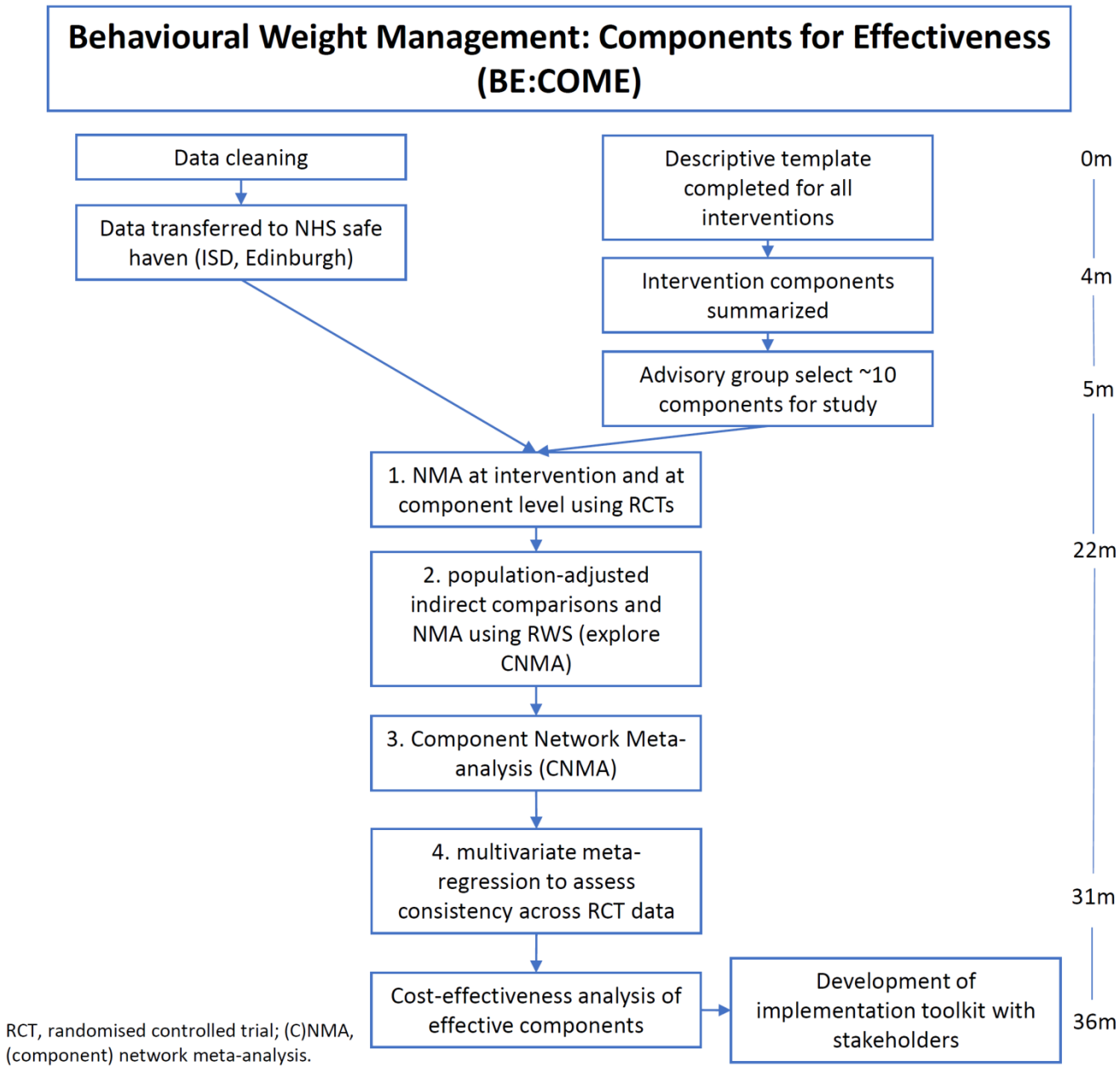
PROTOCOL CONTRIBUTORS

This protocol has been developed by the Jennifer Logue and Olivia Wu (Joint Chief Investigators), in conjunction with co-investigators Louisa Ells, Alison Avenell, Sharon Simpson, Ruth Mackenzie and Sandra Jayacodi (patient representative). Advice was taken from the study advisory group including 3 further patient representatives.

Neither the sponsor nor funder had a role in the development of this protocol.

KEY WORDS: Behaviour change; obesity; meta-analysis; randomised controlled trial.

STUDY FLOW CHART (Figure 1)



Lancaster University

STUDY PROTOCOL

BEhavioural Weight Management: COMponents of Effectiveness Real World Services

LINKED STUDIES

This work is linked to BEhavioural Weight Management: COMponents of Effectiveness Randomised Trials (Lancaster University FHMREC20008) and this analysis shall follow on from that work, combining the anonymised randomised trial data with the real-world data.

Whilst funded as one project, the governance approvals were split due to the different processes required for each. This allows the study team to start the randomised trials analysis whilst obtaining the real-world data approvals.

1 BACKGROUND

Behavioural weight management interventions (BWMIs) are the main funded interventions for obesity in the UK. Broadly these are 12-weekly group sessions focussed on diet, physical activity and behaviour change delivered in primary care/community; these are complex interventions. Described as tier 2 (after guided self-care and before medical or surgical interventions) they are commissioned by primary care or public health, often using commercial organisations for delivery. NICE guidance PH53[1] outlines core components for interventions, however a lack of evidence on effectiveness has meant that these are too broad to effectively assist intervention selection at a local level. NICE were unable to provide specific guidance due to i. lack of clear intervention descriptions in published studies (especially behaviour change techniques) and ii. variable outcome definitions. As a result, they were left with many evidence gaps including "*a lack of trials directly comparing lifestyle weight management programmes in the UK*" and "*a general lack of evidence on which specific components of a lifestyle weight management programme ensure effectiveness*" resulting in research recommendations to address this.

Tier 2 weight management provision has been mapped in England (by Public Health England [PHE][2]) and Scotland[3], both showing large variation in eligibility criteria, provision, length, referral pathway, staffing, setting and mode of delivery.

Very few UK real-world interventions have published evaluation data. PHE commissioned a systematic review in 2016 of published real-world evaluations alongside qualitative work[4,5] but results on the critical features of successful weight management interventions were very limited due to "the lack of detail in the description of intervention components" and little research on key service users such as ethnic minorities. Non-standardised data collection and reporting (e.g. total weight loss, number losing 5% weight) results in the same issues existing for real world services as for published trials; so far, comparison and meta-analysis has been impossible. Commissioners have raised lack of evidence as to what works and lack of clarity of service specifications as a major barrier to commissioning of these vital services[2].

In 2018 we developed a core outcome and instrument set (by consensus) and 119-item intervention description template for use by real-world and research BWMIs, to standardise outcome reporting and intervention description[6] (submitted papers attached).

Current and ongoing research

The current evidence base from randomised trials is limited, poorly reported[7], and often irrelevant to practice[2]. A full systematic review was commissioned by NICE in 2014 resulting in the current guidance[1] and documented evidence gaps. We updated this up to 30/09/17 as part of our core outcome set development[8] identifying a further 16 studies, but no new direct comparisons of interventions. Borek et al[9] published a systematic review of group-based diet and physical activity weight-loss interventions (until 05/2017) and concluded that poor reporting of intervention content limited their ability to accurately discriminate between interventions. A PROSPERO search on 05/05/2019 (WEIGHT AND ADULT AND COMPONENT*) yielded 255 reviews (40 completed) but the majority focus on a single intervention component or are restricted to specific subgroups of the population or conditions (e.g. pregnancy, chronic kidney disease). Those looking at BWMIs are restricted to pairwise comparisons with no attempt at identifying effective components.

We are conducting a network meta-analysis using data from real world services and randomised trials of behavioural weight management interventions conducted in the past 10 years. We will look for differences in the content of the interventions and how they were delivered and use these differences to analyse what elements of an intervention makes it effective, including for specific subgroups of the population.

2 RATIONALE

Prevention is a major part of the health agenda in a country where 27% of adults have obesity (body mass index [BMI] ≥30kg/m^2), with higher prevalence in areas of socioeconomic deprivation[10]. Effective weight management interventions resulting in ≥5% weight loss have significant positive effects on many obesity-related co-morbidities, including cardiovascular and diabetes risk, mobility, non-alcoholic fatty liver disease and polycystic ovarian syndrome[11]. While upstream obesity prevention approaches are paramount, there must be treatment services for those already affected to reduce future healthcare costs. This is clear in the NHS long-term plan[12] which pledges *"targeted access to weight management services in primary care ...where we know we can have a significant impact on improving health, reducing health inequalities and reducing costs"*. To do this there will need to be an expansion in the provision of those interventions most likely to be effective.

We have already established a collaboration of 8 trialists with RCTs, all promising individual participant data and intervention descriptions to allow standardised intervention-level outcome data to be generated. This will facilitate a network meta-analysis (NMA) approach to identify and evaluate effective components that are proven feasible in a real-world setting. We have included online interventions, a mode of delivery that is rapidly expanding, though most components are similar to in-person modes of delivery.

We believe the use of novel approaches to evidence synthesis of complex interventions is the most efficient way to generate new knowledge in this area, directly answer NICE research recommendations and assist commissioners. Given the complexity and (often necessary) variation of these interventions, undertaking head-to-head RCTs alone would be costly, time consuming and of limited usefulness. Knowing that the entirety of programme X is effective in one area (or on average across a few areas) is unhelpful if it is impossible to implement that programme in a different area due to contextual factors such as geography and demographics; improvements can be made across the country if we know what

it is about programme X that makes it effective. The epidemic levels of obesity in the UK, which results in numerous debilitating and costly health conditions mean that we rapidly need better evidence for effective interventions; weight management is currently being commissioned in the dark.

