

Report on Literature Review of Dietary Counselling for Weight Loss Interventions to Inform Updated BODE³ Modelling

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Abstract

The aim of this report is to describe the research work undertaken to explore the topic of dietary counselling for weight loss, and to identify useful options for comparative health economic modelling of one or more dietary counselling interventions.

In Section A, we explore the existing primary research on controlled trials of dietary counselling for weight loss. We were interested in the full spectrum of expressions and versions of dietary counselling for weight loss. Following a systematic search of five journal databases, we identified a high number of studies that met our inclusion and exclusion criteria: 215 studies published after the year 2005. The majority of studies used an RCT study design and a setting that could approximate to a primary care setting was the most common. For half of the studies, the study populations were generally healthy with high BMI or were not recruited specifically because they experienced a certain disease. More than two-thirds of the studies had an intervention focused on achieving weight loss. We found that a substantial challenge in understanding which characteristics of dietary counselling for weight loss increase the effectiveness of this intervention is the breadth and variation of literature on this topic. It is evident that dietary counselling for weight loss is complex, nuanced, and highly variable.

In Section B, we explore the extent to which dietary counselling for weight loss had been explored in existing reviews and meta-analyses. Through searching journal databases, we found 63 reviews that were relevant to dietary counselling for weight loss. The majority were meta-analyses. We concluded that there has been extensive work conducted by other researchers to review and synthesise studies of relevance to dietary counselling for weight loss. The number and diversity of reviews demonstrates how varied dietary counselling for weight loss interventions can be.

In Section C, we examine three different approaches that could be taken to identify dietary counselling weight loss interventions for health economic modelling by the BODE³ Programme. The aims of the health economic modelling will be to compare different variations of dietary counselling for weight loss to determine the most effective, cost-effective, and inequalities-reducing version of this type of intervention. We use the work from Section A and Section B to present three options for obtaining effect sizes for different types of dietary counselling for weight loss: (1) modelling one or more published intervention study that was conducted in New Zealand or a similar context; (2) conducting a novel meta-analysis of controlled trials on dietary counselling for weight loss, including extensive heterogeneity analysis to compare different versions of dietary counselling for weight loss; and (3) modelling using existing meta-analyses that present different types of dietary counselling for weight loss. None of the six intervention studies conducted in NZ aligned closely with BODE³ modelling objectives. Conducting a novel meta-analysis of identified studies would be a substantial undertaking, necessitating first that the scope of potential studies for inclusion be narrowed. The final option of using existing published meta-analyses is the most recommended option for BODE³'s health economic modelling purposes.

The final conclusion and recommendation from this report is that there are suitable existing meta-analyses that would permit a comparison of different types of dietary counselling for weight loss. Among these options, LeBlanc and colleagues' review is recent, highly comprehensive, and closely

aligns with the desired modelling scope and objectives. For examining weight loss interventions delivered via apps, the Schippers et al study from 2017 has the best scope and design for modelling objectives.

Introduction

The aim of this report is to describe the research work undertaken to explore the topic of dietary counselling for weight loss, and to identify useful options for comparative health economic modelling of one or more dietary counselling interventions. We are particularly interested in ways to compare different variations of dietary counselling for weight loss according to intervention characteristics such as intensity, mode of delivery, and provider. To do this, we take three approaches within this report. First, we explore the existing primary research on controlled trials of dietary counselling for weight loss (Section A). Next, we explore the extent to which this topic has been investigated in existing reviews and meta-analyses (Section B). Lastly, we identify future work options for health economic modelling of dietary counselling for weight loss within the BODE³ programme (Section C). We conclude Section C with some final recommendations.

Section A: Existing primary research on controlled trials

INTRODUCTION

Our examination of the existing primary research on dietary counselling for weight loss was instigated by an expressed need from key stakeholders for greater understanding of this intervention and what features of this type of intervention contributed to greater or lesser effectiveness in weight loss (eg, the intensity of the intervention, the mode of delivery, provider, and setting). Additionally, there was a desire to identify how this topic had been previously explored in research and what could this collective body of research do to enhance their understanding of this topic. In the earliest planning stages of this project, there was an expectation that there would be very few published controlled trials on dietary counselling for weight loss and that a novel comprehensive review and meta-analysis of this literature would be highly feasible. There was also an expectation that there would be no existing published meta-analyses that would be suitable for modelling.

Our objective was to determine what the scope of existing primary research controlled studies on dietary counselling for weight loss was. Here we present our project to conduct a systematic search of research on dietary counselling for weight loss among adults affected by overweight or obesity in high-income countries.

METHODS

Search strategy

Our search strategy was designed to capture articles examining the impact of dietary counselling that aimed to achieve weight loss in adults (≥ 18 years old). The outcome of interest was any intervention effect on body weight or BMI. The study applied a broad definition of 'dietary counselling': the provision of nutrition recommendations that are responsive to the individual's or group's health status (eg, high BMI), current diet, or nutrition-related goals. Since stakeholders expressed a desire for the project team to examine the full spectrum of expressions and versions of dietary counselling for weight loss, no restrictions were placed on what the specific intervention characteristics had to be. The intervention could use any mode of delivery (or a combination of modes), interaction in individual or group sessions of any frequency or duration, counselling provided by a human coach or through automated coaching (eg, websites, smartphone apps), and in any setting (eg, primary care, community). Dietary counselling interventions that included a physical activity component were not excluded. No limitations were set pertaining to study duration or follow-up period.

Table 1. Inclusion and exclusion criteria

| | Inclusion criteria | Exclusion criteria |
|--------------|---|---|
| Participants | <ul style="list-style-type: none">• Human adults ≥ 18 years old• Studies targeting (or reporting as a sub-group) individuals with overweight or obesity based on <i>one or more</i>:<ul style="list-style-type: none">○ BMI ≥ 25 kg/m²○ Weight-related eligibility criteria that does not state a specific BMI, but that limits study participants to persons with 'overweight' or 'obesity' | <ul style="list-style-type: none">• Children < 18 years old• Studies targeting populations that do not meet any of the three criteria for overweight or obesity• Studies targeting special populations with limited applicability to the general population (eg, pregnant women, individuals with schizophrenia who have obesity, people currently undergoing cancer treatment) |

| | Inclusion criteria | Exclusion criteria |
|--|--|--|
| | <ul style="list-style-type: none"> ○ Baseline sample characteristics where mean BMI minus 1 standard deviation $\geq 25 \text{ kg/m}^2$ [eg, for mean BMI of 30 ± 2.1, $30 - 2.1 = 27.9$] • General population but including large population groupings such as ‘women with pre-diabetes’ or ‘African American men with high blood pressure’ etc. Includes individuals who have completed treatment (eg, cancer survivors) or surgery (eg, coronary artery bypass graft) | |
| Study design | <ul style="list-style-type: none"> • Refers to the design used in the publication’s analysis; if the publication is a sub-study or secondary analysis of a larger study, ‘study design’ does not refer to this larger study • Experimental studies or randomised controlled studies, including cluster • Quasi-experimental studies or non-randomised control studies (where assignment to a control or intervention group is determined by something other than randomisation) <i>only if</i> this non-randomisation occurs at a <i>group level</i> (eg, a family health practice, community centre, city) • Pilot studies of an experimental design that meet all other inclusion/exclusion criteria • Published in English • Peer-reviewed study published in a journal • Published in January 1, 1990 to present | <ul style="list-style-type: none"> • Quasi-experimental studies or non-randomised control studies where non-randomisation occurs at an <i>individual level</i> (eg, self-select, researchers select, etc) • Observational studies and non-intervention studies (eg, cross-sectional and cohort studies, case reports) • Time-series (repeated measures), pre- and post-test designs with no comparison group, static group comparison (post-intervention only measures, but in both intervention and comparison groups) • Not peer-reviewed (eg, reports, theses and dissertations, unpublished data) • No original data (eg, reviews, editorials, comments) • Studies published only as abstracts |
| Dietary counselling for weight loss intervention | <ul style="list-style-type: none"> • Dietary counselling for weight loss is dietary counselling that aims to achieve weight loss within the adult population. Dietary counselling is defined as the provision of nutrition recommendations that are responsive to the individual’s or group’s health status (eg, high BMI), current diet, or nutrition-related goals. Weight loss may be a primary or secondary objective of the nutrition intervention (eg, the primary objective may be to prevent type 2 diabetes, with a secondary objective of reducing BMI) • The intervention component may use any mode of delivery (or a combination of modes), such as in-person, remote audio or video call (eg, telephone, FaceTime, Skype), text messaging, email, website, or smartphone apps. Formal interaction may occur in either individual or group session(s), and may be of any frequency or duration • Dietary counselling may be provided by a human coach or through automated coaching (eg, websites, smartphone apps) • Dietary counselling interventions that promote dietary change may involve medically supervised diets, dietary | <ul style="list-style-type: none"> • Dietary counselling interventions that do not describe weight loss as an objective, including interventions to address nutrient deficiencies. This also encompasses other types of weight-related dietary interventions, including interventions aimed at maintaining current weight, weight loss maintenance, preventing future weight gain, achieving weight gain, or addressing undernutrition eating disorders (anorexia nervosa, bulimia nervosa). • Dietary interventions, such as mass media campaigns, that are not specifically responsive to the individual or group’s health status, current diet, or nutrition-related goals • Dietary interventions focused on pharmacological interventions (eg, weight loss drug), a specific nutrient or food (eg, flaxseed), or specific supplement (eg, magnesium), or interventions where the provision of meals or meal replacement products is a substantial part of the intervention, even if some dietary counselling is provided • Pre-surgical dietary counselling for weight loss before any type of surgery. This includes weight-loss surgeries such as bariatric or gastric bypass and also other procedures such as organ transplants |

| | Inclusion criteria | Exclusion criteria |
|------------------|--|---|
| | <p>restrictions (including very low calorie diets <800 kcal/day), and meal replacement products. Meal replacements products must only be recommended or, if provided, not form a substantial part of the intervention (eg, free samples)</p> <ul style="list-style-type: none"> • Dietary counselling interventions with a pharmacological component will be included • Dietary counselling interventions that recommend specific diets, such as the DASH diet, will be included only if weight loss is a stated objective • Dietary counselling interventions may also include any type of physical activity promotion, such as recommendations, education, supervised training, etc | <ul style="list-style-type: none"> • Post-surgical dietary counselling for weight following weight-loss surgeries such as bariatric or gastric bypass |
| Setting | <ul style="list-style-type: none"> • All settings • Study must be conducted in a high income country, as defined by the OECD or the World Bank¹ | <ul style="list-style-type: none"> • Study was conducted in a country not defined as a high income country |
| Comparator | <ul style="list-style-type: none"> • Study must compare the intervention to no intervention (control), usual care, minimum care, or nominal intervention (ie, group exposed to intervention activities unrelated to weight loss such as watching a film on recycling) • Usual care and minimum care are <i>not</i> in reference to usual or minimum dietary counselling. Any provided care must <i>not include</i> any activities that would meet the review's definition of dietary counselling • A comparison group may consist of a group taking a placebo drug • A comparison group may only have a physical activity aspect if this component was intended by the study investigators to be <i>non-effective or minimally effective at promoting weight loss</i> (eg, vouchers for free access to a fitness facility, information pamphlets, other basic information) | <ul style="list-style-type: none"> • Study does not compare the intervention to no intervention (control), usual care, minimum care, or nominal intervention • Study's only comparison groups are a retrospective control or created by matching the intervention group to existing datasets • Study's only comparison groups are other types of interventions intended to promote weight loss • Study's comparison group is a known pharmacological intervention, regardless of whether or not it is a weight loss drug or some other type of drug (eg, insulin) • Study's comparison group includes a substantial physical activity intervention (eg, tailored guidance, coaching or personal trainer, required physical activity) • Provided care in the comparator includes activities that meet the review's definition of dietary counselling |
| Primary outcomes | <ul style="list-style-type: none"> • Pre- and post-intervention change in weight or BMI must be reported | <ul style="list-style-type: none"> • No reported pre- and post-intervention change in weight or BMI |

Notes: See Appendix 'OECD and World Bank classification of high income countries'

Potential study designs were limited to those better suited for examining intervention effectiveness: randomised controlled trials (RCTs) and cluster randomised controlled trials. In addition, quasi-experimental study designs were included only if non-randomisation occurred at the group level and not the individual level. All study designs were required to include a control group and both pre- and post-intervention outcome measures. Eligible comparison groups received no intervention (control), usual care, minimum care, or a nominal intervention (eg, watching a film on recycling). The definitions of usual care and minimum care were *not* in reference to usual or minimum dietary counselling—any provided care could not include any activities that would meet the review's definition of dietary counselling. Eligible comparison groups could only have a physical activity aspect if this component

was intended by the study investigators to be non-effective or minimally effective at promoting weight loss (eg, vouchers for free access to a fitness facility, information pamphlets, other basic information, etc). Research jurisdictions were restricted to high-income countries, as defined by the OECD or the World Bank, given these countries' greater relevance to high-income settings (Appendix 'OECD and World Bank classification of high income countries'). All inclusion and exclusion criteria are reported in Table 1. All review tools were piloted and refined by multiple authors prior to use.