Behavioural weight management interventions: summary of main issues	
Importance of behavioural weight management services in the UK	In the UK 27% of adults have obesity and a further 34% have a BMI in the overweight range. 5% weight loss has significant effects on obesity related comorbid conditions such as diabetes, cardiovascular disease and non-alcoholic fatty liver disease. Increasing access to adult community weight management services is explicitly mentioned in the 2019 NHS long term plan.
Variation in service provision across the UK	Current services across the UK vary considerably, including by: eligibility criteria, provision, length, referral pathway, staffing, setting, mode of delivery, dietary, physical activity and behavioural components
Issues with the current evidence base	Major limitations of the current published evidence that have been raised by large NICE and PHE funded systematic reviews include: ● lack of detailed intervention descriptions ● lack of standardised outcome measures ● lack of published studies that reflect the type of services commissioned in the UK
Current NICE guidance	Due to the poor evidence base, current NICE guidance (PH53) covers only a fraction of the variable components of a weight management intervention.
Guidance for commissioners	Commissioners have specifically raised the lack of evidence as to what works and lack of clarity of service specifications as a major barrier to commissioning of these vital services leading to the current situation of variable funding and provision across the UK.
Specific NICE PH53 research recommendations	*"How effective are lifestyle weight management programmes available in the UK, when directly compared using high-quality trials? In particular, what effect do specific components of a multicomponent lifestyle weight management programme have on adherence, effectiveness and cost effectiveness? This includes:* *components, or combinations of components, that support weight loss or the prevention of weight regain; the effect of*

	programme length, intensity, setting and means of delivery (examples of the latter include group, individual and remote support); specific behaviour change techniques (using a recognised taxonomy); the effect of new technologies; the effect of additional support services, such as self-help groups and networks"
Need for novel approaches to evidence synthesis	BWMIs are very complex interventions consisting of >100 components parts. Given this complexity, head to head RCTs alone would be too costly, time consuming and of limited usefulness to identify effective intervention components. Variation in contextual factors such as geography and demographics make the generalisability of RCT findings difficult across the UK. **Novel approaches to evidence synthesis of complex interventions are the most efficient way to generate new knowledge in this area, directly answer NICE research recommendations and assist commissioners.**

Using individual participant data from 30 UK-based real-world interventions and 8 UK-based randomised controlled trials of behavioural weight management interventions and, we will conduct a series of network meta-analyses (including component network meta-analysis) to investigate the relative effectiveness of components of behavioural weight management interventions for weight loss outcomes.

3 THEORETICAL FRAMEWORK

The overall design of this study follows the guidance set out by the NICE Decision Support Unit (DSU)[13,14] on the selection of methods for estimating comparative effectiveness, in the context of complex data structure. Within the indirect comparison framework, we propose to conduct anchored indirect comparison of BWMI data - network meta-analysis and component network meta-analysis.

4 RESEARCH QUESTION/ AIM(S)

Primary aim:

- To determine which individual components of behavioural weight management programmes are associated with greater attendance, intervention completion, and weight loss.

Secondary aims:

- To investigate if the individual components are more effective when delivered on their own or in combination
- To determine if the effects of individual/ groups of components vary depending on the sex, age, BMI, ethnicity or socioeconomic status of participants, including specific key sub-groups known to have poorer weight loss outcomes within currently published interventions
- To determine the cost-effectiveness of any individual/ groups of components found to be effective

4.1 Objectives

1. To map individual components of behavioural weight management interventions used in pragmatic clinical trials
2. To gain research access to individual participant data from 30 UK-based UK-based real-world interventions of behavioural weight management interventions
3. To conduct a series of network meta-analyses at the level of the intervention for randomised controlled trials and real-world services for weight loss outcomes
4. To conduct component network meta-analysis to investigate the relative effectiveness of components of behavioural weight management interventions for weight loss outcomes.
5. To use an established cost-effectiveness model to conduct a cost-effectiveness analysis of the addition of an effective component to an established intervention

4.2 Outcomes

Our core outcome and instrument set (ref) (COMET registration 1056) will be applied to the data set of each intervention. The proposed outcomes definitions (table 1) were all agreed by expert consensus (including PPI) during our core outcomes and instrument set development.

All outcomes are measured at 12 weeks/ 3 months

Weight loss outcomes will be reported with the last observation carried forward (LOCF) and baseline observation carried forward (BOCF) when a 12-week weight is not recorded. For outcomes involving only those defined as completing the intervention (80% of core sessions) LOCF only will be used.

Table 1: Outcome definitions to be used in BE:COME

Primary outcome	Mean change weight in kg change for all participants attending >1 active weight loss session (LOCF & BOCF)
Secondary outcomes	mean % weight change (LOCF & BOCF)
	% achieving >= 5% (all participants attending >1 active weight loss session) (LOCF & BOCF)
	% achieving >= 10% weight loss (all participants attending >1 active weight loss session) (LOCF & BOCF)
	Mean change in weight in kg for all participants completing the programme [80% of core sessions*] (LOCF)
	Mean change in weight in kg for all participants completing the programme [80% of core sessions*] (LOCF)
	% achieving >= 5% (all participants completing the programme [80% of core sessions*]) (LOCF)
	% achieving >= 10% weight loss (all participants completing the programme [80% of core sessions*]) (LOCF)
	Attendance (mean n of weeks attended during core sessions)
	Completion (% of participants who attended at 80% of core sessions*) from total attending at least 1 active weight loss session. *defined as having a weight recorded on or after 80% of the total core intervention duration has elapsed

5 STUDY DESIGN, METHODS OF DATA COLLECTION AND DATA ANALYSIS

5.1 Data collection

Intervention description: We have developed a 119-item standardised intervention description template. This consists of 4 sections – referral pathway, intervention delivery, intervention components (dietary, physical activity, and behaviour change techniques), and costs of the intervention (fixed overheads and per-person). A template will be completed for each BWMI. For real-world services (RWS), the local service lead will complete the template and the research team will then arrange a follow-up telephone call or site visit to clarify outstanding points. For each RWS the intervention-coding will be performed by two team members with a third deciding in the event of disagreement.

The dataset required from participating interventions is outlined in table 2.

Data handling: All data from interventions will be transferred by secure file transfer to NHS Information Service Division (ISD) in Edinburgh who will act as a data safe haven. Analysis will be conducted on their server, accessed via a VPN.

Anonymisation of results: No participant identifiable information will be used at any time. Each intervention will be given a unique site ID and the data-analyst will be blinded to which intervention is which. The advisory group and majority of co-investigators will only see results by study ID, with JL and the Lancaster post-doctoral research associate the only team members who will have the ability to unblind the results. Full blinding by a third party was considered, but as the Lancaster team will have mapped each intervention and coded the components, genuine blinding is impossible.

Data sharing agreements: A data sharing agreement will be signed for each dataset. This will cover the anonymisation of the data, the return of results to each individual intervention and that no programme will be identifiable within any publication.

Table 2. Dataset required from participating interventions (RWS)

Data item	Instructions
Individual unique ID	Site ID (xx) followed by 5-digit consecutive number (yyyyy) in format xxyyyyy
Age	At referral/ start of programme Years to 1 decimal place
Gender	Gender at start of programme (or sex depending on available data) coded as Male/ Female/ Other
Height	metres to 2 decimal places
Deprivation	By Lower Layer Super Output Area derived from postcode; SIMD in Scotland
Ethnicity	2011 UK Census categories
Weight at first active weight loss session	kg to 1 decimal place code as WNR if unavailable
Date of attendance at first active weight loss session where weight was measured	Code as DNA if did not attend
Weight at final attendance at an active weight loss session	kg to 1 decimal place Code as WNR if unavailable
Date of final attendance at active weight loss session where weight was recorded	Code as DNA if did not attend any sessions Will equal start date if only attended 1 session
Only for interventions where duration is >3months	
Weight at active weight loss session closest to maximum of 12 weeks after starting the intervention	kg to 1 decimal place Code as WNR if unavailable
Date of attendance at active weight loss session closest to maximum of 12 weeks after starting the intervention	Code as DNA12 if did not attend any sessions
SIMD (Scottish Index of Multiple Deprivation); WNR (weight not recorded); DNA (did not attend)	

5.2 Quality assessment and issues with data management

We are requesting individual participant data on all participants attending the BWMI intervention over a fixed time period (time period depends on maximum time data are available for that specific intervention being delivered). The major issue is the quality of data recorded; missing data can mean the person had stopped attending, potentially as they were not successfully losing weight. It may alternatively be due to issues with data capture and database maintenance. This is further complicated by differences in the

design of programmes and the time-point that a person would be included on the database. For example, for some programmes this may be the point that a healthcare professional sends a referral form but the individual may never actually book themselves into a weight loss session, for others it may be the point that an individual makes first contact with the intervention programme either by phone or by attending an introductory session, or in some programmes they may only record people when they first attend an active weight loss session. JL and LE have worked with data from many weight management services across the UK and are very used to these differences. It is for this reason that **this study will focus on participants who have attended at least 1 active weight loss session**. The pathway of entry into the intervention programme will be recorded as part of the intervention description template and may be explored as a covariable through meta-regression within the network (e.g. self-referral or health care referral; initial intro/ assessment sessions or straight to active weight loss).

The rates of completion of behavioural weight management programmes can vary considerably between interventions. PHE key performance indicators (KPIs)[15] suggest that 60% of participants should complete the active intervention (though they do not define completion). As completion and effectiveness are intertwined, many do not achieve 60% and completion (attending 80% of active sessions with a weight recorded) is an outcome measure of our study. Many of our included interventions predate these 2017 KPIs. **To this end, we have set an inclusion rule that a minimum of 40% of those attending at least 1 active weight management session go on to complete the intervention programme.** This will allow us to exclude interventions that have either poor data collection or an intervention that people do not want to attend. If we were to insist on higher completion rates we would be left with a sample that only contained highly effective interventions, reducing our ability to identify the components associated with effectiveness (completion and weight loss).

5.3 Selection of components and covariates for analysis

To start, all interventions will complete our 119-item standardised BWMI reporting template. The template information will be summarised on a single spreadsheet document allowing variation across the participating interventions to be visualised.

The expert advisory group will decide on ~10 components and covariates (with components being part of the direct intervention and covariates related to the process of delivering the intervention) that vary based on the which vary across the interventions and are hypothesised to be of importance for effectiveness, considering NICE research recommendations[1] and building on previous work[4]. While these will be the choice of the advisory group, they are likely to cover the following areas (*covariates in italics*):

- Dietary advice (including calorie restriction and macronutrient composition)
- Physical activity (advice only vs supervised)
- Behaviour change techniques (specific techniques and dose)
- Tailoring of the intervention
- *Mode of delivery (including online and apps)*
- *Intensity (hours)*
- *Staff qualifications/ training*
- *Mode of referral*
- *Time from referral to first active session*
- *Locality (mean distance to venue)*

5.4 Subgroup analyses

Specific subgroups will be defined by the advisory group to include analyses by BMI, age, sex, socioeconomic status and ethnicity, and intervention context factors such as rurality. This will include specific key sub-groups known to have poorer weight loss outcomes within currently published interventions (e.g. younger women with severe obesity from areas of high socioeconomic deprivation). This will allow specific recommendations to be made for the design of BWMIs for these key sub-groups.

Other independent covariates with the potential to vary effectiveness will be added to the models.

5.5 Drop-outs and missing data

Drop-out 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. We will exclude any participants who do not have data for age and height from all analyses. We will exclude participants without deprivation or ethnicity data from the relevant subgroup analyses. We will assume that lack of a recorded weight means 'did not attend' and only count sessions with recorded weights as attended.

5.6 Evidence Synthesis

(Section 1 is covered in the RCT analysis protocol but is replicated here (in italics) as the two analyses are linked)

1. We will conduct NMA at intervention and component levels using data from the RCTs. At the intervention level, we will estimate the relative effectiveness of all interventions on primary and secondary outcomes (where data permit), using direct and indirect evidence. We will adopt an anchored indirect comparison approach that requires any two treatments to have a common comparator, or a link through a chain of comparisons. In the context of the 8 RCTs that will be included in the analysis, we will group interventions where appropriate and construct the network of evidence accordingly; all assumptions will be tested in the sensitivity analysis. For instance, all the RCTs included a control arm that consist of usual care – typically some form of brief intervention. We will explore different network structures – one that uses the control arms of the RCTs as the common comparator, and another that split usual care into different distinct interventions (e.g. booklet versus brief advice from health professionals).

We will conduct a one-stage model[16] *within a Bayesian framework – a hierarchical structure that allows the IPD to be pooled in one step while accounting for clustering of data within each trial. We will use minimally informative priors (this will be tested in sensitivity analysis since it has been suggested that in some circumstances, results may be sensitive to the chosen priors*[17]*). We will report the median of the posterior distribution along with 95% credible intervals. Interventions will be ranked to provide probabilities of each intervention being considered the best in the primary and secondary outcomes.*

The validity of an NMA depends on a number of assumptions including transitivity and consistency of findings. Transitivity means that there is no effect modification of the intervention effects or that the prevalence of effect modifiers is similar in the different studies[18]*. A clinical and epidemiological judgement of the plausibility of this assumption requires an assessment of the eligibility criteria of every trial in the network, to assess whether the trial protocols, participants, and interventions delivered etc. are similar in ways that might modify treatment effect. We have identified potentially important characteristics we consider likely to modify treatment effect (section 6.2 above) and will consult further with our advisory group. We will conduct meta-regression to account for these potential differences.*

Another assumption required to ensure the validity of the findings is consistency in networks of evidence (i.e. 'closed loops' of evidence). Inconsistency occurs when there is a discrepancy between a direct and indirect estimate of treatment effect and, therefore, a violation of the consistency assumption. To assess consistency, we will visually inspect the network diagram and use model fit and selection statistics to assess whether discrepancies between direct and indirect evidence are evident.

A component-level approach is useful to disentangle the 'active ingredients' of a complex intervention. In the component network meta-analysis (CNMA), the effect of each intervention will be dismantled through modelling of component-specific effects. For instance, dietary advice, physical activity, and behavioural change techniques may be considered as individual components. In the CNMA, the effect of each intervention will be dismantled through modelling of component-specific effects. We will adapt the methodology of Welton[19] and Freeman[20] and develop three models:

(i) additive effects model (assuming no interaction between components) in which each component has a separate effect and the total effect for each intervention is equal to the sum of the parts;
(ii) extended additive effects model (two-factor interaction model) that allows pairs of components to have bigger or smaller effect than the sum of their individual parts; and
(iii) standard NMA model (saturated CNMA model) with every possible combination of components considered to be a distinct intervention with its own effect.

2. We will determine the comparative effectiveness of individual real-world services. The data from the real-world services are observational single arm studies. We will adopt an unanchored, population-adjusted indirect comparison approach to estimate relative effectiveness of interventions, which does not rely on a common comparator. In order to account for between-studies imbalance in effect modifiers and prognostic variables, we will use an appropriate methodology. Based on the assessment of overlap of baseline characteristics, we will explore regression-based models, and propensity score methods such as inverse probability weighting, double robust estimation.

3. We will bring together the RCT and observational data in an NMA and explore the potential of using CNMA, through the use of three-level hierarchical models[21]. At the first level, all the data will be synthesised by study design (RCT and observational studies), using a design-specific heterogeneity parameter. At the second level, the design-specific summary estimates are pooled in a joint NMA, accounting for between-design heterogeneity. At the third level, we will explore two different approaches to modelling: (i) we assume the basic parameters to be exchangeable across designs, which accounts for design-level heterogeneity; and (ii) we assume consistency within and across the study designs; we will synthesise a new NMA with the estimates of the basic parameters and their variance-covariance matrix from the design-level NMAs.

4. We will use a multivariate meta-regression approach to assess consistency across the body of evidence[22]. This approach generates consistency and inconsistency models as multivariate random-effects meta-regression. This will give us a measure on how confident we can be on our model assumptions.

6 STUDY SETTING

Table 3 outlines the collaborating real-world services included in this meta-analysis. These are the interventions that agreed to participate at time of the grant application. Changes to staff and circumstances since then may mean that this is subject to change, with the possible addition of further services.

Table 3: Description of collaborating real-world services

Name	Estimated participants	Type	UK nation
NHS Ayrshire & Arran	700	NHS	Scotland
NHS Lanarkshire	2500	NHS	Scotland
NHS Lothian	1200	NHS	Scotland
NHS Greater Glasgow and Clyde	3000	NHS	Scotland
Aneurin Bevin UHB	3000	NHS	Wales
Lighten up, Birmingham	3000	Local Authority	England
Fit for Life, Brent	600	Local Authority	England
Thurrock Healthy Lifestyle Service	2000	Local Authority	England
Healthy Lifestyle, Gloucester	2000	Local Authority	England
Lifestyle ready, Leicester	2000	Local Authority	England
My Weight Matters, Essex	5000	Local Authority	England
Healthy weight Northumberland	600	Local Authority	England
One You, Tonbridge	500	Local Authority	England
Aspire Health, Wakefield	2500	Local Authority	England
North Yorkshire Weight Management	10000	Local Authority	England
Beezee Bodies	2000	Local Authority	England
West Sussex Wellbeing	800	Local Authority	England
ABL Nottinghamshire	1000	Local Authority	England
Healum	500	Commercial	England
Thrive Tribe	2370	Commercial	England
More Life	10000	Commercial	England
Low Carb Programme	80000	Commercial	UK-wide
Second Nature	20000	Commercial	UK-wide

7 SAMPLE AND RECRUITMENT

7.1 Eligibility Criteria

As this is a meta-analysis of data from existing real-world behavioural weight management interventions, eligibility criteria is applied to the intervention as a whole.

7.1.1 Inclusion criteria

Inclusion criteria (for weight management interventions):

- UK-based (primary care or community; online acceptable if developed as alternative to face to face community services)
- Complies with NICE guidance (multicomponent – diet, physical activity, behaviour change techniques, duration ≥3months/12 weeks, weigh-ins at least every 2 weeks, dietary targets)
- Intervention inclusion criteria: BMI ≥25 and age ≥18
- Data available for ≥500 participants
- Minimum 40% completion rate of the active weight loss sessions

7.1.2 Exclusion criteria

Exclusion criteria (for weight management interventions):

- Weight management interventions designed exclusively for diabetes, pre-diabetes, other specific single medical conditions only (i.e. one medical condition excluding all others), pregnancy, postpartum or families.

7.2 Identification of real-world services

Brief information was circulated to all weight management services in Scotland and England by PHE (via the regional hubs) and Health Scotland. In addition, the UK Association for the Study of Obesity emailed 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 Nov 2018. Interested providers then discussed participation with the research team and provided a letter stating their participation in principle.

7.2.1 Size of sample

Formal power calculations are not applicable to this type of analysis. The choice of included RCTs was based on the searched described above (section 7.2).

7.3.2 Consent

This study is using no identifiable information and analysis is taking place within an NHS data safe haven. Therefore, no individual consent is being sought from individuals included in the dataset.

8 ETHICAL AND REGULATORY CONSIDERATIONS

This is a meta-analysis of individual participant data from existing real-world services. There is no risk to the individual and the study fully complies with GDPR legislation. No personal information will be shared by the data controllers of the real-world services, with all the data being fully anonymised and age being in years rather than suppling date of birth (see table 1). The study is ensuring the highest levels of data governance are being applied by transferring all data from the RWSs to an NHS safe haven (eDRIS which is part of Public Health Scotland) via the NHS secure file transfer system, and then with analysis being conducted on Public Health Scotland servers with access via a secure virtual private network. eDRIS staff will control access to the data ensuring access only to those who have completed information governance training and have a legitimate role in the study. No data will be released to output (e.g. tables or figures) until it has been checked my eDRIS staff who will ensure no small subgroups which may lead in inadvertent disclosure and that the output is relevant to the approved research question.