Figure 1. Example search string for Scopus

| Concept | Search String |
|----------------------------------|---|
| Dietary counselling intervention | (TITLE-ABS-KEY ("diet program*") OR TITLE-ABS-KEY ("weight loss intervention" OR "behavior* therapy" OR "obesity management")) OR (TITLE-ABS-KEY (counsel* OR consult* OR visit OR advice OR session OR meeting) AND TITLE-ABS-KEY (diet* OR nutrition* OR "weight loss")) |
| Outcome (weight change) | AND TITLE-ABS-KEY (bodyweight OR weight OR bmi OR "body mass index" OR obes* OR overweight OR anthropome* OR "body composition") |
| Study setting | AND TITLE-ABS-KEY("clinical trial" OR "primary care" OR "primary medical care" OR outpatient OR "general practice" OR "practice-based" OR commercial OR community OR "phone call" OR telehealth OR "tele-health" OR teleconsultation OR "tele-consultation*" OR app OR mobile OR web OR internet OR online OR "text messaging" OR "social media" OR remote OR e-mail OR "cell phone" OR smartphone OR ((university OR college OR undergraduate) W/3 student)) |
| Study design | AND TITLE-ABS-KEY (trial OR experiment*) |
| Language | AND (LIMIT-TO(LANGUAGE, "English")) |
| Document type | AND (EXCLUDE (DOCTYPE, "ab") OR EXCLUDE (DOCTYPE, "ch") OR EXCLUDE (DOCTYPE, "bz") OR EXCLUDE (DOCTYPE, "ed") OR EXCLUDE (DOCTYPE, "le") OR EXCLUDE (DOCTYPE, "no") OR EXCLUDE (DOCTYPE, "pr") OR EXCLUDE (DOCTYPE, "rp") OR EXCLUDE (DOCTYPE, "re") OR EXCLUDE (DOCTYPE, "sh")) |

ab, abstract report; bz, business article; ch, chapter; ed, editorial; le, letter; no, note; re, review; rp, report; sh, short survey, TITLE-ABS-KEY, title abstract keyword

Systematic searches were conducted in five databases: Scopus, CINAHL Plus with Full Text (EBSCOhost), Medline Pending, Cochrane Central Register of Controlled Trials, and Nutrition and Food Sciences (hosted by CABI). Article titles, abstracts, and keywords within each database were searched using search terms developed around four concepts: dietary counselling intervention, outcome of interest (weight change), study setting, and study design. Each source was searched for these common concepts, but with database-specific syntax (Figure 1; Appendix 'Search strings for journal databases'). Using database filters, results were restricted to English-language peer-reviewed publications from 1990 onwards and peer-reviewed research articles with original data. In test searches, abstract-only publications provided insufficient detail on the intervention, and were subsequently filtered out. Prior to finalising the search strategy, the database selection, search strings, filter use, article types, and other search properties were tested extensively, refined, and reviewed by multiple researchers.

The searches were conducted on June 20, 2018. The entire search yields were imported into the software Covidence [Veritas Health Innovation, Melbourne, Australia]. This software is designed to organise systematic reviews and was used to manage the current study's relevance screening, application of the inclusion and exclusion criteria, data extraction, and critical appraisal. Using Covidence's built-in functions, duplicate studies were identified and removed.

After screening and reviewing these studies, we took steps to identify potentially relevant studies that may have been missed in our original searches. We reviewed the reference lists of relevant studies for publications that were not in our search yields. We also examined the reference lists of the 10 most relevant systematic reviews and meta-analyses that we identified through searches in PubMed.¹⁻¹⁰ We sought reviews where weight loss was an outcome, dietary counselling interventions plausibly met our definition, and the study populations were adults. Apart from age, we aimed to get variety in the characteristics of the population and interventions. Priority was given to more recent and larger reviews.

Study screening and review

Relevance screening was the first step in the article review process. Each article's title and, if required, abstract was read to determine if the article potentially met the review's inclusion criteria. Three reviewers independently dual-screened the first 20% of studies with the aim to identify and clarify any discrepancies in the interpretation and application of the inclusion criteria. Of these dual-screened studies (2,129 in total), there were voting differences for 5%. These conflicts were resolved through discussion and consensus by the reviewers, thereby adding further clarity to the use of the inclusion criteria. Following this clarification process, the remainder of the studies (80%) were screened by a single reviewer.

Potentially relevant studies were then reviewed in full text using the inclusion and exclusion criteria (Table 1). Ineligible studies were removed using an exclusion hierarchy, with coding for the specific reason for exclusion (Appendix 'Hierarchy for excluding studies'). Using the same approach as in relevance screening, three reviewers independently dual-screened the first 20% of studies with the overall aim of adding further clarity to the inclusion criteria and exclusion hierarchy. Voting differences occurred for 20% of the dual-screened studies (278 studies were dual-screened), which were resolved through discussion and consensus. The remaining 80% were reviewed by a single reviewer. Reviewers consulted with the other reviewers on challenging exclusion decisions. There were several occurrences of multiple studies reporting similar or same outcomes from the same data set (eg, a study with 'main results' and several secondary or ancillary studies). During full text review, these studies were flagged. After the completion of full text review, each set of overlapping studies was further reviewed. If the authors identified the 'main results' paper, this paper was favoured and the ancillary studies excluded. Where no main paper was identified by the authors, the paper that analysed the largest sample size was favoured and the remaining studies excluded. Studies that were identified through reference list reviews and met the inclusion criteria were imported into Covidence.

Data extraction

The data extraction stage includes reading each included article in-depth, along with any necessary supplementary materials, and extracting pre-specified categories of information. We created a list of numerous study characteristics that are of relevance to understanding the effectiveness of different

versions of dietary counselling for weight loss. We defined each characteristic, and assured alignment between these characteristics and the terms used throughout the study, such as in the inclusion and exclusion criteria (Appendix 'Definitions of study characteristics'). These definitions were written in the beginning of our study to support a shared understanding of terminology across the study investigators.

Data extraction is a detailed and labour-intensive process. Thus, we determined that an abbreviated list of study characteristics was sufficient for describing the breadth of relevant research on dietary counselling for weight loss. In this brief data extraction, we extracted information from each article on the following characteristics: first author, year; full reference; publication year; corresponding secondary study; study design (reported); study design (category); risk or disease category; risk or disease category: notes; setting (reported); setting (category); setting: notes; intervention aim in active phase; and intervention aim in active phase: notes (Table 2).

Table 2. Characteristics for brief data extraction

| CHARACTERISTIC AND DEFINITION |
|--|
| Identification |
| <p>First author, year The first author's last name and year of publication.</p> <p>Full reference The publication's full reference.</p> <p>Publication year The year of publication.</p> <p>Corresponding secondary study For publications where this is the main study and there is one or more secondary studies (select one of: no; yes).</p> |
| Methods |
| <p>Study design (reported) The study design type, as reported by the authors. Refers to the general design of the study for understanding the relationship between independent and dependent variables.</p> <p>*Study design (category) Based on the review's definitions of different study design types, what is the study design (select one of: randomised controlled trial; cluster randomised controlled trial; quasi-experimental study)? Definitions adapted from Guest & Namey (2015) Public Health Research Methods.</p> <p><i>Randomised controlled trial:</i> Individuals are assigned to the intervention or control based on randomisation.</p> <p><i>Cluster randomised controlled trial:</i> The unit of randomisation is at a level higher than the individual (eg, hospital or facility, or geographic unit such as district). Based on randomisation, the unit is assigned to the intervention or control.</p> <p><i>Quasi-experimental study:</i> Involves an intervention group and a comparison group, but this assignment is determined by means other than randomisation. The only included quasi-experimental studies are those in which non-randomisation occurs at a group level (eg, a family health practice, community centre, city). This study design may also be referred to as a 'natural experiment' or 'non-equivalent control group'.</p> |
| Population Characteristics |
| <p>Risk or disease category</p> |

CHARACTERISTIC AND DEFINITION

Based on criteria used by the study's authors and the objectives of the study and intervention, identify which risk or disease category best describes the study's participants at baseline. The health of the population will influence the nature of the intervention and the study's outcomes, including BMI. Select one of:

Risk of CVD: Includes individuals with raised blood pressure (hypertension) or raised blood cholesterol (hypercholesterolemia), or at risk of one of these conditions. Other characteristics may have been used to identify risk of CVD, such as weight status, family history, gender, physical activity level, tobacco use, or type 2 diabetes. Excludes individuals who meet the criteria for 'Have CVD'.

Have CVD: More severe than 'Risk of CVD'. Consists of individuals who have some type of CVD, including: coronary artery diseases (CAD) such as angina and myocardial infarction (commonly known as a heart attack); stroke; heart failure; hypertensive heart disease; rheumatic heart disease; cardiomyopathy; abnormal heart rhythms; congenital heart disease; valvular heart disease; carditis; aortic aneurysms; peripheral artery disease; thromboembolic disease; and venous thrombosis.

Risk of T2DM: Includes individuals with pre-diabetes or at risk of pre-diabetes. Other characteristics may have been used to identify risk of T2DM, such as diet, weight status, family history, physical activity level, tobacco use, or history of gestational diabetes. Excludes individuals who meet the criteria for 'Have T2DM'.

Have T2DM: More severe than 'Risk of T2DM'. Consists of individuals who have T2DM.

Cancer survivors: Individuals who have completed cancer treatment.

Have other known chronic condition: The study's participants are characterised as having some other known chronic condition, such as sleep apnea, infertility, or mild depression.

General or unspecified: The authors do not have specific criteria pertaining to disease risk or disease status, nor is the intervention designed to specifically reduce risk around one of these conditions. This category encompasses studies that target individuals with overweight or obesity, studies that target the general population, or studies that aim to improve general wellbeing, so long as the study does not meet the definition of one of the above categories.

Risk or disease category: notes

If necessary, add any explanatory notes for the decision made on 'Risk or disease category'. If none are necessary, add 'None'.

Intervention Characteristics

Setting (reported)

What the authors say the intervention setting is – the general environment in which the intervention is delivered (eg, 'tertiary hospitals'). It may be different from the means used to recruit participants. If nothing mentioned, add 'none mentioned', along with what the setting might be interpreted as.

Setting (category)

Based on the review's definitions of different settings, what is the setting (select one of: Primary care; Commercial; Community; Other).

Primary care: Dietary counselling is delivered in a setting that is relevant to primary care. In NZ, primary health care covers a broad range of health services, including diagnosis and treatment, health education, counselling, disease prevention, and screening.

Commercial: Dietary counselling is delivered in a 'business' context (eg, commercial weight loss programmes, gyms). While the research participants may not be paying for the services (due to research design), typically the dietary counselling would involve some type of fee paid to the business. This does not include fees that individuals may pay for general primary care services.

Community: Dietary counselling is delivered in a setting within the neighbourhoods where participants live, work, study, or engage in leisure. Alternatively, a community setting may be based on culture, ethnicity, age, or other connecting points. A community setting is intentionally distinct from primary care or commercial.

Other: Dietary counselling is delivered in a setting that is not primary care, commercial, or community. Includes settings where specialist health care is delivered (eg, medically-based weight-loss clinics) and at-home interventions.

Setting: notes

CHARACTERISTIC AND DEFINITION

Additional details related to the setting (eg, 'two hospitals, public and private', 'self-help at home').

Intervention aim in ACTIVE phase

What the intervention in the ACTIVE phase was aiming to achieve (select one of: primarily weight loss; multiple risk factors, including weight). These categories are defined as follows:

Primarily weight loss: the intervention is primarily focused on reducing weight. The study is most likely framed as being about a weight loss intervention.

Multiple risk factors, including weight: the intervention aims to improve multiple risk factors, including weight. The study is most likely framed at addressing a non-weight risk factor (eg, reducing CVD risk), or a combination of risk factors.

Intervention aim in ACTIVE phase: notes

If necessary, add any clarifying notes to explain why the previous variable's answer was selected. If nothing to mention, add 'None'.

Analysis

The purpose of our analysis was to compare the included studies according to the key characteristics of: publication year; study design (category); risk or disease category; setting (category); and intervention aim in active phase. We performed a brief descriptive analysis that quantified and compared studies by these characteristics.

RESULTS

The project's PRISMA chart is reported in Figure 2. We identified 15,443 studies through database searches. Over 5,000 (5,069) duplicates were removed. After screening and full text review, 303 studies were deemed adherent to the inclusion criteria. An additional 12 studies that were identified through reference list review and published reviews meet the inclusion criteria, for a total of 315 studies. Among these studies, there were 24 cases of overlapping studies involving 65 publications (ie, using the same data and reporting the same results, but published as different papers). Based on our protocol for identifying the primary study, we removed 41 publications which we deemed to be 'secondary' publications, leaving a total of 274 articles.

Our search and review identified a high number of articles. The majority of studies were published after the year 2005 (Figure 3). Given the volume of articles on this topic, we decided to focus further analysis on those published after 2005. Additional rationale for this decision was the distinct difference in the dietary counselling for weight loss treatment guidelines between the older studies and the newer studies. For example, in the 1990s, dietary counselling for weight loss focused on reducing fat intake. Current care guidelines adopt a more holistic approach to consider a range of dietary components and patterns. Fifty-nine studies were published between 1990 and 2005; the remaining number of studies was 215.