8.1 Assessment and management of risk

This is a very low risk study. It uses pre-existing data with no transfer of personal data and consideration given for data governance (see section 8).

8.2 Research Ethics Committee (REC) and other Regulatory review & reports

Before the start of the study, a favourable opinion will be sought from Lancaster University Faculty of Health and Medicine's REC for the study protocol.

Substantial amendments that require review by the REC will not be implemented until that review is in place and other mechanisms are in place to implement at site. All correspondence with the REC will be retained.

The Chief Investigator's will produce the annual reports as required and notify the REC of the end of the study. An annual progress report (APR) will be submitted to the REC within 30 days of the anniversary date on which the favourable opinion was given, and annually until the study is declared ended. If the study is ended prematurely, the Chief Investigator will notify the REC, including the reasons for the premature termination. Within one year after the end of the study, the Chief Investigator will submit a final report with the results, including any publications/abstracts, to the REC.

Regulatory Review & Compliance

Before any existing RWS can transfer data into the study database, the Chief Investigator will ensure that appropriate approvals from participating organisations are in place. In the case of this study that means an appropriate contract with Public Health Scotland for the use of the eDRIS service, and data transfer agreements with the data controller for each RWS dataset. These contracts will be fully compliant with GDPR legislation.

For any amendment to the study, the Chief Investigator, in agreement with the sponsor, will submit information to the appropriate body in order for them to issue approval for the amendment. The Chief Investigator or designee will work with the sponsor so they can put the necessary arrangements in place to implement the amendment to confirm their support for the study as amended.

Amendments

If the sponsor wishes to make a substantial amendment to the REC application or the supporting documents, the sponsor must submit a valid notice of amendment to the REC for consideration. The REC will provide a response regarding the amendment within 35 days of receipt of the notice. It is the sponsor's responsibility to decide whether an amendment is substantial or non-substantial for the purposes of submission to the REC.

The amendment history will be tracked on the front page of the protocol.

8.3 Peer review

This project is funded by the National Institute of Health Research. It was reviewed over two stages by the Health Technology Assessment Evidence Synthesis Board, including three external peer-reviewers.

8.4 Patient & Public Involvement

Development of research:

10 members of the public with personal experience of weight management programmes were members of the expert group (10 out of a total 40 members) that developed the core outcome and instrument sets that make up the outcomes being studied in this project. This proposal was then developed with input from 4 PPI representatives who will continue to input throughout the project. Their specific expertise was used to develop the plans for PPI input during the project, identify training needs, and they also helped draft and edit the lay person summary.

Active involvement in the project:

We have 3 people (JP, MR, MO) with personal experience of weight management on the advisory committee, and one further individual, SJ, who is a co-investigator. Recruited via "People in Research", we have ensured a mix of weight management experience, geography and gender (50% female), with two experienced in PPI who will provide mentorship. An initial training day will provide study background and the role of a PPI rep. Roles will include a user perspective on which components may be important and advising on dissemination to the public. Towards the end of the project, specific populations groups that are harder to reach (e.g. BAME and 18-25 years olds from areas of high socioeconomic deprivation) will be consulted via established PPI groups (through existing links of Co-Is) to ensure that their views and needs are part of any implementation guidance.

All of our PPI members will be paid appropriately for their time. We have budgeted a rate of £225/full day meeting which will cover the full day plus meeting preparation (12 hours @£18.75/ hour). Our PPI co-I will attend a further 3 in person trial management meetings and will also receive £120 honoraria for each investigator meeting held via teleconference, including time for preparation and work between meetings (10 meetings throughout project). Together with the research team, they will help prepare a *final report on the impact of PPI on the project and its outcomes.*

8.5 Protocol compliance

Given the nature of this study, protocol deviations are unlikely. As data-processor, Public Health Scotland will only allow the export of results/ figure/table from their servers after these have been checked by a member of their staff that the output does not disclose sensitive information (including by

small sub-group size) and that the output is in keeping with the research questions and aims defined within this protocol.

In the unlikely event of any accidental protocol deviation, these will be documented and reported to the Chief Investigator and Sponsor immediately.

8.6 Data protection and patient confidentiality

This study complies fully with General Data Protection Regulation legislation. No personal data is processed during the project. The Data Controller is Lancaster University and each University partner than currently hosts the RCT data is considered a data processor. eDRIS (Public Health Scotland) is also considered a data processor on behalf of Lancaster University. All data management arrangements for this study have been reviewed by Michael Abbots, Information Governance Manager and Data Protection Officer, Lancaster University.

8.7 Indemnity

This study is covered under Lancaster University's insurance policy, covering harm to participants arising from the management of the research and harm to participants arising from the design of the research.

8.8 Access to the final study dataset

Access to the full final study dataset will be controlled by Public Health Scotland as data processor on behalf of Lancaster University. They will allow access to the dataset for named individuals (as part of the project team) who have completed appropriate information governance training. The dataset will be access virtually from the University of Glasgow and Lancaster University, and will remain on the servers of NHS ISD Scotland. Access will be restricted to the joint Chief Investigators, Olivia Wu and Jennifer Logue, and the 2 post-doctoral research associates employed to work on this study.

5 years after completion of the project the dataset will be deleted by Public Health Scotland (retention only to allow any reanalysis in relation to peer-reviewer comments on outputs). However, recognising the unique nature of this resource, each contributing weight management service will be asked to maintain a copy of the dataset as used in this study so we can request them easily in future funded and approved studies.

9 DISSEMINIATION POLICY

9.1 Dissemination policy

This protocol, and subsequent versions, will be published by the NIHR at fundingawards.nihr.ac.uk. The final report will be published in the NIHR Health Technology Assessment Journal (https://www.journalslibrary.nihr.ac.uk/hta). NIHR must be notified of all publications, press releases, and oral presentations at least 28 days beforehand. The funder must be acknowledged in all outputs as follows:

"This study/project is funded by the National Institute for Health Research (NIHR) [(HTA12953) Health Technology Assessment]. The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care."

The outputs of this work will cover academic outputs, as well as a toolkit for commissioners and providers. We will host a meeting in month 31 for all contributing intervention providers, triallists and

representatives from the 4 nations' public health bodies, to discuss the implementation of results and share best practice. We want this group to act as beacons of good practice, disseminating the results through their networks. With assistance from this group, we will develop a toolkit that can be shared to all commissioners and providers.

For wider dissemination, we will publish this work in scientific journals and present at conferences including the British Dietetic Association, UK and European Associations for the Study of Obesity. Between the investigators and advisors, we have representatives on many government committees, guidelines and professional organisations and we will utilise these links to disseminate the results further.

We anticipate that the results of this study will immediately be taken up in the commissioning of weight management programmes. Public Health England have direct representation on the study advisory group (Jamie Blackshaw, Obesity and Healthy Weight Lead, PHE) and this work will be incorporated in their commissioning guidance and disseminated directly to Directors of Public Health via PHE regional centre.

Our PPI members, working with the research team, will help produce both a summary of this work for members of the public. We will disseminate this via traditional and social media and utilise the expertise and networks of the European Council for People with Obesity and Obesity UK (a charity supporting people living with obesity in the UK).

9.2 Authorship eligibility guidelines and any intended use of professional writers

The final NIHR report and any published journal papers will be authored by several named authors "on behalf of the BE:COME investigators". This wider investigator grouping will include the grant investigators, study advisors and chief investigators of contributing trials. Criteria for named individual authorship will be based on the International Committee of Medical Journal Editors defined authorship criteria.

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FUNDED BY

NIHR | National Institute for Health Research

Lancaster University

FULL/LONG TITLE OF THE STUDY

BEhavioural Weight Management: COMponents of Effectiveness

SHORT STUDY TITLE / ACRONYM

BE:COME

PROTOCOL VERSION NUMBER AND DATE

Protocol version number	Date effective	Summary of changes
0.1	**05/02/2020**	
1.0	**09/09/2020**	
1.1	**26/10/2020**	**Gender/ sex added to table 2 "Dataset requested from participating RCTs"**

RESEARCH REFERENCE NUMBERS

FUNDERS Number:	NIHR12953
PROSPERO Registration:	CRD42020183949
FHM REC Number:	FHMREC20008

SIGNATURE PAGE

The undersigned confirm that the following protocol has been agreed and accepted and that the Chief Investigator agrees to conduct the study in compliance with the approved protocol and will adhere to the principles outlined in the Declaration of Helsinki, the Sponsor's SOPs, and other regulatory requirement.

I agree to ensure that the confidential information contained in this document will not be used for any other purpose other than the evaluation or conduct of the investigation without the prior written consent of the Sponsor

I also confirm that I will make the findings of the study publicly available through publication or other dissemination tools without any unnecessary delay and that an honest accurate and transparent account of the study will be given; and that any discrepancies from the study as planned in this protocol will be explained.

For and on behalf of the Study Sponsor:

Signature: Date:

..../...../.....

Name (please print):

.....

Position:

.....

Chief Investigator:

Signature: Date:

..../...../.....

Name: (please print):

.....

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KEY STUDY CONTACTS

Insert full details of the key study contacts including the following

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STUDY SUMMARY

Study Title	BEhavioural Weight Management: COMponents of Effectiveness
Internal ref. no. (or short title)	BE:COME
Study Design	Network meta-analysis using individual participant data
Study Participants	All participants (active and control arms) of 8 UK based randomised controlled trials of behavioural weight management.
Planned Size of Sample (if applicable)	N/A
Follow up duration (if applicable)	12 weeks
Planned Study Period	01/12/2020 to 31/07/2023 (32 months)
Research Question/Aim(s)	Primary aim: To determine which individual components of behavioural weight management programmes are associated with greater attendance, intervention completion, and weight loss. Secondary aims 1. To investigate if the individual components are more effective when delivered on their own or in combination 2. To determine if the effects of individual/ groups of components vary depending on the sex, age, BMI, ethnicity, or socioeconomic status of participants, including specific key sub-groups known to have poorer weight loss outcomes within currently published interventions

FUNDING AND SUPPORT IN KIND

FUNDER(S) (Names and contact details of ALL organisations providing funding and/or support in kind for this study)	**FINANCIAL AND NON FINANCIALSUPPORT GIVEN**
National Institute of Health Research	**£505,026.12**

ROLE OF STUDY SPONSOR AND FUNDER

This study is sponsored by Lancaster University. The sponsor has no role or control in in study design, conduct, data analysis and interpretation, manuscript writing, and dissemination of results.