Figure 2. PRISMA flow chart

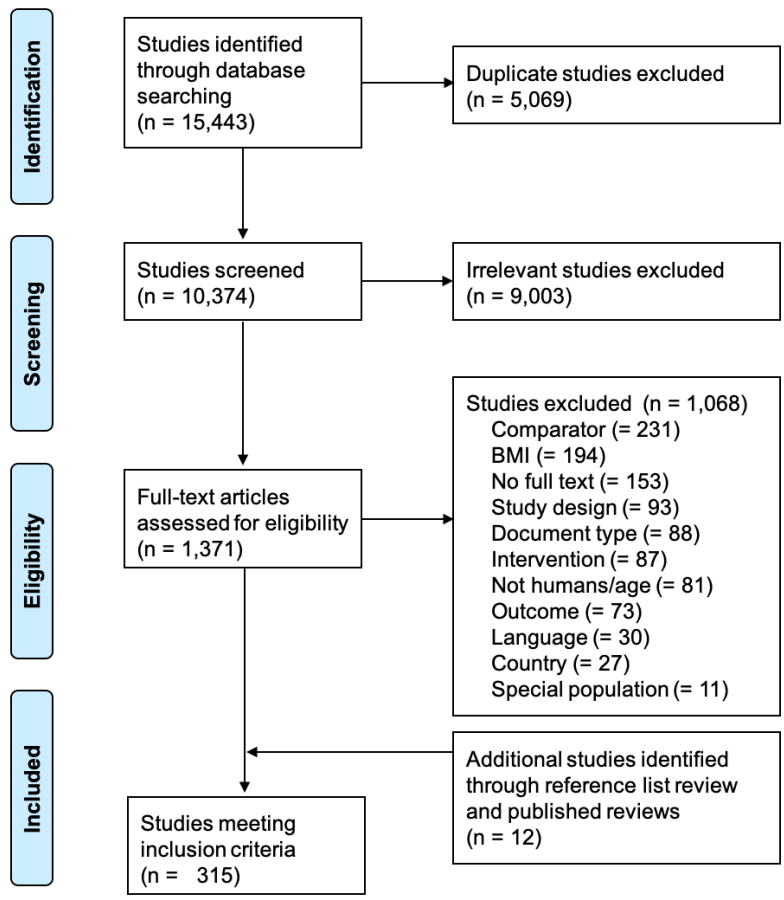
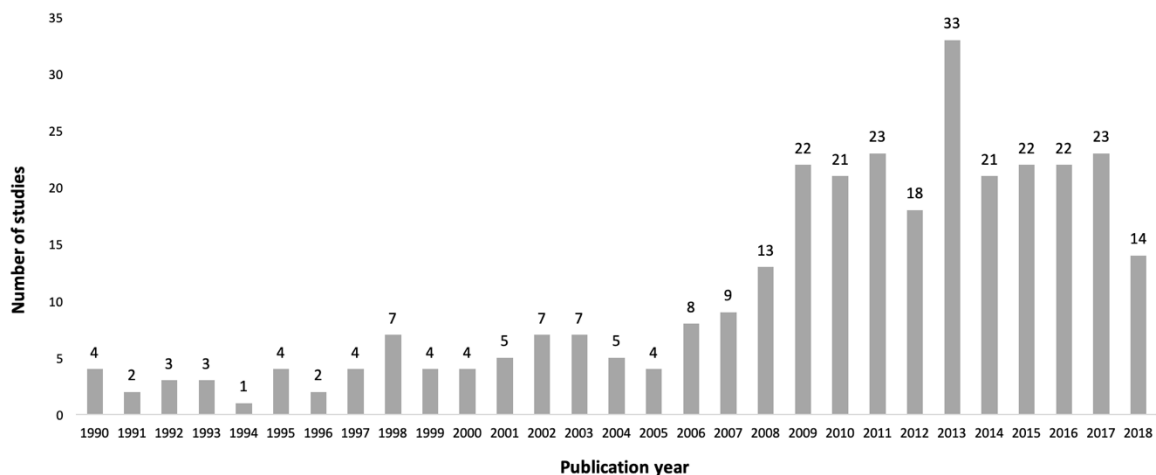


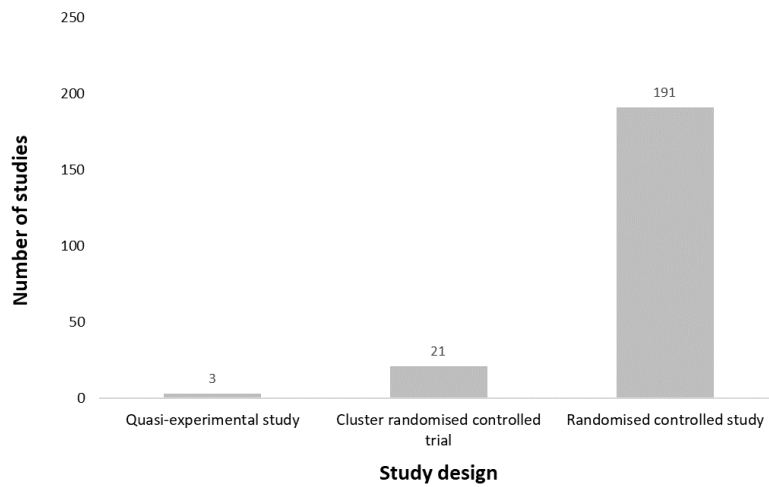
Figure 3. Articles by publication year (n=274)



Study characteristics

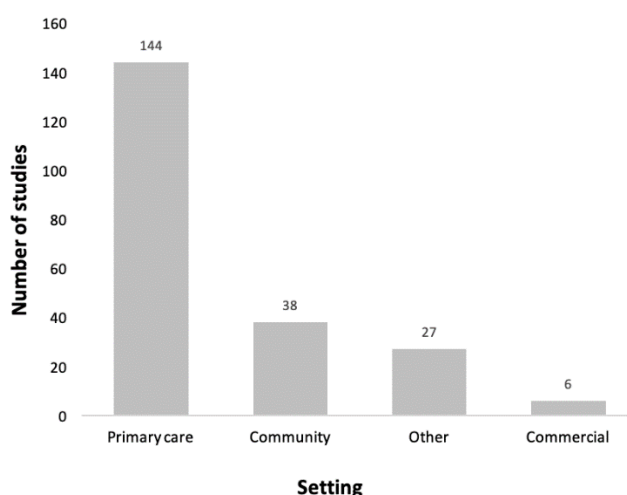
The brief data extraction enabled a comparison of the 215 included studies based on key characteristics. The vast majority of studies used a RCT design (89%). The remaining studies were cluster randomised controlled trials (10%) or quasi-experimental studies (1%; Figure 4).

Figure 4. Articles by study design (n=215)



When categorising the studies according to pre-defined setting types, two-thirds (67%) of studies were categorised as primary care (Figure 5). The studies in this category are quite diverse since this definition considers studies that could generally approximate to a primary care setting, not just studies that clearly described the setting as primary care. Numerous authors did not explicitly describe their study's setting. In these cases we used information on the study's design (eg, randomised control trial) or intervention providers (eg, physicians) to assume some type of setting that met the primary care definition. Further work could re-examine the studies in the primary care category and conduct a more granular categorisation. The remaining settings were community (17%), other (13%), and commercial (3%). The studies with an 'other' setting could be re-examined as many of these studies were conducted in a home-based or purely online setting, and could be re-categorised into a more specific group.

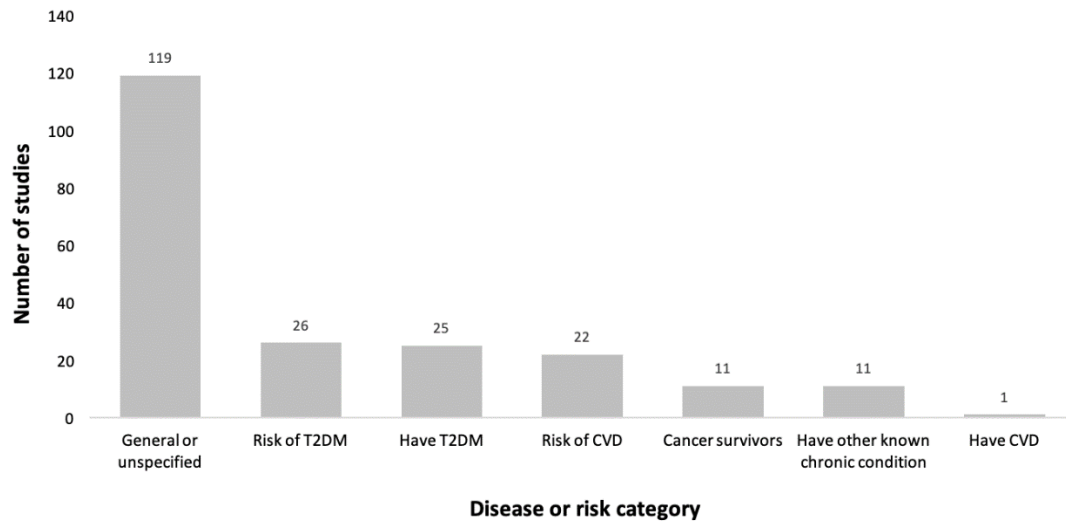
Figure 5. Articles by setting (n=215)



Studies' populations were considered based on how the authors described the sample population's risk or disease status in the inclusion or exclusion criteria (Figure 6). Most of the studies (55%) recruited samples that were in the 'general or unspecified' disease or risk category. These participants

were generally healthy with a high BMI, or were not recruited specifically because they experienced a certain disease or were at high risk of a certain disease. The remaining studies used populations that met our definitions of *risk of type 2 diabetes mellitus* (12%), *have type 2 diabetes mellitus* (12%), *risk of cardiovascular disease* (10%), cancer survivors (5%), have other known chronic conditions (5%), and *have cardiovascular disease* (<1%). Conditions in the ‘other’ category were varied (eg, knee osteoarthritis, migraines, binge eating disorder, erectile dysfunction).

Figure 6. Articles by risk or disease category (n=215)



Most of the studies had an intervention that was primarily aimed at weight loss (71% of studies). The remaining were studies in which the intervention strongly targeted changing multiple risk factors, weight loss being among the risk factors (29%; Figure 7).

Figure 7. Articles by intervention aim (n=215)

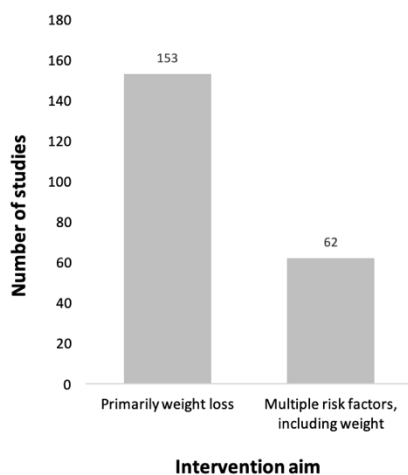


Table 3 reports the 215 studies and their characteristics that were the focus of the brief data extraction review. Studies that were conducted in NZ are examined in greater depth within Section C Part 1 of this report.

Table 3. Characteristics of studies (n=215)

| STUDY | STUDY DESIGN | RISK OR DISEASE CATEGORY | SETTING | INTERVENTION AIM |
|-----------------------------------|-------------------------------------|------------------------------------|--------------|---|
| Ackermann 2008 ¹¹ | Cluster randomised controlled trial | Risk of T2DM | Community | Primarily weight loss |
| Adachi 2007 ¹² | RCT | General or unspecified | Other | Primarily weight loss |
| Admiraal 2013 ¹³ | RCT | Risk of T2DM | Primary care | Multiple risk factors, including weight |
| Aguiar 2016 ¹⁴ | RCT | Risk of T2DM | Other | Primarily weight loss |
| Ahern 2017 ¹⁵ | RCT | General or unspecified | Commercial | Primarily weight loss |
| Ahn 2016 ¹⁶ | RCT | General or unspecified | Other | Primarily weight loss |
| Allen 2017 ¹⁷ | Cluster randomised controlled trial | Have other known chronic condition | Primary care | Multiple risk factors, including weight |
| Anderson 2018 ¹⁸ | RCT | General or unspecified | Other | Primarily weight loss |
| Anton 2011 ¹⁹ | RCT | General or unspecified | Community | Primarily weight loss |
| Appel 2011 ²⁰ | RCT | Risk of CVD | Primary care | Primarily weight loss |
| Ash 2006 ²¹ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Aveyard 2016 ²² | RCT | General or unspecified | Commercial | Primarily weight loss |
| Azar 2016 ²³ | RCT | Have T2DM | Primary care | Multiple risk factors, including weight |
| Barham 2011 ²⁴ | RCT | Risk of T2DM | Community | Primarily weight loss |
| Barnes 2014 ²⁵ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Batra 2013a ²⁶ | Cluster randomised controlled trial | General or unspecified | Community | Primarily weight loss |
| Bennett 2010 ²⁷ | RCT | Risk of CVD | Primary care | Primarily weight loss |
| Bennett 2012 ²⁸ | RCT | Risk of CVD | Primary care | Primarily weight loss |
| Bertz 2012 ²⁹ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Blumenthal 2010b ³⁰ | RCT | Risk of CVD | Primary care | Multiple risk factors, including weight |
| Bo 2007 ³¹ | RCT | Risk of T2DM | Primary care | Multiple risk factors, including weight |
| Bond 2018 ³² | RCT | Have other known chronic condition | Primary care | Primarily weight loss |
| Bouchard 2009 ³³ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Bóveda-Fontán 2015 ³⁴ | Cluster randomised controlled trial | Risk of CVD | Primary care | Multiple risk factors, including weight |
| Braakhuis 2017 ³⁵ | RCT | Cancer survivors | Primary care | Primarily weight loss |
| Brindal 2012 ³⁶ | RCT | General or unspecified | Other | Primarily weight loss |
| Brown 2018 ³⁷ | RCT | Cancer survivors | Primary care | Primarily weight loss |
| Cadmus-Bertram 2013 ³⁸ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Carnie 2013 ³⁹ | RCT | General or unspecified | Community | Primarily weight loss |
| Carter 2013 ⁴⁰ | RCT | General or unspecified | Other | Primarily weight loss |

| STUDY | STUDY DESIGN | RISK OR DISEASE CATEGORY | SETTING | INTERVENTION AIM |
|------------------------------------|-------------------------------------|------------------------------------|--------------|---|
| Castejón 2013 ⁴¹ | RCT | Have T2DM | Community | Multiple risk factors, including weight |
| Chambliss 2011 ⁴² | RCT | General or unspecified | Primary care | Primarily weight loss |
| Christian 2008 ⁴³ | RCT | Have T2DM | Primary care | Primarily weight loss |
| Christian 2011 ⁴⁴ | Cluster randomised controlled trial | Risk of T2DM | Primary care | Primarily weight loss |
| Cleo 2018 ⁴⁵ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Colleran 2012 ⁴⁶ | RCT | General or unspecified | Other | Primarily weight loss |
| Conroy 2014 ⁴⁷ | RCT | General or unspecified | Primary care | Multiple risk factors, including weight |
| Coppell 2010 ⁴⁸ | RCT | Have T2DM | Primary care | Multiple risk factors, including weight |
| Craigie 2011 ⁴⁹ | RCT | General or unspecified | Other | Primarily weight loss |
| Crane 2015 ⁵⁰ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Davis 2006 ⁵¹ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Davis 2016 ⁵² | RCT | General or unspecified | Primary care | Primarily weight loss |
| Davy 2013 ⁵³ | RCT | General or unspecified | Community | Primarily weight loss |
| Dennison 2014 ⁵⁴ | RCT | General or unspecified | Other | Primarily weight loss |
| Dobler 2018 ⁵⁵ | RCT | Have T2DM | Primary care | Multiple risk factors, including weight |
| Duncan 2016 ⁵⁶ | RCT | Risk of CVD | Primary care | Primarily weight loss |
| Dunn 2016 ⁵⁷ | RCT | General or unspecified | Other | Primarily weight loss |
| Eakin 2013 ⁵⁸ | RCT | Have T2DM | Primary care | Primarily weight loss |
| Eakin 2014 ⁵⁹ | RCT | Have T2DM | Primary care | Primarily weight loss |
| Edelman 2015 ⁶⁰ | RCT | Have T2DM | Primary care | Multiple risk factors, including weight |
| Egawa 2006 ⁶¹ | RCT | General or unspecified | Community | Multiple risk factors, including weight |
| El-Kader 2016 ⁶² | RCT | Have other known chronic condition | Primary care | Primarily weight loss |
| Faridi 2010 ⁶³ | Quasi-experimental study | Have T2DM | Community | Multiple risk factors, including weight |
| Fitzgibbon 2010 ⁶⁴ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Foster-Schubert 2012 ⁶⁵ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Fukuoka 2015 ⁶⁶ | RCT | Risk of T2DM | Primary care | Primarily weight loss |
| Gallagher 2012 ⁶⁷ | RCT | Have T2DM | Primary care | Primarily weight loss |
| Garip 2017 ⁶⁸ | Cluster randomised controlled trial | General or unspecified | Community | Primarily weight loss |
| Godino 2016 ⁶⁹ | RCT | General or unspecified | Community | Primarily weight loss |
| Goodwin 2014 ⁷⁰ | RCT | Cancer survivors | Primary care | Primarily weight loss |