This study is funded by the National Institute for Health Research. The funder has no influence over trial design, conduct, data analysis and interpretation, manuscript writing, and dissemination of results. The research team will send reports regarding the progress of the trial to the funder at agreed intervals.

ROLES AND RESPONSIBILITIES OF STUDY MANAGEMENT COMMITEES/GROUPS & INDIVIDUALS

There are two main groups involved in the running of this study. Both are independent of the sponsor and both are chaired by the Chief-Investigator. As this is evidence synthesis there is no regulatory or funder requirement for independent oversight. Public and patient involvement is embedded within both committees.

Study Management Group:

Responsible for delivery of all study aims and objectives including final and interim reports to funder, day-to-day study management.

Membership: Joint Chief Investigators (chair); all co-investigators (including PPI co-investigator); postdoctoral research associated employed on the project.

Study Advisory Group:

Responsible for advising the study management group on selection of components for analysis, analytical plans, data interpretation, dissemination and implementation.

Membership: Joint Chief Investigators (chair); all co-investigators (including PPI co-investigator); postdoctoral research associated employed on the project; study advisors (expertise from evidence synthesis, dietetics, sports science, behaviour change, psychology, local authority commissioning, public health and 3 PPI advisors).

Meeting frequency: Broadly the management group will meet bi-monthly throughout the project and the advisory group three times across the project (months 10,18, & 29).

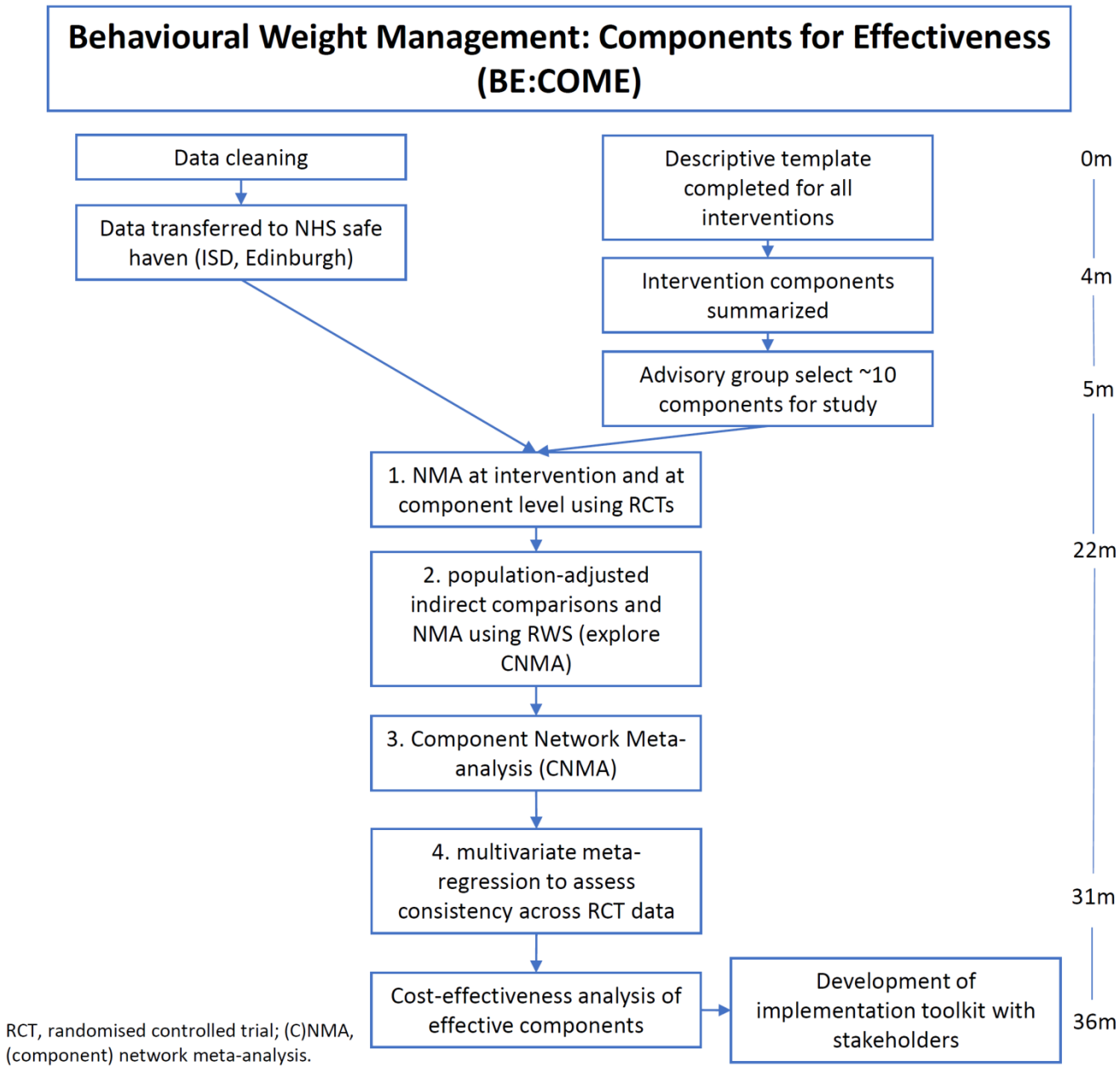
PROTOCOL CONTRIBUTORS

This protocol has been developed by the Jennifer Logue and Olivia Wu (Joint Chief Investigators), in conjunction with co-investigators Louisa Ells, Alison Avenell, Sharon Simpson, Ruth Mackenzie and Sandra Jayacodi (patient representative). Advice was taken from the study advisory group including 3 further patient representatives.

Neither the sponsor nor funder had a role in the development of this protocol.

KEY WORDS: Behaviour change; obesity; meta-analysis; randomised controlled trial.

STUDY FLOW CHART (Figure 1)



STUDY PROTOCOL

BEhavioural Weight Management: COMponents of Effectiveness

1 BACKGROUND

Behavioural weight management interventions (BWMIs) are the main funded interventions for obesity in the UK. Broadly these are 12-weekly group sessions focussed on diet, physical activity and behaviour change delivered in primary care/community; these are complex interventions. Described as tier 2 (after guided self-care and before medical or surgical interventions) they are commissioned by primary care or public health, often using commercial organisations for delivery. NICE guidance PH53[1] outlines core components for interventions, however a lack of evidence on effectiveness has meant that these are too broad to effectively assist intervention selection at a local level. NICE were unable to provide specific guidance due to i. lack of clear intervention descriptions in published studies (especially behaviour change techniques) and ii. variable outcome definitions. As a result, they were left with many evidence gaps including "*a lack of trials directly comparing lifestyle weight management programmes in the UK*" and "*a general lack of evidence on which specific components of a lifestyle weight management programme ensure effectiveness*" resulting in research recommendations to address this.

Tier 2 weight management provision has been mapped in England (by Public Health England [PHE][2]) and Scotland[3], both showing large variation in eligibility criteria, provision, length, referral pathway, staffing, setting and mode of delivery.

Very few UK real-world interventions have published evaluation data. PHE commissioned a systematic review in 2016 of published real-world evaluations alongside qualitative work[4,5] but results on the critical features of successful weight management interventions were very limited due to "the lack of detail in the description of intervention components" and little research on key service users such as ethnic minorities. Non-standardised data collection and reporting (e.g. total weight loss, number losing 5% weight) results in the same issues existing for real world services as for published trials; so far, comparison and meta-analysis has been impossible. Commissioners have raised lack of evidence as to what works and lack of clarity of service specifications as a major barrier to commissioning of these vital services[2].

In 2018 we developed a core outcome and instrument set (by consensus) and 119-item intervention description template for use by real-world and research BWMIs, to standardise outcome reporting and intervention description[6] (submitted papers attached).

Current and ongoing research

The current evidence base from randomised trials is limited, poorly reported[7], and often irrelevant to practice[2]. A full systematic review was commissioned by NICE in 2014 resulting in the current guidance[1] and documented evidence gaps. We updated this up to 30/09/17 as part of our core outcome set development[8] identifying a further 16 studies, but no new direct comparisons of interventions. Borek et al[9] published a systematic review of group-based diet and physical activity weight-loss interventions (until 05/2017) and concluded that poor reporting of intervention content limited their ability to accurately discriminate between interventions. A PROSPERO search on 05/05/2019 (WEIGHT AND ADULT AND COMPONENT*) yielded 255 reviews (40 completed) but the majority focus on a single intervention component or are restricted to specific subgroups of the population or conditions (e.g. pregnancy,

chronic kidney disease). Those looking at BWMIs are restricted to pairwise comparisons with no attempt at identifying effective components.

We are conducting a network meta-analysis using data from randomised trials of behavioural weight management interventions conducted in the past 10 years. We will look for differences in the content of the interventions and how they were delivered and use these differences to analyse what elements of an intervention makes it effective, including for specific subgroups of the population.