| STUDY | STUDY DESIGN | RISK OR DISEASE CATEGORY | SETTING | INTERVENTION AIM |
|--------------------------------|-------------------------------------|------------------------------------|--------------|---|
| Gorin 2018 ⁷¹ | RCT | General or unspecified | Commercial | Primarily weight loss |
| Gray 2013 ⁷² | RCT | General or unspecified | Community | Primarily weight loss |
| Greaves 2008 ⁷³ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Greaves 2015 ⁷⁴ | RCT | Risk of CVD | Primary care | Primarily weight loss |
| Green 2014 ⁷⁵ | RCT | Risk of CVD | Primary care | Multiple risk factors, including weight |
| Gustafson 2009 ⁷⁶ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Gutschall 2009 ⁷⁷ | RCT | Have T2DM | Primary care | Multiple risk factors, including weight |
| Haapala 2009 ⁷⁸ | RCT | General or unspecified | Other | Primarily weight loss |
| Haggerty 2017 ⁷⁹ | RCT | Cancer survivors | Primary care | Primarily weight loss |
| Haire-Joshu 2018 ⁸⁰ | RCT | General or unspecified | Other | Primarily weight loss |
| Hansel 2017 ⁸¹ | RCT | Have T2DM | Other | Primarily weight loss |
| Hardcastle 2008 ⁸² | RCT | Risk of CVD | Primary care | Multiple risk factors, including weight |
| Hardcastle 2013 ⁸³ | RCT | Risk of CVD | Primary care | Multiple risk factors, including weight |
| Harris 2013 ⁸⁴ | Cluster randomised controlled trial | General or unspecified | Primary care | Multiple risk factors, including weight |
| Hartman 2016 ⁸⁵ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Heideman 2015 ⁸⁶ | RCT | Risk of T2DM | Primary care | Multiple risk factors, including weight |
| Holtrop 2017 ⁸⁷ | Cluster randomised controlled trial | General or unspecified | Primary care | Multiple risk factors, including weight |
| Huber 2015 ⁸⁸ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Hunt 2014 ⁸⁹ | RCT | General or unspecified | Community | Primarily weight loss |
| Hunter 2008 ⁹⁰ | RCT | General or unspecified | Community | Primarily weight loss |
| Hurkmans 2018 ⁹¹ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Huseinovic 2016 ⁹² | RCT | General or unspecified | Primary care | Primarily weight loss |
| Huseinovic 2018 ⁹³ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Hutchesson 2018 ⁹⁴ | RCT | General or unspecified | Other | Primarily weight loss |
| Ibáñez 2010 ⁹⁵ | RCT | General or unspecified | Primary care | Primarily weight loss |
| James 2015 ⁹⁶ | RCT | Cancer survivors | Primary care | Multiple risk factors, including weight |
| Janus 2012 ⁹⁷ | RCT | Risk of T2DM | Primary care | Multiple risk factors, including weight |
| Jay 2013 ⁹⁸ | Quasi-experimental study | General or unspecified | Primary care | Primarily weight loss |
| Jenkins 2017 ⁹⁹ | Cluster randomised controlled trial | Risk of CVD | Primary care | Multiple risk factors, including weight |
| Jenkinson 2009 ¹⁰⁰ | RCT | Have other known chronic condition | Primary care | Multiple risk factors, including weight |

| STUDY | STUDY DESIGN | RISK OR DISEASE CATEGORY | SETTING | INTERVENTION AIM |
|------------------------------------|-------------------------------------|------------------------------------|--------------|---|
| Johansen 2017 ¹⁰¹ | RCT | Have T2DM | Primary care | Multiple risk factors, including weight |
| Johnson 2008 ¹⁰² | RCT | General or unspecified | Other | Primarily weight loss |
| Johnston 2013 ¹⁰³ | RCT | General or unspecified | Commercial | Primarily weight loss |
| Jolly 2011 ¹⁰⁴ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Juul 2016 ¹⁰⁵ | RCT | Risk of T2DM | Primary care | Multiple risk factors, including weight |
| Kang 2010 ¹⁰⁶ | RCT | Risk of T2DM | Community | Multiple risk factors, including weight |
| Katsagoni 2018 ¹⁰⁷ | RCT | Have other known chronic condition | Primary care | Multiple risk factors, including weight |
| Kerksick 2010 ¹⁰⁸ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Kesman 2011 ¹⁰⁹ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Kim 2008 ¹¹⁰ | Quasi-experimental study | General or unspecified | Community | Primarily weight loss |
| Kirkwood 2007 ¹¹¹ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Koniak-Griffin 2015 ¹¹² | RCT | General or unspecified | Community | Primarily weight loss |
| Korcegez 2017 ¹¹³ | RCT | Have T2DM | Primary care | Multiple risk factors, including weight |
| Kraschnewski 2011 ¹¹⁴ | RCT | General or unspecified | Other | Primarily weight loss |
| Kuller 2012 ¹¹⁵ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Lim 2008 ¹¹⁶ | RCT | Risk of CVD | Primary care | Multiple risk factors, including weight |
| Linde 2011 ¹¹⁷ | RCT | General or unspecified | Community | Primarily weight loss |
| Lindström 2006 ¹¹⁸ | RCT | Risk of T2DM | Primary care | Multiple risk factors, including weight |
| Liss 2018 ¹¹⁹ | RCT | Have T2DM | Primary care | Primarily weight loss |
| Little 2016 ¹²⁰ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Lutes 2008 ¹²¹ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Lutes 2017 ¹²² | RCT | Have T2DM | Community | Multiple risk factors, including weight |
| Lynch 2014 ¹²³ | RCT | Have T2DM | Community | Primarily weight loss |
| Ma 2009 ¹²⁴ | RCT | Risk of CVD | Primary care | Multiple risk factors, including weight |
| Ma 2013 ¹²⁵ | RCT | Risk of T2DM | Primary care | Primarily weight loss |
| Ma 2015 ¹²⁶ | RCT | Have other known chronic condition | Primary care | Primarily weight loss |
| Manini 2014 ¹²⁷ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Mann 2016 ¹²⁸ | Cluster randomised controlled trial | Risk of T2DM | Primary care | Multiple risk factors, including weight |
| Martin 2008 ¹²⁹ | Cluster randomised controlled trial | General or unspecified | Primary care | Primarily weight loss |
| Martin 2015 ¹³⁰ | RCT | General or unspecified | Primary care | Primarily weight loss |

| STUDY | STUDY DESIGN | RISK OR DISEASE CATEGORY | SETTING | INTERVENTION AIM |
|--------------------------------|-------------------------------------|------------------------------------|--------------|---|
| McConnon 2007 ¹³¹ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Mefferd 2007 ¹³² | RCT | Cancer survivors | Primary care | Primarily weight loss |
| Mehring 2013 ¹³³ | Cluster randomised controlled trial | General or unspecified | Primary care | Primarily weight loss |
| Melchart 2017 ¹³⁴ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Miller 2016 ¹³⁵ | RCT | Risk of CVD | Primary care | Multiple risk factors, including weight |
| Mishra 2013 ¹³⁶ | Cluster randomised controlled trial | General or unspecified | Community | Multiple risk factors, including weight |
| Mitchell 2015 ¹³⁷ | RCT | General or unspecified | Community | Primarily weight loss |
| Mohamed 2013 ¹³⁸ | RCT | Have T2DM | Primary care | Multiple risk factors, including weight |
| Moncrieft 2016 ¹³⁹ | RCT | Have T2DM | Primary care | Multiple risk factors, including weight |
| Morey 2009 ¹⁴⁰ | RCT | Cancer survivors | Other | Primarily weight loss |
| Morgan 2011a ¹⁴¹ | RCT | General or unspecified | Community | Primarily weight loss |
| Morgan 2011b ¹⁴² | RCT | General or unspecified | Primary care | Primarily weight loss |
| Morgan 2013 ¹⁴³ | RCT | General or unspecified | Other | Primarily weight loss |
| Morgan 2014a ¹⁴⁴ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Nakade 2012 ¹⁴⁵ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Nanchahal 2012 ¹⁴⁶ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Napolitano 2013 ¹⁴⁷ | RCT | General or unspecified | Community | Primarily weight loss |
| Nicklas 2014 ¹⁴⁸ | RCT | Risk of T2DM | Other | Primarily weight loss |
| O'Brien 2014 ¹⁴⁹ | RCT | General or unspecified | Primary care | Primarily weight loss |
| O'Brien 2016 ¹⁵⁰ | Cluster randomised controlled trial | General or unspecified | Other | Primarily weight loss |
| O'Brien 2017 ¹⁵¹ | RCT | Risk of T2DM | Community | Primarily weight loss |
| O'Brien 2018 ¹⁵² | RCT | Have other known chronic condition | Primary care | Primarily weight loss |
| Oh 2015 ¹⁵³ | RCT | Risk of T2DM | Primary care | Primarily weight loss |
| Oldroyd 2006 ¹⁵⁴ | RCT | Risk of T2DM | Primary care | Multiple risk factors, including weight |
| Olson 2016 ¹⁵⁵ | Cluster randomised controlled trial | General or unspecified | Community | Primarily weight loss |
| Østbye 2009 ¹⁵⁶ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Pakiz 2011 ¹⁵⁷ | RCT | Cancer survivors | Primary care | Primarily weight loss |
| Palomba 2010 ¹⁵⁸ | RCT | Have other known chronic condition | Primary care | Multiple risk factors, including weight |
| Patrick 2009 ¹⁵⁹ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Patrick 2011 ¹⁶⁰ | RCT | General or unspecified | Other | Primarily weight loss |

| STUDY | STUDY DESIGN | RISK OR DISEASE CATEGORY | SETTING | INTERVENTION AIM |
|-------------------------------------|-------------------------------------|------------------------------------|--------------|---|
| Penn 2009 ¹⁶¹ | RCT | Risk of T2DM | Primary care | Multiple risk factors, including weight |
| Petrella 2017 ¹⁶² | RCT | General or unspecified | Community | Primarily weight loss |
| Petrofsky 2010 ¹⁶³ | RCT | General or unspecified | Primary care | Multiple risk factors, including weight |
| Pettman 2009 ¹⁶⁴ | RCT | Risk of T2DM | Primary care | Multiple risk factors, including weight |
| Pimenta 2012 ¹⁶⁵ | RCT | General or unspecified | Primary care | Multiple risk factors, including weight |
| Proeschold-Bell 2017 ¹⁶⁶ | RCT | General or unspecified | Community | Multiple risk factors, including weight |
| Puhkala 2015 ¹⁶⁷ | RCT | General or unspecified | Community | Primarily weight loss |
| Ravaud 2009 ¹⁶⁸ | Cluster randomised controlled trial | Have other known chronic condition | Primary care | Multiple risk factors, including weight |
| Reeves 2016 ¹⁶⁹ | RCT | Cancer survivors | Primary care | Primarily weight loss |
| Rejeski 2011b ¹⁷⁰ | RCT | Have CVD | Community | Multiple risk factors, including weight |
| Rosas 2015 ¹⁷¹ | RCT | Risk of CVD | Primary care | Primarily weight loss |
| Roumen 2008 ¹⁷² | RCT | Risk of T2DM | Primary care | Multiple risk factors, including weight |
| Sallit 2009 ¹⁷³ | RCT | General or unspecified | Primary care | Multiple risk factors, including weight |
| Samuel-Hodge 2009a ¹⁷⁴ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Samuel-Hodge 2009b ¹⁷⁵ | Cluster randomised controlled trial | Have T2DM | Community | Multiple risk factors, including weight |
| Samuel-Hodge 2013 ¹⁷⁶ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Samuel-Hodge 2017 ¹⁷⁷ | RCT | Have T2DM | Primary care | Primarily weight loss |
| Schroder 2010 ¹⁷⁸ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Sevick 2012 ¹⁷⁹ | RCT | Have T2DM | Primary care | Multiple risk factors, including weight |
| Shapiro 2012 ¹⁸⁰ | RCT | General or unspecified | Other | Primarily weight loss |
| Share 2015 ¹⁸¹ | RCT | General or unspecified | Primary care | Multiple risk factors, including weight |
| Sherwood 2010 ¹⁸² | RCT | General or unspecified | Primary care | Primarily weight loss |
| Siddiqui 2017 ¹⁸³ | RCT | Risk of T2DM | Community | Multiple risk factors, including weight |
| Silva 2010 ¹⁸⁴ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Sniehotta 2011 ¹⁸⁵ | RCT | Have T2DM | Primary care | Primarily weight loss |
| Sorkin 2014 ¹⁸⁶ | RCT | Have T2DM | Community | Primarily weight loss |
| Spring 2017 ¹⁸⁷ | Cluster randomised controlled trial | General or unspecified | Primary care | Primarily weight loss |
| Steinberg 2013 ¹⁸⁸ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Stolley 2009 ¹⁸⁹ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Stuart 2014 ¹⁹⁰ | RCT | Risk of CVD | Primary care | Multiple risk factors, including weight |