2 RATIONALE

Prevention is a major part of the health agenda in a country where 27% of adults have obesity (body mass index [BMI] ≥30kg/m^2), with higher prevalence in areas of socioeconomic deprivation[10]. Effective weight management interventions resulting in ≥5% weight loss have significant positive effects on many obesity-related co-morbidities, including cardiovascular and diabetes risk, mobility, non-alcoholic fatty liver disease and polycystic ovarian syndrome[11]. While upstream obesity prevention approaches are paramount, there must be treatment services for those already affected to reduce future healthcare costs. This is clear in the NHS long-term plan[12] which pledges *"targeted access to weight management services in primary care ...where we know we can have a significant impact on improving health, reducing health inequalities and reducing costs"*. To do this there will need to be an expansion in the provision of those interventions most likely to be effective.

We have already established a collaboration of 8 trialists with RCTs, all promising individual participant data and intervention descriptions to allow standardised intervention-level outcome data to be generated. This will facilitate a network meta-analysis (NMA) approach to identify and evaluate effective components that are proven feasible in a real-world setting. We have included online interventions, a mode of delivery that is rapidly expanding, though most components are similar to in-person modes of delivery.

We believe the use of novel approaches to evidence synthesis of complex interventions is the most efficient way to generate new knowledge in this area, directly answer NICE research recommendations and assist commissioners. Given the complexity and (often necessary) variation of these interventions, undertaking head-to-head RCTs alone would be costly, time consuming and of limited usefulness. Knowing that the entirety of programme X is effective in one area (or on average across a few areas) is unhelpful if it is impossible to implement that programme in a different area due to contextual factors such as geography and demographics; improvements can be made across the country if we know what it is about programme X that makes it effective. The epidemic levels of obesity in the UK, which results in numerous debilitating and costly health conditions mean that we rapidly need better evidence for effective interventions; weight management is currently being commissioned in the dark.

Behavioural weight management interventions: summary of main issues

Importance of behavioural weight management services in the UK	In the UK 27% of adults have obesity and a further 34% have a BMI in the overweight range. 5% weight loss has significant effects on obesity related comorbid conditions such as diabetes, cardiovascular disease and non-alcoholic fatty liver disease. Increasing access to adult community weight management services is explicitly mentioned in the 2019 NHS long term plan.
Variation in service provision across the UK	Current services across the UK vary considerably, including by: eligibility criteria, provision, length, referral pathway, staffing, setting, mode of delivery, dietary, physical activity and behavioural components
Issues with the current evidence base	Major limitations of the current published evidence that have been raised by large NICE and PHE funded systematic reviews include: ● lack of detailed intervention descriptions ● lack of standardised outcome measures ● lack of published studies that reflect the type of services commissioned in the UK
Current NICE guidance	Due to the poor evidence base, current NICE guidance (PH53) covers only a fraction of the variable components of a weight management intervention.
Guidance for commissioners	Commissioners have specifically raised the lack of evidence as to what works and lack of clarity of service specifications as a major barrier to commissioning of these vital services leading to the current situation of variable funding and provision across the UK.
Specific NICE PH53 research recommendations	*"How effective are lifestyle weight management programmes available in the UK, when directly compared using high-quality trials? In particular, what effect do specific components of a multicomponent lifestyle weight management programme have on adherence, effectiveness and cost effectiveness? This includes:* *components, or combinations of components, that support weight loss or the prevention of weight regain; the effect of programme length, intensity, setting and means of delivery (examples of the latter include group, individual and remote support); specific behaviour change techniques (using a recognised taxonomy); the effect of new technologies; the effect*

	of additional support services, such as self-help groups and networks"
Need for novel approaches to evidence synthesis	BWMIs are very complex interventions consisting of >100 components parts. Given this complexity, head to head RCTs alone would be too costly, time consuming and of limited usefulness to identify effective intervention components. Variation in contextual factors such as geography and demographics make the generalisability of RCT findings difficult across the UK. **Novel approaches to evidence synthesis of complex interventions are the most efficient way to generate new knowledge in this area, directly answer NICE research recommendations and assist commissioners.**

Using individual participant data from 8 UK-based randomised controlled trials of behavioural weight management interventions, we will conduct a series of network meta-analyses (including component network meta-analysis) to investigate the relative effectiveness of components of behavioural weight management interventions for weight loss outcomes.

3 THEORETICAL FRAMEWORK

The overall design of this study follows the guidance set out by the NICE Decision Support Unit (DSU)[13,14] on the selection of methods for estimating comparative effectiveness, in the context of complex data structure. Within the indirect comparison framework, we propose to conduct anchored indirect comparison of RCT data - network meta-analysis and component network meta-analysis

4 RESEARCH QUESTION/ AIM(S)

Primary aim:

- To determine which individual components of behavioural weight management programmes are associated with greater attendance, intervention completion, and weight loss.

Secondary aims:

- To investigate if the individual components are more effective when delivered on their own or in combination
- To determine if the effects of individual/ groups of components vary depending on the sex, age, BMI, ethnicity or socioeconomic status of participants, including specific key sub-groups known to have poorer weight loss outcomes within currently published interventions

4.1 Objectives

6. To map individual components of behavioural weight management interventions used in pragmatic clinical trials
7. To gain research access to individual participant data from 8 UK-based randomised controlled trials of behavioural weight management interventions
8. To conduct a series of network meta-analyses at the level of the intervention for randomised controlled trials
9. To conduct component network meta-analysis to investigate the relative effectiveness of components of behavioural weight management interventions for weight loss outcomes

4.2 Outcomes

Our core outcome and instrument set (ref) (COMET registration 1056) will be applied to the data set of each intervention. The proposed outcomes definitions (table 1) were all agreed by expert consensus (including PPI) during our core outcomes and instrument set development.

All outcomes are measured at 12 weeks/ 3 months

Weight loss outcomes will be reported with the last observation carried forward (LOCF) and baseline observation carried forward (BOCF) when a 12-week weight is not recorded. For outcomes involving only those defined as completing the intervention (80% of core sessions) LOCF only will be used.

Table 1: Outcome definitions to be used in BE:COME

Primary outcome	Mean change weight in kg change for all participants attending >1 active weight loss session (LOCF & BOCF)
Secondary outcomes	mean % weight change (LOCF & BOCF)
	% achieving >= 5% (all participants attending >1 active weight loss session) (LOCF & BOCF)
	% achieving >= 10% weight loss (all participants attending >1 active weight loss session) (LOCF & BOCF)
	Mean change in weight in kg for all participants completing the programme [80% of core sessions*] (LOCF)
	Mean change in weight in kg for all participants completing the programme [80% of core sessions*] (LOCF)
	% achieving >= 5% (all participants completing the programme [80% of core sessions*]) (LOCF)
	% achieving >= 10% weight loss (all participants completing the programme [80% of core sessions*]) (LOCF)
	Attendance (mean n of weeks attended during core sessions)
	Completion (% of participants who attended at 80% of core sessions*) from total attending at least 1 active weight loss session. *defined as having a weight recorded on or after 80% of the total core intervention duration has elapsed

5 STUDY DESIGN, METHODS OF DATA COLLECTION AND DATA ANALYSIS

5.1 Data collection

Intervention description: We have developed a 119-item standardised intervention description template. This consists of 4 sections – referral pathway, intervention delivery, intervention components (dietary, physical activity, and behaviour change techniques), and costs of the intervention (fixed overheads and per-person). A template will be completed for each BWMI. For RCTs this will be completed by the research team using intervention manuals supplied by the trial investigators, and then forwarded the trial team for clarification and further input. For each RCT the intervention-coding will be performed by two team members with a third deciding in the event of disagreement.

The dataset required from participating interventions is outlined in table 2.

Data handling: All data from interventions will be transferred by secure file transfer to NHS Information Service Division (ISD) in Edinburgh who will act as a data safe haven. Analysis will be conducted on their server, accessed via a VPN.

Anonymisation of results: No participant identifiable information will be used at any time. Each intervention will be given a unique site ID and the data-analyst will be blinded to which intervention is which. The advisory group and majority of co-investigators will only see results by study ID, with JL and the Lancaster post-doctoral research associate the only team members who will have the ability to unblind the results. Full blinding by a third party was considered, but as the Lancaster team will have mapped each intervention and coded the components, genuine blinding is impossible.

Data sharing agreements: A data sharing agreement will be signed for each dataset. This will cover the anonymisation of the data, the return of results to each individual intervention and that no programme will be identifiable within any publication.

Table 2. Dataset required from participating interventions (RCTs)

Data item	Instructions
Individual unique ID	Site ID (xx) followed by 5-digit consecutive number (yyyyy) in format xxyyyyy
Age	At referral/ start of programme Years to 1 decimal place
Gender	Gender at start of programme (or sex depending on available data) coded as Male/ Female/ Other
Height	metres to 2 decimal places
Deprivation	By Lower Layer Super Output Area derived from postcode; SIMD in Scotland
Ethnicity	2011 UK Census categories
Weight at first active weight loss session	kg to 1 decimal place code as WNR if unavailable
Date of attendance at first active weight loss session where weight was measured	Code as DNA if did not attend
Weight at final attendance at an active weight loss session	kg to 1 decimal place Code as WNR if unavailable
Date of final attendance at active weight loss session where weight was recorded	Code as DNA if did not attend any sessions Will equal start date if only attended 1 session
Only for interventions where duration is >3months	
Weight at active weight loss session closest to maximum of 12 weeks after starting the intervention	kg to 1 decimal place Code as WNR if unavailable
Date of attendance at active weight loss session closest to maximum of 12 weeks after starting the intervention	Code as DNA12 if did not attend any sessions
SIMD (Scottish Index of Multiple Deprivation); WNR (weight not recorded); DNA (did not attend)	

5.2 Quality assessment and issues with data management

RCTs will be assessed for Risk of Bias using the Cochrane Tool. The use of IPD makes much of the bias assessment less relevant, and blinding of participants, personnel and outcomes assessment is generally not possible in behavioural weight management interventions. We shall therefore assess for selection bias related to randomisation. Only trials deemed low risk of selection bias will be included.