| STUDY | STUDY DESIGN | RISK OR DISEASE CATEGORY | SETTING | INTERVENTION AIM |
|----------------------------------|-------------------------------------|------------------------------------|--------------|---|
| Sturgeon 2017 ¹⁹¹ | RCT | Cancer survivors | Commercial | Multiple risk factors, including weight |
| Svensden 2007 ¹⁹² | RCT | Have other known chronic condition | Primary care | Multiple risk factors, including weight |
| Svetkey 2009 ¹⁹³ | Cluster randomised controlled trial | Risk of CVD | Primary care | Multiple risk factors, including weight |
| Svetkey 2015 ¹⁹⁴ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Tan 2016 ¹⁹⁵ | RCT | Have other known chronic condition | Primary care | Primarily weight loss |
| Tanaka 2010 ¹⁹⁶ | RCT | Risk of CVD | Other | Primarily weight loss |
| Tarraga 2017 ¹⁹⁷ | RCT | General or unspecified | Primary care | Primarily weight loss |
| ter Bogt 2009 ¹⁹⁸ | RCT | Risk of CVD | Primary care | Primarily weight loss |
| ter Bogt 2011 ¹⁹⁹ | RCT | Risk of CVD | Primary care | Primarily weight loss |
| Thomas 2015 ²⁰⁰ | RCT | General or unspecified | Other | Primarily weight loss |
| Truby 2006 ²⁰¹ | RCT | General or unspecified | Commercial | Primarily weight loss |
| Tsai 2010 ²⁰² | RCT | General or unspecified | Primary care | Primarily weight loss |
| VanWormer 2009 ²⁰³ | RCT | General or unspecified | Other | Primarily weight loss |
| Villareal 2006 ²⁰⁴ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Villareal 2011 ²⁰⁵ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Villareal 2017 ²⁰⁶ | RCT | General or unspecified | Primary care | Multiple risk factors, including weight |
| Vincent 2014 ²⁰⁷ | Cluster randomised controlled trial | Risk of T2DM | Community | Primarily weight loss |
| vonGruenigen 2008 ²⁰⁸ | RCT | Cancer survivors | Primary care | Primarily weight loss |
| Vos 2014 ²⁰⁹ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Vos 2016 ²¹⁰ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Wadden 2011 ²¹¹ | RCT | Risk of T2DM | Primary care | Primarily weight loss |
| Walker 2012 ²¹² | RCT | General or unspecified | Primary care | Primarily weight loss |
| Weiss 2006 ²¹² | RCT | General or unspecified | Primary care | Primarily weight loss |
| West 2011 ²¹³ | Cluster randomised controlled trial | General or unspecified | Community | Primarily weight loss |
| White 2010 ²¹⁴ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Wier 2009 ²¹⁵ | RCT | General or unspecified | Community | Primarily weight loss |
| Wier 2011 ²¹⁶ | RCT | General or unspecified | Community | Primarily weight loss |
| Wiltheiss 2013 ²¹⁷ | RCT | General or unspecified | Other | Primarily weight loss |
| Wister 2007 ²¹⁸ | RCT | Risk of CVD | Other | Multiple risk factors, including weight |
| Wright 2013 ²¹⁹ | RCT | General or unspecified | Primary care | Primarily weight loss |

| STUDY | STUDY DESIGN | RISK OR DISEASE CATEGORY | SETTING | INTERVENTION AIM |
|---------------------------------|--------------|--------------------------|--------------|---|
| Wright 2017 ²²⁰ | RCT | Risk of CVD | Primary care | Multiple risk factors, including weight |
| Xiao 2013 ²²¹ | RCT | Risk of T2DM | Primary care | Primarily weight loss |
| Yannakoulia 2007 ²²² | RCT | Have T2DM | Primary care | Multiple risk factors, including weight |
| Yardley 2014 ²²³ | RCT | General or unspecified | Primary care | Primarily weight loss |
| Yeh 2016 ²²⁴ | RCT | Risk of T2DM | Community | Multiple risk factors, including weight |

CONCLUSION

Overall, there was a very high number of controlled trials on interventions that met our definition of dietary counselling for weight loss: 215 studies having been published since the year 2005. Our brief examination of these studies' key characteristics found that the majority used an RCT study design and a setting that could generally approximate to a primary care setting. In half of the studies, participants were generally healthy with a high BMI or were not recruited because they experienced a certain disease. More than two-thirds of the studies had an intervention focused on achieving weight loss.

We found that a substantial challenge in understanding what characteristics of dietary counselling for weight loss increase the effectiveness of this intervention is the breadth and variation of literature on this topic. It is evident that dietary counselling for weight loss is complex, nuanced, and highly variable. The authors of controlled trial studies have invested considerable resources into comparing different versions of this intervention in an effort to understand how to improve weight loss outcomes. However, these studies are extremely varied in the type of characteristics that could influence the effectiveness of dietary counselling on weight. These characteristics include not just the components of the intervention (eg, content, intensity, provider, etc), but also the health of the population, the setting of the intervention, and the primary aim of the intervention. Given the high number of different characteristics, there is an almost unlimited number of ways that different characteristics could be combined. This makes it difficult to tease out precisely which characteristics truly enhance or inhibit effectiveness.

Further examination of this topic would require a more in-depth data extraction of population, setting, and intervention characteristics. Given the volume of research on this topic, it would likely be necessary to narrow the scope based on one or two critical characteristics, such as setting. Limiting the literature in this manner would prohibit certain comparisons (eg, between different settings), and would require research questions that are specifically focused on only the included characteristics.

Section B: Existing reviews and meta-analyses

INTRODUCTION

We sought to identify existing published reviews and meta-analyses related to the topic of dietary counselling for weight loss. These types of studies are conducted by teams of researchers who systematically identify, compile, and synthesise articles related to specific interventions, populations, study designs, or outcomes. By bringing together multiple studies, a high-quality review can provide a clearer picture of whether or not an intervention is effective at achieving the desired health benefits. It can provide insights into specific aspects of the intervention that enhanced effectiveness. Reviews are also important tools for identifying the richness of existing research or important research gaps.

With this in mind, we aimed to understand the extent to which dietary counselling for weight loss studies had been examined in existing reviews and meta-analyses. Is this a relatively unexplored topic in reviews? Or are there major gaps that need to be addressed in future reviews? The question guiding this investigation was: what are the existing reviews and meta-analyses of relevance to dietary counselling for weight loss?

METHODS

We adopted the same definition of dietary counselling that was used when we were identifying existing primary research on controlled trials (see Section B), which is the provision of nutrition recommendations that are responsive to the individual's or group's health status (eg, high BMI), current diet, or nutrition-related goals. This broad definition meant that a potentially large number of reviews would be relevant.

A variety of search methods were used to identify reviews. In PubMed, keywords related to dietary counselling, weight loss, behaviour change, and reviews or meta-analyses were searched in various combinations. The 'review' filter was applied to some searches. Relevant reviews were used to identify similar reviews using PubMed's 'similar articles' tool and by examining publications that had cited the review. This search approach could not be characterised as comprehensive; however, using these iterative steps, we sought to identify the maximum number of relevant reviews and meta-analyses. These searches were conducted between March 2018-December 2019. For each relevant review, the abstract was read. For the most relevant reviews, the paper was read in its entirety.

RESULTS

We identified 63 reviews that were relevant to dietary counselling for weight loss (Table 4). The studies were organised into six thematic categories: dietary counselling interventions, weight management programmes by health professionals, weight management programmes using mhealth or web, commercial weight loss programmes, promotion of improved health related to CVD or diabetes, and weight management programmes that focus on diet or lifestyle or behaviour change interventions. The majority of these reviews were meta-analyses (86%), 13% of studies were systematic reviews, and 1% used a narrative review design.

Table 4. Reviews of relevance to dietary counselling for weight loss

| REVIEW | REVIEW TITLE | REVIEW OBJECTIVE | REVIEW DESIGN |
|---|---|---|-------------------|
| Dietary counselling interventions | | | |
| Dansinger 2007 ³ | Meta-analysis: the effect of dietary counseling for weight loss | ‘To perform a meta-analysis of the effect of dietary counseling compared with usual care on body mass index (BMI) over time in adults.’ | Meta-analysis |
| Mitchell 2017 ²²⁵ | Effectiveness of dietetic consultations in primary health care: a systematic review of randomized controlled trials | ‘The aim of this systematic review was to evaluate the evidence of the effectiveness of individual consultations provided exclusively by dietitians in primary care to support adult patients to modify dietary intake and improve health outcomes.’ | Systematic review |
| Riegel 2018 ²²⁶ | Efficacy of nutritional recommendations given by registered dietitians compared to other healthcare providers in reducing arterial blood pressure: Systematic review and meta-analysis | ‘To evaluate the effect of nutritional intervention performed by a multidisciplinary team with and without registered dietitians compared to usual care in blood pressure control of hypertensive patients.’ | Meta-analysis |
| Rose 2013 ²²⁷ | Physician weight loss advice and patient weight loss behavior change: a literature review and meta-analysis of survey data | ‘We aimed to systematically review the survey literature regarding the effectiveness of PCP-provided advice related to patient weight loss behaviors, followed by a meta-analysis examining the hypothesis that PCP counseling would enhance patient participation in weight loss efforts.’ | Meta-analysis |
| Williams 2019 ¹⁰ | How effective are dietitians in weight management? A systematic review and meta-analysis of randomized controlled trials | ‘The purpose of this current paper was to quantify the effectiveness of dietitians providing individualized nutrition care to adults for weight control through a meta-analysis of relevant studies.’ | Meta-analysis |
| Weight management programmes by health professionals | | | |
| Barnes 2015 ²²⁸ | A systematic review of motivational interviewing for weight loss among adults in primary care | ‘To systematically examine randomized controlled trials of motivational interviewing for weight loss in primary care centres.’ | Systematic review |
| Bhattarai 2013 ²²⁹ | Effectiveness of interventions to promote healthy diet in primary care: Systematic review and meta-analysis of randomised controlled trials | ‘This review aimed to estimate the effectiveness of interventions to promote healthy diet for primary prevention among participants attending primary care.’ | Meta-analysis |
| Booth 2014 ²³⁰ | Effectiveness of behavioural weight loss interventions delivered in a primary care setting: a systematic review and meta-analysis | ‘To estimate the effect of behavioural interventions delivered in primary care on body weight in overweight and obese adults.’ | Meta-analysis |
| Brown 2006 ²³¹ | Literature review of nursing practice in managing obesity in primary care: developments in the UK | ‘To review empirical studies reporting primary care nursing practice in relation to obesity management for adults in the UK; to place these in the context of policy and professional developments.’ | Narrative review |
| Brown 2016 (BMJ Open) ²³² | Community pharmacy-delivered interventions for public health priorities: a systematic review of interventions for alcohol reduction, smoking cessation and weight management, including | ‘To systematically review the effectiveness of community pharmacy-delivered interventions for alcohol reduction, smoking cessation and weight management.’ | Meta-analysis |

| REVIEW | REVIEW TITLE | REVIEW OBJECTIVE | REVIEW DESIGN |
|--|---|--|---------------|
| | meta-analysis for smoking cessation | | |
| Brown 2016 (Public Health Research) ²³³ | Community pharmacy interventions for public health priorities: a systematic review of community pharmacy-delivered smoking, alcohol and weight management interventions | 'To systematically review the effectiveness of community pharmacy interventions to manage alcohol misuse, smoking cessation and weight loss; to explore if and how age, sex, ethnicity and socioeconomic status moderate effectiveness; and to describe how the interventions have been organised, implemented and delivered.' | Meta-analysis |
| Franz 2007 ²³⁴ | Weight-loss outcomes: a systematic review and meta-analysis of weight-loss clinical trials with a minimum 1-year follow-up | 'To assist health professionals who counsel patients with overweight and obesity, a systematic review was undertaken to determine types of weight-loss interventions that contribute to successful outcomes and to define expected weight-loss outcomes from such interventions.' | Meta-analysis |
| LeBlanc 2011 ²³⁵ | Effectiveness of primary care-relevant treatments for obesity in adults: A systematic evidence review for the U.S. Preventive Services Task Force | 'To summarize effectiveness and harms of primary care-relevant weight-loss interventions for overweight and obese adults.' | Meta-analysis |
| LeBlanc 2018 (Evidence Synthesis) ²³⁶ | Behavioral and pharmacotherapy weight loss interventions to prevent obesity-related morbidity and mortality in adults: an updated systematic review for the U.S. Preventive Services Task Force | 'To systematically review evidence on benefits and harms of behavioral and pharmacotherapy weight loss and weight loss maintenance interventions in adults to inform the US Preventive Services Task Force.' | Meta-analysis |
| LeBlanc 2018 (JAMA) ⁷ | Behavioral and pharmacotherapy weight loss interventions to prevent obesity-related morbidity and mortality in adults: an updated systematic review for the U.S. Preventive Services Task Force | 'To systematically review evidence on benefits and harms of behavioral and pharmacotherapy weight loss and weight loss maintenance interventions in adults to inform the US Preventive Services Task Force.' | Meta-analysis |
| Weight management programmes using mhealth or web | | | |
| Arambepola 2016 ²³⁷ | The impact of automated brief messages promoting lifestyle changes delivered via mobile devices to people with type 2 diabetes: a systematic literature review and meta-analysis of controlled trials | 'To examine the effectiveness of interventions to change lifestyle behavior delivered via automated brief messaging in patients with type 2 diabetes.' | Meta-analysis |
| Bian 2017 ²³⁸ | The effect of technology-mediated diabetes prevention interventions on weight: a meta-analysis | 'The primary purpose of this meta-analysis is to assess the effect of technology-mediated lifestyle interventions on weight loss in those at risk for developing type 2 diabetes.' | Meta-analysis |
| Fakih El Khoury 2019 ²³⁹ | The effects of dietary mobile apps on nutritional outcomes in adults with chronic diseases | 'The aim of this review is to assess the effects of the use of dietary mobile apps on nutritional outcomes in adults with chronic diseases.' | Meta-analysis |
| Flores Mateo 2015 ²⁴⁰ | Mobile phone apps to promote weight loss and increase physical activity: a systematic review and meta-analysis | 'To perform a systematic review and meta-analysis of studies to compare the efficacy of mobile phone apps compared with other approaches to promote weight loss and increase physical activity.' | Meta-analysis |
| Hutchesson 2015 ⁶ | eHealth interventions for the prevention and treatment of | 'To evaluate the effectiveness of eHealth interventions for the prevention and | Meta-analysis |