Our initial assessment of the 8 collaborating trials is that they all fulfil this criterion. Some of the trials have used self-reported weight at 12 weeks when the participant is not able or willing to attend; this is complicated as the self-reported weight can be incorrect (usually with greater weight loss) but removing these participants would bias the sample towards only having participants that felt confident enough in their weight loss to return to see the research team. To manage with this, **we will conduct sensitivity analysis excluding participants with self-reported 12-week weight data from the analysis**.

The rates of completion of behavioural weight management programmes can vary considerably between interventions. PHE key performance indicators (KPIs)[15] suggest that 60% of participants should complete the active intervention (though they do not define completion). As completion and effectiveness are intertwined, many do not achieve 60% and completion (attending 80% of active sessions with a weight recorded) is an outcome measure of our study. Many of our included interventions predate these 2017 KPIs. The collaborating RCTs all appear to have a published completion rate >60% but the definition used varies in the percent of sessions attended (often >50%). As research studies, the RCTs will have weight recorded for all participants including those who no longer wish to attend the intervention, and therefore we have set an inclusion criterion of **60% of RCT participants having a weight recorded at 12 weeks**.

5.3 Selection of components and covariates for analysis

To start, all interventions will complete our 119-item standardised BWMI reporting template. The template information will be summarised on a single spreadsheet document allowing variation across the participating interventions to be visualised.

The expert advisory group will decide on ~10 components and covariates (with components being part of the direct intervention and covariates related to the process of delivering the intervention) that vary based on the which vary across the interventions and are hypothesised to be of importance for effectiveness, considering NICE research recommendations[1] and building on previous work[4]. While these will be the choice of the advisory group, they are likely to cover the following areas (*covariates in italics*):

- Dietary advice (including calorie restriction and macronutrient composition)
- Physical activity (advice only vs supervised)
- Behaviour change techniques (specific techniques and dose)
- Tailoring of the intervention
- *Mode of delivery (including online and apps)*
- *Intensity (hours)*
- *Staff qualifications/ training*
- *Mode of referral*
- *Time from referral to first active session*
- *Locality (mean distance to venue)*

5.4 Subgroup analyses

Specific subgroups will be defined by the advisory group to include analyses by BMI, age, sex, socioeconomic status and ethnicity, and intervention context factors such as rurality. This will include specific key sub-groups known to have poorer weight loss outcomes within currently published interventions (e.g. younger women with severe obesity from areas of high socioeconomic deprivation). This will allow specific recommendations to be made for the design of BWMIs for these key sub-groups.

Other independent covariates with the potential to vary effectiveness will be added to the models.

5.5 Drop-outs and missing data

Drop-out 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. We will exclude any participants who do not have data for age and height from all analyses. We will exclude participants without deprivation or ethnicity data from the relevant subgroup analyses. We will assume that lack of a recorded weight means 'did not attend' and only count sessions with recorded weights as attended.

5.6 Evidence synthesis

We will conduct NMA at intervention and component levels using data from the RCTs. At the intervention level, we will estimate the relative effectiveness of all interventions on primary and secondary outcomes (where data permit), using direct and indirect evidence. We will adopt an anchored indirect comparison approach that requires any two treatments to have a common comparator, or a link through a chain of comparisons. In the context of the 8 RCTs that will be included in the analysis, we will group interventions where appropriate and construct the network of evidence accordingly; all assumptions will be tested in the sensitivity analysis. For instance, all the RCTs included a control arm that consist of usual care – typically some form of brief intervention. We will explore different network structures – one that uses the control arms of the RCTs as the common comparator, and another that split usual care into different distinct interventions (e.g. booklet versus brief advice from health professionals).

We will conduct a one-stage model[16] within a Bayesian framework – a hierarchical structure that allows the IPD to be pooled in one step while accounting for clustering of data within each trial. We will use minimally informative priors (this will be tested in sensitivity analysis since it has been suggested that in some circumstances, results may be sensitive to the chosen priors[17]). We will report the median of the posterior distribution along with 95% credible intervals. Interventions will be ranked to provide probabilities of each intervention being considered the best in the primary and secondary outcomes.

The validity of an NMA depends on a number of assumptions including transitivity and consistency of findings. Transitivity means that there is no effect modification of the intervention effects or that the prevalence of effect modifiers is similar in the different studies[18]. A clinical and epidemiological judgement of the plausibility of this assumption requires an assessment of the eligibility criteria of every trial in the network, to assess whether the trial protocols, participants, and interventions delivered etc. are similar in ways that might modify treatment effect. We have identified potentially important characteristics we consider likely to modify treatment effect (section 6.2 above) and will consult further with our advisory group. We will conduct meta-regression to account for these potential differences. Another assumption required to ensure the validity of the findings is consistency in networks of evidence (i.e. 'closed loops' of evidence). Inconsistency occurs when there is a discrepancy between a direct and indirect estimate of treatment effect and, therefore, a violation of the consistency assumption. To assess

consistency, we will visually inspect the network diagram and use model fit and selection statistics to assess whether discrepancies between direct and indirect evidence are evident.

A component-level approach is useful to disentangle the 'active ingredients' of a complex intervention. In the component network meta-analysis (CNMA), the effect of each intervention will be dismantled through modelling of component-specific effects. For instance, dietary advice, physical activity, and behavioural change techniques may be considered as individual components. In the CNMA, the effect of each intervention will be dismantled through modelling of component-specific effects. We will adapt the methodology of Welton[19] and Freeman[20] and develop three models:

(i) additive effects model (assuming no interaction between components) in which each component has a separate effect and the total effect for each intervention is equal to the sum of the parts;

(ii) extended additive effects model (two-factor interaction model) that allows pairs of components to have bigger or smaller effect than the sum of their individual parts; and

(iii) standard NMA model (saturated CNMA model) with every possible combination of components considered to be a distinct intervention with its own effect.

We will use a multivariate meta-regression approach to assess consistency across the body of evidence[21]. This approach generates consistency and inconsistency models as multivariate random-effects meta-regression. This will give us a measure on how confident we can be on our model assumptions.

For any components identified as effective, we will work with our collaborating providers and advisory group to define the cost implications of implementation. We will use the PHE Weight Management Economic Assessment Tool[22] (as per the core outcome and instrument set) to assess the cost effectiveness of the addition of the component(s) (having obtained intervention costs for each programme at the start of the project). The tool is essentially an excel-based calculator and has the capability to provide economic assessment from several perspectives, including that of the NHS and personal social services. Based on a reduction of BMI over time as a result of an intervention, the tool estimates the reduced incidence of type 2 diabetes, coronary heart disease, stroke, colorectal cancer, and breast cancer in that population. The associated change in healthcare costs is also estimated and compared with the cost of the intervention. Further, the tool also estimates cumulative QALYs gained due to this reduction in BMI. Cost-effectiveness is expressed as incremental costs per QALY gained to determine whether the intervention is cost-effective against the NICE £20,000 threshold.

A full data-analysis protocol will be developed in month 10 of the study once the **components and covariates for analysis have been selected.**

6 STUDY SETTING

Table 3 outlines the randomised trials included in this meta-analysis:

Table 3: Description of included randomised controlled trials

Trial title	Year completed	Number of participants	Setting	Participants	Intervention	Primary outcome
Lighten up	2010	740	Primary care, Birmingham, UK	Age ≥ 18; BMI ≥ 25 + at least 1 comorbid condition OR BMI ≥ 30	7 different 12-week BWMIs (mainly group-based or 1:1)	Mean weight change at 12 weeks
Football Fans in Training	2012	747	Professional football clubs in Scotland, UK	Male only, age 35-65, BMI ≥ 28	12-weeks BWMI in group setting vs waiting list control	Mean weight change at 12 months
Be WELL	2013	329	Bowel Cancer Screening programme from 4 Scottish NHS Health Boards, UK	Colorectal adenoma (non-cancer) found through screening programme (eligible age 50-74), BMI ≥ 25	12-month 1:1 BWMI delivered face to face and via telephone vs usual care control	Mean weight change at 12 months
Act WELL	2020	552	Breast Cancer Screening programme from 4 Scottish NHS Health Boards, UK	No active cancer (screening detected or other); eligible for screening - age 50-70 and female only; BMI ≥ 25	12-month 1:1 BWMI delivered face to face and via telephone vs usual care control	Mean weight change at 12 months Mean change in physical activity (co-primary outcome)
POWER +	2015	818	Primary care, Southampton and Oxford, UK.	Age ≥ 18, BMI ≥ 28 + at least 1	6-month Web-based BWMI + 7 face to face sessions vs	Mean weight change at 12 months

				additional risk factor OR BMI ≥ 30	Web-based + 7 online/ phone support session vs brief web-based advice	
WRAP	2015	1267	Primary care, England, UK	Age ≥ 18; BMI ≥ 28	12 vs 52 weeks of group BWMI	Mean weight change at 12 months
CAMWELL	2011	381	Primary care, London, UK	Age ≥ 18; BMI ≥ 25	12-month BWMI delivered over 14 face to face 1:1 sessions by advisors in primary care vs usual care	Mean weight change at 12 months
SWAP	2015	330	Primary care, London, UK	Age ≥ 18, BMI ≥ 28 + at least 1 additional risk factor OR BMI ≥ 30. Maximum BMI 45.	8-weekly group BMWI sessions delivered face to face vs 4 1:1 short sessions with practice nurse over 8 weeks.	Mean weight change at 12 months

7 SAMPLE AND RECRUITMENT

7.1 Eligibility Criteria

As this is a meta-analysis of data from existing randomised trials, eligibility criteria is applied to the trial as a whole.

7.1.1 Inclusion criteria

Inclusion criteria (for weight management interventions):

- UK-based (primary care or community; online acceptable if developed as alternative to face to face community services)
- Complies with NICE guidance (multicomponent – diet, physical activity, behaviour change techniques, duration ≥3months/12 weeks, weigh-ins at least every 2 weeks, dietary targets)
- Intervention inclusion criteria: BMI ≥25 and age ≥18
- Minimum 40% completion rate of the active weight loss sessions
- Minimum 60% 12-week weight recorded
- Completion in the past 10 years

7.1.2 Exclusion criteria

Exclusion criteria (for weight management interventions):

- Weight management interventions designed exclusively for diabetes, pre-diabetes, other specific single medical conditions only (i.e. one medical condition excluding all others), pregnancy, postpartum or families.