| REVIEW | REVIEW TITLE | REVIEW OBJECTIVE | REVIEW DESIGN |
|---------------------------------|---|---|-------------------|
| | overweight and obesity in adults: a systematic review with meta-analysis | treatment of overweight and obesity in adults.' | |
| Job 2018 ²⁴¹ | Effectiveness of extended contact interventions for weight management delivered via text messaging: a systematic review and meta-analysis | 'To examine (i) the effectiveness of extended contact, text message interventions for adults in supporting weight management, and (ii) which intervention characteristics are common to those that are effective.' | Meta-analysis |
| Kodama 2012 ²⁴² | Effect of Web-based lifestyle modification on weight control: a meta-analysis | 'Our aim of this meta-analysis is to systematically review the weight loss or maintenance effect of the Internet component in obesity treatment programs.' | Meta-analysis |
| Neve 2010 ²⁴³ | Effectiveness of web-based interventions in achieving weight loss and weight loss maintenance in overweight and obese adults: a systematic review with meta-analysis | 'The objectives of this systematic review are to evaluate the effectiveness of web-based interventions on weight loss and maintenance and identify which components of web-based interventions are associated with greater weight change and low attrition rates.' | Meta-analysis |
| Raaijmakers 2015 ²⁴⁴ | Technology-based interventions in the treatment of overweight and obesity: A systematic review | 'This review aims to provide insight in the available evidence regarding technology-based interventions for overweight or obese adults and their effects on weight change, adherence and quality of life.' | Systematic review |
| Reed 2011 ²⁴⁵ | The effect of computers for weight loss: a systematic review and meta-analysis of randomized trials | 'We conducted a systematic review and meta-analysis of randomized controlled trials comparing the effectiveness of computer- based interventions versus non-computer-based interventions for reducing weight or BMI among overweight and obese adults.' | Meta-analysis |
| Schippers 2017 ²⁴⁶ | A meta-analysis of overall effects of weight loss interventions delivered via mobile phones and effect size differences according to delivery mode, personal contact, and intervention intensity and duration | 'This systematic review and meta-analysis assesses whether weight loss interventions delivered via mobile phones reduce body weight and which intervention characteristics are associated with efficacy.' | Meta-analysis |
| Sherrington 2016 ²⁴⁷ | Systematic review and meta-analysis of internet-delivered interventions providing personalized feedback for weight loss in overweight and obese adults | 'The aim was to assess whether internet-delivered weight loss interventions providing personalized feedback were more effective for weight loss in overweight and obese adults in comparison with control groups receiving no personalized feedback.' | Meta-analysis |
| Siopis 2015 ²⁴⁸ | A systematic review and meta-analysis of interventions for weight management using text messaging | 'This review investigates the efficacy of weight management programmes incorporating text messaging.' | Meta-analysis |
| Tang 2016 ⁹ | Self-directed interventions to promote weight loss: a systematic review and meta-analysis | 'This review addressed three research questions: How effective are self-directed interventions (without ongoing professional contact) in promoting short-, medium-, and long-term weight loss in adults? Are particular modes of delivery of self-directed weight-loss interventions more or less effective? Do particular, | Meta-analysis |

| REVIEW | REVIEW TITLE | REVIEW OBJECTIVE | REVIEW DESIGN |
|--|--|--|-------------------|
| | | frequently employed change techniques enhance effectiveness?' | |
| Wieland 2012 ²⁴⁹ | Interactive computer-based interventions for weight loss or weight maintenance in overweight or obese people | 'To assess the effects of interactive computer-based interventions for weight loss or weight maintenance in overweight or obese people.' | Meta-analysis |
| Commercial weight loss programmes | | | |
| Gudzune 2015 ⁴ | Efficacy of commercial weight-loss programs: an updated systematic review | 'To compare weight loss, adherence, and harms of commercial or proprietary weight-loss programs versus control/education (no intervention, printed materials only, health education curriculum, or <3 sessions with a provider) or behavioral counseling among overweight and obese adults.' | Systematic review |
| McEvedy 2017 ²⁵⁰ | Ineffectiveness of commercial weight-loss programs for achieving modest but meaningful weight loss: Systematic review and meta-analysis | 'This study collates existing evidence regarding weight loss among overweight but otherwise healthy adults who use commercial weight-loss programs.' | Meta-analysis |
| Tsai 2005 ²⁵¹ | Systematic review: an evaluation of major commercial weight loss programs in the United States | 'To describe the components, costs, and efficacy of the major commercial and organized self-help weight loss programs in the United States that provide structured in-person or online counseling.' | Systematic review |
| Promotion of improved health related to CVD or diabetes | | | |
| Terranova 2014 ²⁵² | Effectiveness of lifestyle-based weight loss interventions for adults with type 2 diabetes: a systematic review and meta-analysis | 'To provide a systematic review and meta-analysis of recent evidence on the effectiveness of lifestyle-based weight loss interventions for adults with type 2 diabetes.' | Meta-analysis |
| Patnode 2017 (Evidence Synthesis) ²⁵³ | Behavioral counseling to promote a healthful diet and physical activity for cardiovascular disease prevention in adults without known cardiovascular disease risk factors | 'Do primary care behavioral counseling interventions to improve diet, increase physical activity, and/or reduce sedentary behavior improve intermediate outcomes associated with CVD in adults?' (1 of 4 questions examined). | Meta-analysis |
| Patnode 2017 (JAMA) ²⁵⁴ | Behavioral counseling to promote a healthful diet and physical activity for cardiovascular disease prevention in adults without known cardiovascular disease risk factors: updated evidence report and systematic review for the US Preventive Services Task Force | 'To systematically review the evidence on the benefits and harms of behavioral counseling for the primary prevention of cardiovascular disease in adults without known cardiovascular risk factors to inform the US Preventive Services Task Force.' | Meta-analysis |
| Sun 2017 ²⁵⁵ | The effectiveness and cost of lifestyle interventions including nutrition education for diabetes prevention: a systematic review and meta-analysis | 'The purpose of this systematic review was to conduct a comprehensive meta-analysis to synthesize the effectiveness, cost, and cost-effectiveness reported across studies testing diabetes prevention interventions.' | Meta-analysis |
| Doshmangir 2018 ²⁵⁶ | The effectiveness of theory- and model-based lifestyle interventions on HbA1c among patients with type 2 diabetes: a systematic review and meta-analysis | 'This systematic review and meta-analysis aimed to identify, evaluate, and quantify the impact of theory- and model-based lifestyle interventions on type 2 diabetes.' | Meta-analysis |
| Fleming 2008 ²⁵⁷ | Lifestyle interventions in primary care: systematic review of randomized controlled trials | 'To determine whether lifestyle counseling interventions delivered in primary care settings by primary care providers to their | Systematic review |

| REVIEW | REVIEW TITLE | REVIEW OBJECTIVE | REVIEW DESIGN |
|---|--|---|---------------|
| | | low-risk adult patients are effective in changing factors related to cardiovascular risk.' | |
| Franz 2015 ²⁵⁸ | Lifestyle weight-loss intervention outcomes in overweight and obese adults with type 2 diabetes: a systematic review and meta-analysis of randomized clinical trials | 'In overweight or obese adults with type 2 diabetes, what are the outcomes on hemoglobin A1c (HbA1c) from lifestyle weight-loss interventions resulting in weight losses greater than or less than 5% at 12 months? And, what are the weight and metabolic outcomes from differing amounts of macronutrients in weight loss interventions?' | Meta-analysis |
| Saneei 2014 ²⁵⁹ | Influence of Dietary Approaches to Stop Hypertension (DASH) diet on blood pressure: a systematic review and meta-analysis on randomized controlled trials | 'We aimed to review systematically and perform a meta-analysis to assess the magnitude of the effect of the DASH diet on blood pressure in randomized controlled trials (RCTs) among adults.' | Meta-analysis |
| Semlitsch 2016 ²⁶⁰ | Long-term effects of weight-reducing diets in people with hypertension | '1) To assess the long-term effects of weight-reducing diets in people with hypertension on all-cause mortality, cardiovascular morbidity, and adverse events (including total serious adverse events, withdrawal due to adverse events, and total non-serious adverse events). 2) To assess the long-term effects of weight-reducing diets in people with hypertension on change from baseline in systolic blood pressure, change from baseline in diastolic blood pressure, and body weight reduction.' | Meta-analysis |
| Stevens 2015 ²⁶¹ | Preventing the progression to type 2 diabetes mellitus in adults at high risk: a systematic review and network meta-analysis of lifestyle, pharmacological and surgical interventions | 'The objective of this review was to quantify the effectiveness of lifestyle, pharmacological and surgical interventions in reducing the progression to Type 2 diabetes mellitus in people with IFG or IGT.' | Meta-analysis |
| Weight management programmes that focus on diet or lifestyle or behaviour change interventions | | | |
| Armstrong 2011 ²⁶² | Motivational interviewing to improve weight loss in overweight and/or obese patients: a systematic review and meta-analysis of randomized controlled trials | 'The aim of this paper was to systematically review randomized controlled trials (RCTs) that investigate the effectiveness of motivational interviewing for reducing body mass, measured by change in body weight or BMI in adults who are overweight or obese.' | Meta-analysis |
| Avenell 2004 ²⁶³ | What interventions should we add to weight reducing diets in adults with obesity? A systematic review of randomized controlled trials of adding drug therapy, exercise, behaviour therapy or combinations of these interventions | 'We sought to systematically review studies where drug therapy, the provision of an exercise programme, or behaviour therapy were evaluated as additions to dietary advice in adults with obesity, in order to enhance long-term benefits on weight, cardiovascular risk factors and clinical outcomes.' | Meta-analysis |
| Barrett 2018 ²⁶⁴ | Integrated motivational interviewing and cognitive behaviour therapy for lifestyle mediators of overweight and obesity in community-dwelling adults: a systematic review and meta-analyses | 'The aim of this study was to investigate whether integrated motivational interviewing and cognitive behaviour therapy leads to changes in lifestyle mediators of overweight and obesity in community-dwelling adults.' | Meta-analysis |

| REVIEW | REVIEW TITLE | REVIEW OBJECTIVE | REVIEW DESIGN |
|------------------------------------|---|---|---------------|
| Barte 2014 ²⁶⁵ | Differences in weight loss across different BMI classes: a meta-analysis of the effects of interventions with diet and exercise | 'In this systematic review, differences in 1-year weight change and percentage weight change after lifestyle interventions were investigated for participants varying in initial BMI using meta-analyses.' | Meta-analysis |
| Borek 2018 ² | Group-based diet and physical activity weight-loss interventions: a systematic review and meta-analysis of randomised controlled trials | 'We synthesised evidence on (1) design and delivery of group-based weight-loss interventions; (2) effectiveness; and (3) associations between intervention characteristics, change techniques, and effectiveness.' | Meta-analysis |
| Cleo 2019 ²⁶⁶ | Efficacy of habit-based weight loss interventions: a systematic review and meta-analysis | 'This systematic review and meta-analysis aims to determine the efficacy of habit-based interventions on weight loss.' | Meta-analysis |
| Dombrowski 2014 ²⁶⁷ | Long term maintenance of weight loss with non-surgical interventions in obese adults: systematic review and meta-analyses of randomised controlled trials | 'To systematically review and describe currently available approaches to supporting maintenance of weight loss in obese adults and to assess the evidence for the effectiveness of these interventions.' | Meta-analysis |
| Galani 2007 ²⁶⁸ | Prevention and treatment of obesity with lifestyle interventions: review and meta-analysis | 'The aim of the present study was to systematically assess the mid to long-term effectiveness (1–6 years) of lifestyle interventions in the prevention and treatment of obesity.' | Meta-analysis |
| Hartmann-Boyce 2014a | Behavioural weight management programmes for adults assessed by trials conducted in everyday contexts: systematic review and meta-analysis | 'We aimed to determine the clinical effectiveness of multicomponent behavioural weight management programmes for overweight and obese adults compared with minimal intervention controls, as tested in randomized controlled trials.' | Meta-analysis |
| Hartmann-Boyce 2014b ⁵ | Effect of behavioural techniques and delivery mode on effectiveness of weight management: systematic review, meta-analysis and meta-regression | 'A systematic review, meta-analysis and meta-regression were conducted to evaluate the effectiveness of multicomponent behavioural weight management programmes and examine how programme characteristics affect mean weight loss.' | Meta-analysis |
| Hartmann-Boyce 2015 ²⁷⁰ | Self-help for weight loss in overweight and obese adults: systematic review and meta-analysis | To evaluate the effectiveness of self help interventions for weight loss in overweight and obese adults and to identify the most effective components in terms of behavioral processes.' | Meta-analysis |
| Hebden 2012 ²⁷¹ | Lifestyle intervention for preventing weight gain in young adults: a systematic review and meta-analysis of RCTs | 'To review randomized controlled trials (RCTs) of lifestyle behaviour change interventions for preventing weight gain among healthy young adults, and identify the specific characteristics of effective interventions.' | Meta-analysis |
| Johns 2014 ²⁷² | Diet or exercise interventions vs combined behavioral weight management programs: a systematic review and meta-analysis of direct comparisons | 'We aimed to examine the clinical effectiveness of combined behavioral weight management programs (BWMPs) targeting weight loss in comparison to single component programs, using within study comparisons.' | Meta-analysis |
| Johns 2016 ²⁷³ | Weight change among people randomized to minimal intervention control groups in weight loss trials | 'The aim of this study was to use data from minimal intervention control groups in randomized controlled trials to examine the evidence for this assumption and the | Meta-analysis |

| REVIEW | REVIEW TITLE | REVIEW OBJECTIVE | REVIEW DESIGN |
|--------------------------------|---|--|-------------------|
| | | effect of frequency of weighing on weight change.' | |
| Loveman 2011 ²⁷⁴ | The clinical effectiveness and cost-effectiveness of long-term weight management schemes for adults: a systematic review | 'To assess the long-term clinical effectiveness and cost-effectiveness of multicomponent weight management schemes for adults in terms of weight loss and maintenance of weight loss.' | Systematic review |
| Lv 2017 ⁸ | Behavioral lifestyle interventions for moderate and severe obesity: A systematic review | 'The primary aim of this review was to synthesize available evidence for comparative effectiveness of behavioral lifestyle interventions alone (i.e., not in combination with pharmacotherapy or surgery) in moderately and severely obese adults.' | Systematic review |
| Middleton 2012 ²⁷⁵ | The impact of extended care on the long-term maintenance of weight loss: a systematic review and meta-analysis | 'The purpose of the current study was to conduct a systematic review and meta-analysis of randomized-controlled trials investigating the impact of extended care on long-term weight loss maintenance.' | Meta-analysis |
| Norris 2005 ²⁷⁶ | Long-term effectiveness of weight-loss interventions in adults with pre-diabetes: a review | 'To assess the effectiveness of weight-loss and weight-control interventions for adults with pre-diabetes (impaired fasting glucose and impaired glucose tolerance), an important risk factor for the development of type 2 diabetes.' | Meta-analysis |
| Plotnikoff 2015 ²⁷⁷ | Effectiveness of interventions targeting physical activity, nutrition and healthy weight for university and college students: A systematic review and meta-analysis | 'The objective of this paper is to systematically review the best available evidence regarding the impact of health behavior interventions to improve physical activity, diet and/ or weight outcomes and targeted at students enrolled in tertiary education institutions.' | Meta-analysis |
| Wu 2009 ²⁷⁸ | Long-term effectiveness of diet-plus-exercise interventions vs. diet-only interventions for weight loss: a meta-analysis | 'The objective of this study was to systematically review the effect of diet-plus-exercise interventions vs. diet-only interventions on both long-term and short-term weight loss.' | Meta-analysis |

CONCLUSION

There has been extensive work conducted by other researchers to review and synthesise studies of relevance to dietary counselling for weight loss. The number and diversity of reviews demonstrates how varied dietary counselling for weight loss interventions can be. Published reviews tended to have a specific narrow scope of the intervention, population, outcomes, and follow-up time period of interest. Those studies that used a broader definition for the intervention tended to be supported by large research teams, thereby meeting the resource needs required for reviewing dozens of studies. Section C Part 3 identifies seven meta-analyses of potential relevance for health economic modelling. Any researchers seeking to conduct new reviews on this topic should first identify any outstanding research questions that could be yet answered through meta-analysis or meta-regression methods. This may require identifying more granular research questions rather than over-arching questions that would require a broad scope and the resources necessary for examining the high number of articles. Thus, any new review should consider applying a narrow set of inclusion criteria unless well supported by a large research team.

Section C: Future work

INTRODUCTION

There are three different approaches that could be taken to identify dietary counselling weight loss interventions for health economic modelling by the BODE³ Programme. The aims of additional health economic modelling (to update initial modelling work) could be to compare different variations of dietary counselling for weight loss to determine the most effective and cost-effective versions of this type of intervention, and to examine the impact on existing inequities. To do this type of modelling requires obtaining intervention effect sizes that are calculated from research on different expressions and versions of dietary counselling for weight loss. Additionally, for each intervention, the modelling researchers must construct a cost associated with delivering that type of intervention. To do this costing, existing research needs to have reported the intervention in sufficient detail to determine the intervention inputs (eg, providers, time, supporting resources, facilities, etc) and then assign costs to them.

Based on the work presented in Section A and Section B of this report, we present three options for obtaining effect sizes for different types of dietary counselling for weight loss: (1) modelling one or more published intervention study that was conducted in New Zealand or a similar context; (2) conducting a novel meta-analysis of controlled trials on dietary counselling for weight loss, including extensive heterogeneity analysis to compare different versions of dietary counselling for weight loss; and (3) modelling using existing meta-analyses that present different types of dietary counselling for weight loss. Here we describe each of these options, the studies available to inform them, and the advantages and disadvantages of each approach.

1. MODELLING OF A NEW ZEALAND INTERVENTION STUDY

A first option for identifying modelling effect sizes is to replicate one or more interventions that have been conducted within New Zealand. During the Section A work, we identified six studies conducted in New Zealand (Table 5 **Error! Reference source not found.**; Figure 8 **Error! Reference source not found.**). The benefit of modelling these studies is potentially higher internal validity and greater transparency and simplicity for costing the interventions. Studies conducted in Australia may be another option due to socio-demographic and health system similarities between the two nations.

As shown in Table 5, most of the New Zealand specific studies were conducted among sample populations with a specified disease risk or disease status: at risk of CVD (2 studies), cancer survivors (1 study), have T2DM (1 study). The remaining two studies were conducted among a sample population that was generally healthy or was not recruited for a specific risk or disease status. These two studies were also the oldest studies, having been published in 2001 and 2002. Five out of six studies were in a setting that could approximate to primary care; these studies also used an RCT study design. The last study was a quasi-experimental study in a community setting. Half of the studies had an intervention aim focused on primarily weight loss, while the other half were focused on multiple risk factors that included weight loss. Based on the abstracts presented in Figure 8, these New Zealand studies seem to each be designed for quite specific populations, using targeted intervention approaches and having varying intervention goals.

Table 5. Characteristics of studies conducted in New Zealand (n=6)

| STUDY | STUDY DESIGN | RISK OR DISEASE CATEGORY | SETTING | INTERVENTION AIM |
|------------------------------|--------------------------|--------------------------|--------------|---|
| Bell 2001 | Quasi-experimental study | General or unspecified | Community | Primarily weight loss |
| Braakhuis 2017 ³⁵ | RCT | Cancer survivors | Primary care | Primarily weight loss |
| Coppell 2010 ⁴⁸ | RCT | Have T2DM | Primary care | Multiple risk factors, including weight |
| Duncan 2016 ⁵⁶ | RCT | Risk of CVD | Primary care | Primarily weight loss |
| McAuley 2002 ²⁸⁰ | RCT | General or unspecified | Primary care | Multiple risk factors, including weight |
| Wright 2017 ²²⁰ | RCT | Risk of CVD | Primary care | Multiple risk factors, including weight |

Figure 8. Abstracts of identified studies on dietary counselling for weight loss conducted in New Zealand

Bell 2001. A nutrition and exercise intervention program for controlling weight in Samoan communities in New Zealand²⁷⁹

OBJECTIVE: To promote weight loss in Samoan church communities through an exercise program and nutrition education. METHODS: A quasi-experimental design was used to assess weight change, over 1 y, in cohorts of people aged 20-77 y from three non-randomised Samoan church communities (two intervention, n=365 and one control, n=106) in Auckland, New Zealand. The intervention churches received aerobics sessions and nutrition education about dietary fat. RESULTS: Baseline body mass index for the intervention and control churches was (mean+/-s.e.) 34.8+/-0.4 and 34.3+/-0.9 kg/m(2), respectively. The intervention churches lost an average of 0.4+/-0.3 kg compared to a 1.3+/-0.6 kg weight gain in the control church (P=0.039, adjusted for confounders). The number of people who were vigorously active increased by 10% in the intervention churches compared to a 5% decline in the control church (P=0.007). Nutrition education had little apparent impact on knowledge or behaviour. CONCLUSION: Samoan communities in New Zealand are very obese and have high rates of annual weight gain. A community-based intervention program arrested this weight gain in the short term.

Braakhuis 2017. The Effects of Dietary Nutrition Education on Weight and Health Biomarkers in Breast Cancer Survivors³⁵

Weight gain after breast cancer diagnosis portends a poorer prognosis, and the majority of sufferers appear to gain weight. Metabolic syndrome is a common co-condition with breast cancer. The Mediterranean diet has been used to reduce excess weight, metabolic syndrome, and to improve the inflammatory profile, and therefore may offer the breast cancer survivor specific benefits over and above the currently recommended nutrition guidelines to eat a low fat, healthy diet. The aim of this randomised controlled trial was to investigate whether a Mediterranean (MD) or low-fat diet (LF) reduce weight and general health in survivors of stage 1-3 breast cancer through a six-month, six-session education package to support dietary change. A control dietary arm received no intervention. Outcome measures for weight, body mass index (BMI), waist circumference, blood lipids, blood glucose, dietary adherence, 3-day food diary, and PREDIMED questionnaire and quality of life were assessed. Both dietary intervention arms, on average, lost weight over the course of the intervention, with significant (p < 0.05) decreases seen in BMI and waist circumference measurements. The control arm gained weight and significantly (p < 0.05) increased BMI and waist circumference measurements overall (1.10 ± 3.03 kg, 0.40 ± 1.65 kg/m2, and 1.94 ± 2.94 cm respectively). Positive trends in blood biomarkers were observed for the intervention arms. Dietary adherence was sufficient. Nutritional education and group support appears to exert beneficial effects on health in breast cancer survivors, of lesser importance is the type of diet that forms the basis of the education.

Coppell 2010. Nutritional intervention in patients with type 2 diabetes who are hyperglycaemic despite optimised drug treatment--Lifestyle Over and Above Drugs in Diabetes (LOADD) study: randomised controlled trial⁴⁸

OBJECTIVE: To determine the extent to which intensive dietary intervention can influence glycaemic control and risk factors for cardiovascular disease in patients with type 2 diabetes who are hyperglycaemic despite optimised drug treatment. DESIGN: Randomised controlled trial. SETTING: Dunedin, New Zealand. PARTICIPANTS: 93 participants aged less than 70 years with type 2 diabetes and a glycated haemoglobin (HbA(1c)) of more than 7% despite optimised drug treatments plus at least two of overweight or obesity, hypertension, and dyslipidaemia. INTERVENTION: Intensive individualised dietary advice (according to the nutritional recommendations of the European Association for the Study

of Diabetes) for six months; both the intervention and control participants continued with their usual medical surveillance. MAIN OUTCOME MEASURES: HbA(1c) was the primary outcome. Secondary outcomes included measures of adiposity, blood pressure, and lipid profile. RESULTS: After adjustment for age, sex, and baseline measurements, the difference in HbA(1c) between the intervention and control groups at six months (-0.4%, 95% confidence interval -0.7% to -0.1%) was highly statistically significant (P=0.007), as were the decreases in weight (-1.3 kg, -2.4 to -0.1 kg; P=0.032), body mass index (-0.5, -0.9 to -0.1; P=0.026), and waist circumference (-1.6 cm, -2.7 to -0.5 cm; P=0.005). A decrease in saturated fat (-1.9% total energy, -3.3% to -0.6%; P=0.006) and an increase in protein (1.6% total energy, 0.04% to 3.1%; P=0.045) in the intervention group were the most striking differences in nutritional intake between the two groups. CONCLUSIONS: Intensive dietary advice has the potential to appreciably improve glycaemic control and anthropometric measures in patients with type 2 diabetes and unsatisfactory HbA(1c) despite optimised hypoglycaemic drug treatment.

Duncan 2016. Family-centered brief intervention for reducing obesity and cardiovascular disease risk: A randomized controlled trial¹⁵⁶

OBJECTIVE: To assess the effects of a family-centered, physical activity and nutrition "brief" intervention (time-limited contact) on body weight and related health outcomes in primary health care patients with an elevated 5-year cardiovascular disease (CVD) risk. METHODS: This study implemented a cluster randomized controlled trial design with two treatment conditions: a CVD risk assessment and one-time consultation ("usual care" control) and a CVD risk assessment and up to five home sessions that aimed to reduce obesity by encouraging physical activity and healthy eating (intervention). Three hundred and twenty patients aged 35 to 65 years from 16 primary health care clinics in Auckland, New Zealand, participated in the study. Intervention effects on BMI, waist circumference, blood pressure, blood cholesterol, triglycerides, 5-year CVD risk, physical activity, and dietary patterns were assessed using generalized linear mixed models. RESULTS: When compared with the control group, the intervention resulted in a significant but relatively modest decrease in BMI between baseline and the 12-month follow-up (-0.633 kg m⁻², P_{adj} = 0.048). Significant decreases were also observed for total cholesterol at 4 and 12 months, the total cholesterol to high-density lipoprotein cholesterol ratio at 4 months, 5-year CVD risk at 4 months, and fast food consumption at 12 months. CONCLUSIONS: Our findings show that a family-centered brief intervention targeting physical activity and nutrition can generate slightly better obesity-related health outcomes than usual care alone.

McAuley 2002. Intensive lifestyle changes are necessary to improve insulin sensitivity: a randomized controlled trial¹⁸⁰

OBJECTIVE: The extent to which lifestyle must be altered to improve insulin sensitivity has not been established. This study compares the effect on insulin sensitivity of current dietary and exercise recommendations with a more intensive intervention in normoglycemic insulin-resistant individuals. RESEARCH DESIGN AND METHODS: Seventy-nine normoglycemic insulin-resistant (determined by the euglycemic insulin clamp) men and women were randomized to either a control group or one of two combined dietary and exercise programs. One group (modest level) was based on current recommendations and the other on a more intensive dietary and exercise program. Insulin sensitivity was measured using a euglycemic insulin clamp, body composition was measured using dual-energy X-ray absorptiometry, and anthropometry and aerobic fitness were assessed before and after a 4-month intervention period. Four-day dietary intakes were recorded, and fasting glucose, insulin, and lipids were measured. RESULTS: Only the intensive group showed a significant improvement in insulin sensitivity (23% increase, P=0.006 vs. 9% in the modest group, P=0.23). This was associated with a significant improvement in aerobic fitness (11% increase in the intensive group, P=0.02 vs. 1% in the modest group, P=0.94) and a greater fiber intake, but no difference in reported total or saturated dietary fat. CONCLUSIONS: Current clinical dietary and exercise recommendations, even when vigorously implemented, did not significantly improve insulin sensitivity; however, a more intensive program did. Improved aerobic fitness appeared to be the major difference between the two intervention groups, although weight loss and diet composition may have also played an important role in determining insulin sensitivity.