7.2 Identification of randomised controlled trials

Collaborating RCTs were identified through searches of ISRCTN, Clinicaltrials.gov and clinicaltrialsregister.eu by searching broadly using “weight” OR “obesity”. Criteria were UK-based, community/primary care/online interventions similar to those commissioned by public health, completed in the past 10 years. 8 RCTs[23–30] were identified and all agreed to collaborate.

7.2.1 Size of sample

Formal power calculations are not applicable to this type of analysis. The choice of included RCTs was based on the searched described above (section 7.2).

7.3.2 Consent

All 8 trials had fully informed consent from each participant. Table 3 outlines the primary outcome of the trials to which the participant was consenting. In all cases the primary outcomes weight loss at either 12 weeks or 12 months and therefore in keeping with the aim of this analysis.

8 ETHICAL AND REGULATORY CONSIDERATIONS

Aim: To explain how the research question/aim(s) and design/methods fit into the ethical and regulatory framework. A clear explanation of the risk and benefits to the participants should be included as well as addressing any specific needs/considerations of the sample. State how the data collection methods used uphold the dignity of the participants.

The protocol should also include a justification of how the protocol is in line with relevant legislation or requirements to gain approval to conduct the study at the proposed sites.

This is a meta-analysis of individual participant data from existing randomised controlled trials and the primary outcomes is the same as that of the original RCT. There is no risk to the individual and the study fully complies with GDPR legislation. No personal information will be shared by the data controllers of the original RCTs, with all the data being fully anonymised and age being in years rather than suppling date of birth (see table 1). The study is ensuring the highest levels of data governance are being applied by transferring all data from the RCTs to an NHS safe haven (eDRIS which is part of Public Health Scotland) via the NHS secure file transfer system, and then with analysis being conducted on Public Health Scotland servers with access via a secure virtual private network. eDRIS staff will control access to the data ensuring access only to those who have completed information governance training and have a legitimate role in the study. No data will be released to output (e.g. tables or figures) until it has been checked my eDRIS staff who will ensure no small subgroups which may lead in inadvertent disclosure and that the output is relevant to the approved research question.

8.1 Assessment and management of risk

This is a very low risk study. It uses pre-existing data with no transfer of personal data and consideration given for data governance (see section 8).

8.2 Research Ethics Committee (REC) and other Regulatory review & reports

Before the start of the study, a favourable opinion will be sought from Lancaster University Faculty of Health and Medicine's REC for the study protocol, including the existing informed consent forms.

Substantial amendments that require review by the REC will not be implemented until that review is in place and other mechanisms are in place to implement at site. All correspondence with the REC will be retained.

The Chief Investigator's will produce the annual reports as required and notify the REC of the end of the study. An annual progress report (APR) will be submitted to the REC within 30 days of the anniversary date on which the favourable opinion was given, and annually until the study is declared ended. If the study is ended prematurely, the Chief Investigator will notify the REC, including the reasons for the premature termination. Within one year after the end of the study, the Chief Investigator will submit a final report with the results, including any publications/abstracts, to the REC.

Regulatory Review & Compliance

Before any existing RCT can transfer data into the study database, the Chief Investigator will ensure that appropriate approvals from participating organisations are in place. In the case of this study that means an appropriate contract with Public Health Scotland for the use of the eDRIS service, and data transfer agreements with the data controller for each RCT dataset. These contracts will be fully compliant with GDPR legislation.

For any amendment to the study, the Chief Investigator, in agreement with the sponsor, will submit information to the appropriate body in order for them to issue approval for the amendment. The Chief Investigator or designee will work with the sponsor so they can put the necessary arrangements in place to implement the amendment to confirm their support for the study as amended.

Amendments

If the sponsor wishes to make a substantial amendment to the REC application or the supporting documents, the sponsor must submit a valid notice of amendment to the REC for consideration. The REC will provide a response regarding the amendment within 35 days of receipt of the notice. It is the sponsor's responsibility to decide whether an amendment is substantial or non-substantial for the purposes of submission to the REC.

The amendment history will be tracked on the front page of the protocol.

8.3 Peer review

This project is funded by the National Institute of Health Research. It was reviewed over two stages by the Health Technology Assessment Evidence Synthesis Board, including three external peer-reviewers.

8.4 Patient & Public Involvement

Development of research:

10 members of the public with personal experience of weight management programmes were members of the expert group (10 out of a total 40 members) that developed the core outcome and instrument sets that make up the outcomes being studied in this project. This proposal was then developed with input from 4 PPI representatives who will continue to input throughout the project. Their specific expertise was used to develop the plans for PPI input during the project, identify training needs, and they also helped draft and edit the lay person summary.

Active involvement in the project:

We have 3 people (JP, MR, MO) with personal experience of weight management on the advisory committee, and one further individual, SJ, who is a co-investigator. Recruited via "People in Research", we have ensured a mix of weight management experience, geography and gender (50% female), with two experienced in PPI who will provide mentorship. An initial training day will provide study background and the role of a PPI rep. Roles will include a user perspective on which components may be important and advising on dissemination to the public. Towards the end of the project, specific populations groups that are harder to reach (e.g. BAME and 18-25 years olds from areas of high socioeconomic deprivation) will be consulted via established PPI groups (through existing links of Co-Is) to ensure that their views and needs are part of any implementation guidance.

All of our PPI members will be paid appropriately for their time. We have budgeted a rate of £225/full day meeting which will cover the full day plus meeting preparation (12 hours @£18.75/ hour). Our PPI co-I will attend a further 3 in person trial management meetings and will also receive £120 honoraria for each investigator meeting held via teleconference, including time for preparation and work between meetings (10 meetings throughout project). Together with the research team, they will help prepare a *final report on the impact of PPI on the project and its outcomes.*

8.5 Protocol compliance

Given the nature of this study, protocol deviations are unlikely. As data-processor, Public Health Scotland will only allow the export of results/ figure/table from their servers after these have been checked by a member of their staff that the output does not disclose sensitive information (including by small sub-group size) and that the output is in keeping with the research questions and aims defined within this protocol.

In the unlikely event of any accidental protocol deviation, these will be documented and reported to the Chief Investigator and Sponsor immediately.

8.6 Data protection and patient confidentiality

This study complies fully with General Data Protection Regulation legislation. No personal data is processed during the project. The Data Controller is Lancaster University and each University partner than currently hosts the RCT data is considered a data processor. eDRIS (Public Health Scotland) is also considered a data processor on behalf of Lancaster University. All data management arrangements for this study have been reviewed by Michael Abbots, Information Governance Manager and Data Protection Officer, Lancaster University.

8.7 Indemnity

This study is covered under Lancaster University's insurance policy, covering harm to participants arising from the management of the research and harm to participants arising from the design of the research.

8.8 Access to the final study dataset

Access to the full final study dataset will be controlled by Public Health Scotland as data processor on behalf of Lancaster University. They will allow access to the dataset for named individuals (as part of the project team) who have completed appropriate information governance training. The dataset will be access virtually from the University of Glasgow and Lancaster University, and will remain on the servers of NHS ISD Scotland. Access will be restricted to the joint Chief Investigators, Olivia Wu and Jennifer Logue, and the 2 post-doctoral research associates employed to work on this study.

5 years after completion of the project the dataset will be deleted by Public Health Scotland (retention only to allow any reanalysis in relation to peer-reviewer comments on outputs). However, recognising the unique nature of this resource, each contributing trial will be asked to maintain a copy of the dataset as used in this study so we can request them easily in future funded and approved studies.

9 DISSEMINIATION POLICY

9.1 Dissemination policy

This protocol, and subsequent versions, will be published by the NIHR at fundingawards.nihr.ac.uk. The final report will be published in the NIHR Health Technology Assessment Journal (https://www.journalslibrary.nihr.ac.uk/hta). NIHR must be notified of all publications, press releases, and oral presentations at least 28 days beforehand. The funder must be acknowledged in all outputs as follows:

"This study/project is funded by the National Institute for Health Research (NIHR) [(HTA12953) Health Technology Assessment]. The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care."

The outputs of this work will cover academic outputs, as well as a toolkit for commissioners and providers. We will host a meeting in month 31 for all contributing intervention providers, triallists and representatives from the 4 nations' public health bodies, to discuss the implementation of results and share best practice. We want this group to act as beacons of good practice, disseminating the results through their networks. With assistance from this group, we will develop a toolkit that can be shared to all commissioners and providers.

For wider dissemination, we will publish this work in scientific journals and present at conferences including the British Dietetic Association, UK and European Associations for the Study of Obesity. Between the investigators and advisors, we have representatives on many government committees, guidelines and professional organisations and we will utilise these links to disseminate the results further.

We anticipate that the results of this study will immediately be taken up in the commissioning of weight management programmes. Public Health England have direct representation on the study advisory group (Jamie Blackshaw, Obesity and Healthy Weight Lead, PHE) and this work will be incorporated in their commissioning guidance and disseminated directly to Directors of Public Health via PHE regional centre.

Our PPI members, working with the research team, will help produce both a summary of this work for members of the public. We will disseminate this via traditional and social media and utilise the expertise and networks of the European Council for People with Obesity and Obesity UK (a charity supporting people living with obesity in the UK).

9.3 Authorship eligibility guidelines and any intended use of professional writers

The final NIHR report and any published journal papers will be authored by several named authors "on behalf of the BE:COME investigators". This wider investigator grouping will include the grant investigators, study advisors and chief investigators of contributing trials. Criteria for named individual authorship will be based on the International Committee of Medical Journal Editors defined authorship criteria.

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