Wright 2017. The BROAD study: A randomised controlled trial using a whole food plant-based diet in the community for obesity, ischaemic heart disease or diabetes²²⁰

BACKGROUND/OBJECTIVE: There is little randomised evidence using a whole food plant-based (WFPB) diet as intervention for elevated body mass index (BMI) or dyslipidaemia. We investigated the effectiveness of a community-based dietary programme. Primary end points: BMI and cholesterol at 6 months (subsequently extended). SUBJECTS: Ages 35-70, from one general practice in Gisborne, New Zealand. Diagnosed with obesity or overweight and at least one of type 2 diabetes, ischaemic heart disease, hypertension or hypercholesterolaemia. Of 65 subjects randomised (control n=32, intervention n=33), 49 (75.4%) completed the study to 6 months. Twenty-three (70%) intervention participants were followed up at 12 months. METHODS: All participants received normal care. Intervention participants attended facilitated meetings twice-weekly for 12 weeks, and followed a non-energy-restricted WFPB diet with vitamin B12 supplementation. RESULTS: At 6 months, mean BMI reduction was greater with the WFPB diet compared with normal care (4.4 vs 0.4, difference: 3.9 kg m⁻² (95% confidence interval (CI)±1), P<0.0001). Mean cholesterol reduction was greater with the WFPB diet, but the difference was not significant compared with normal care (0.71 vs 0.26, difference: 0.45 mmol l⁻¹ (95% CI±0.54), P=0.1), unless dropouts were excluded (difference: 0.56 mmol l⁻¹ (95% CI±0.54), P=0.05). Twelve-month mean reductions for the WFPB diet group were 4.2 (±0.8) kg m⁻² BMI points and 0.55 (±0.54, P=0.05)

mmol l-1 total cholesterol. No serious harms were reported. CONCLUSIONS: This programme led to significant improvements in BMI, cholesterol and other risk factors. To the best of our knowledge, this research has achieved greater weight loss at 6 and 12 months than any other trial that does not limit energy intake or mandate regular exercise.

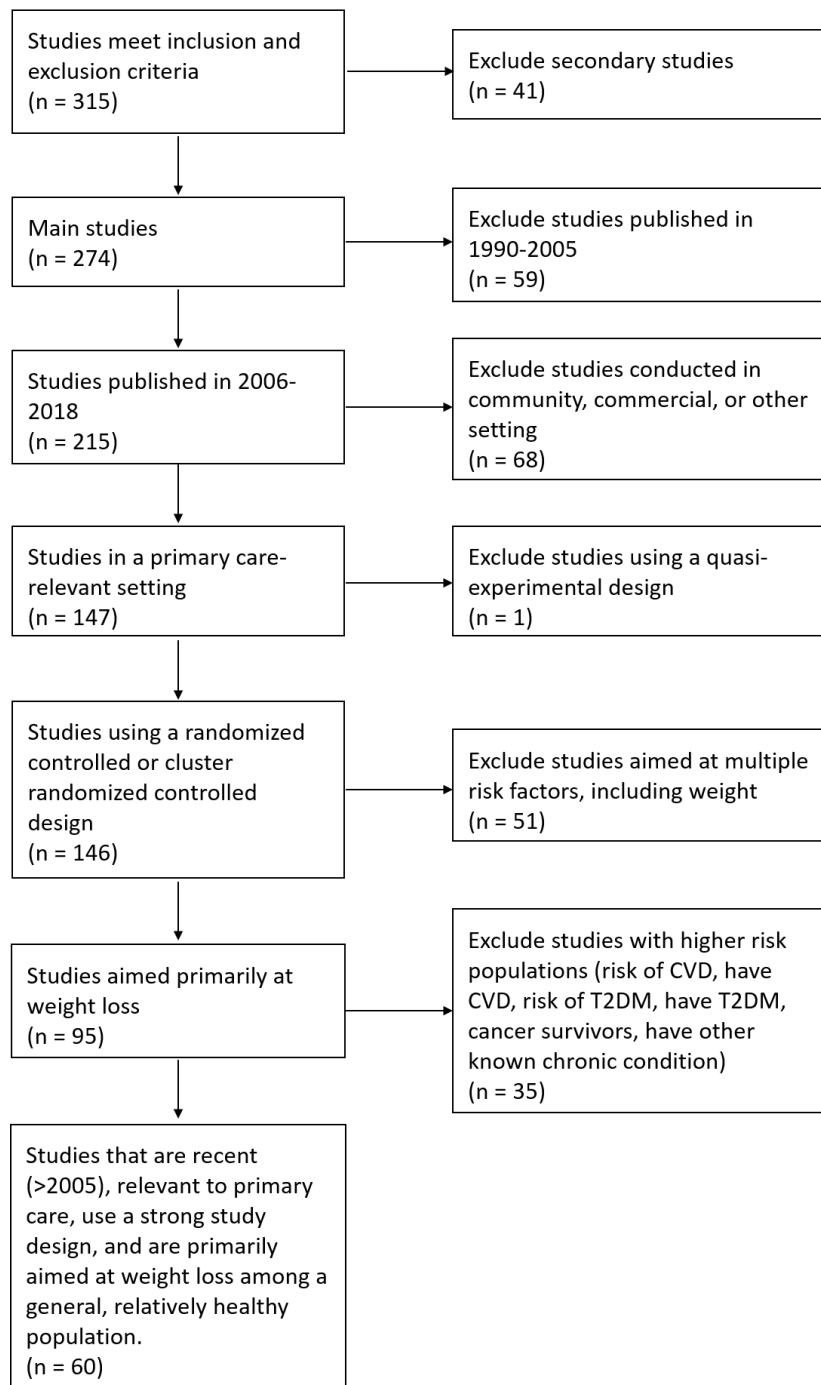
2. NOVEL META-ANALYSIS OF IDENTIFIED STUDIES

The second option of modelling inputs on dietary counselling for weight loss is to conduct a novel meta-analysis of studies on this topic. In Section A, we identified 315 existing primary studies that met our inclusion and exclusion criteria. After eliminating the 41 secondary studies, 274 studies remain. A novel meta-analysis would require reducing the number of studies to make a full data extraction and meta-analysis feasible. The number of studies can be reduced by narrowing the inclusion criteria. As an example, we have narrowed the scope to focus on studies conducted in a primary care relevant-setting among a relatively healthy population using an intervention that is primarily aimed at weight loss (Figure 9). **Error! Reference source not found.** This reduces the number of studies to 60 studies, which is still a high number of studies given the complexity of data extraction necessary to examine the characteristics that might influence the effectiveness and cost-effectiveness of dietary counselling for weight loss.^{21,25,29,33,38,42,45,50-52,64,65,73,76,85,88,91-93,95,104,108,109,111,115,120,121,127,129-131,133,134,142,144-146,149,156,159,174,176,178,182,184,187-189,194,197,202,204,205,209,210,212,214,219,223,281}

However the number of studies for inclusion may be reduced, there are still a substantial number of steps that need to be taken before a meta-analysis could be calculated. For example, there may be a desire to narrow the number of studies even further to just those that were conducted in a real-world primary care setting. This would require developing an explicit definition of a primary care setting that is transferable to contexts outside of New Zealand. Each study would need to be re-read and categorised. Each study needs to have its data extracted according to some type of data extraction framework (see Appendix 'Definitions of study characteristics' for possible characteristics).

A further step is that to be able to accurately compare different types of dietary counselling for weight loss requires that numerous characteristics are tracked in a detailed manner. A critical appraisal tool needs to be tested and applied to all studies. All the study outcomes need to be standardised into the same format, which can require some complex calculations. The searches will need to be re-run to identify any studies that have been published since 2018. The relationships and variables of interest need to be identified before undertaking meta-analysis and adhere to best practice recommendations.²⁸² All steps need to have quality control measures integrated, including duplicate data extraction on a minimum of key study characteristics and calculations. The PROSPERO registration should be updated to reflect the research questions and study methods. Altogether, even though significant groundwork has already been done, a novel meta-analysis will still require a substantial amount of work.

Figure 9. Process of narrowing study scope for meta-analysis



3. UPDATED MODELLING USING EXISTING META-ANALYSES

In this part we present seven existing meta-analyses that were considered for possible health economic modelling. As shown in Section B, we found 63 reviews that were relevant to dietary counselling for weight loss. In selecting the seven reviews for closer examination, we focused on reviews that were conducted among a generally healthy population with a high BMI. The rationale for this is that the health economic modelling that we will conduct will apply to the general population of New Zealanders with high BMI. The modelling will *not* be focused on sub-populations with specific health conditions, such as individuals at high risk of T2DM or CVD, individuals who have been diagnosed with T2DM or CVD, or individuals who are cancer survivors or have some other known chronic condition.

We selected reviews that included studies emphasising comparator groups with no or minimal health intervention, rather than reviews on studies that compared only different variations of dietary counselling for weight loss. The reviews that we selected were those that examined a type of dietary counselling that could conceivably be delivered within a New Zealand context or reviews on dietary counselling for weight loss using mhealth modes of delivery. The latter was for additional health economic modelling that the BODE³ Programme will be undertaking.

Review 1

The first review is LeBlanc et al's 'Behavioral and pharmacotherapy weight loss interventions to prevent obesity-related morbidity and mortality in adults: an updated systematic review for the U.S. Preventive Services Task Force,' published as *Evidence Synthesis* Number 168 (2018).²³⁶ A shortened version of this work is reported in JAMA.⁷

Study overview

In this review, eligible studies were those that focused on weight loss in adults with overweight or obesity or studies focusing on maintenance of previous weight loss. The review organised the interventions into three separate analyses (behavioural weight loss interventions, pharmacotherapy weight loss interventions, and weight loss maintenance interventions) and included multiple subgroup analyses to identify characteristics associated with programme effectiveness. Only interventions deemed 'primary care-relevant' met the study's inclusion criteria. The authors described these interventions as follows (pg 11):

We included interventions that were conducted in or recruited from primary care or a health care system or that we judged could feasibly be implemented in or referred from primary care. We included studies of commercial weight loss programs that are widely available in the community at a national level. We excluded studies that took place exclusively in or in conjunction with worksites, churches, or other settings that are not generalizable to primary care given pre-existing social ties that are not easily reproducible in primary care.²³⁶

In the report's discussion, the authors' conclusions about the behaviour-based weight loss intervention analyses included comments on study heterogeneity and the characteristics that were associated with greater or lesser intervention effectiveness:²³⁶

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However, pooled analyses resulted in considerable statistical heterogeneity, reflecting the clinical heterogeneity across studies. The heterogeneity in each individual intervention arm and differences in the populations, settings, and trial quality made it difficult to disentangle what variables might be driving larger effects. The trials used various modes of intervention delivery (group, individual, mixed, technology-based, and print-based) but were generally designed to help participants achieve or maintain a 5 percent or greater weight loss through a combination of dietary changes (including specific caloric goals) and increased physical activity (generally promoting at least 150 minutes of moderate-intensity activity per week). In addition, most interventions encouraged self-monitoring of weight and provided additional tools to assist with weight loss or maintenance (eg, pedometers, food scales, exercise videos).

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It is nearly impossible to determine to what extent specific population and intervention characteristics were driving intervention effects given the within- and between-study heterogeneity in population, intervention, and broader study characteristics. Few interventions included interaction with a PCP [primary care provider], and among those that did, the level of PCP interaction was variable. In addition, no two studies had exactly the same intervention messaging, schedule, or mode delivery, although many built off of learnings from earlier trials (eg, the Diabetes Prevention Programme). We applied a priori subgroup analyses and meta-regression in an effort to identify whether any particular intervention modes or characteristics were driving larger effects. We did not find that the main intervention mode (group vs individual vs technology vs mixed), the involvement of a PCP, or the duration of the intervention significantly affected the direction or magnitude of the benefit. In contrast to our previous review, we did not find that a greater number of sessions in the first year were associated with greater weight loss. However, most of the interventions had at least 12 sessions within the first year of the intervention. In addition, there were many more trials in this update that focused on technology-based interventions, with few (if any) actual counseling sessions; rather, such studies used multiple contacts with participants via emails, text messages, or social networking applications. Given the inclusion of more interventions with few formal sessions but a high number of contacts (a more inclusive measure than our previous counting of a formal 'session'), we also examined the effect of the number of participant contacts. This analysis was also not associated with effect size. The one intervention component that was related to greater weight loss was the inclusion of any use of group sessions in the intervention (whether that was the main mode of delivery or an additional component). While it is possible that including some group interaction creates a social bond that leads to greater weight loss, there were also many other differences among studies (ie, age of participants, health status of participants, other delivery components), which precludes any firm conclusions about this finding. To fully address whether certain intervention components are more effective would require examination of comparative-effectiveness studies (which were specifically excluded in

this review). The ideal counseling intervention for any given individual likely depends on consideration of his or her specific clinical characteristics and preferences.

An overview of this review’s characteristics is found in Table 6.

Table 6. Characteristics of LeBlanc et al (2018) review²³⁶

| REVIEW CHARACTERISTIC | DESCRIPTION |
|-----------------------|---|
| Study designs | Randomised or clinically controlled trials that report data at least 12 months following the start of the intervention |
| Population | Adults with overweight or obesity. The review excluded any study that selected participants based on the presence of a chronic disease in which weight loss or maintenance was a component of disease management (eg, known CVD, T2DM) |
| Setting | Settings that were generalisable to primary care |
| Intervention | Behavioural weight loss interventions, pharmacotherapy weight loss interventions, or weight maintenance interventions |
| Comparators | Any of: no intervention (eg, wait list, usual care, assessment-only); minimal intervention (eg, usual care limited to quarterly counselling sessions or generic brochures); attention controls (eg, similar format and intensity but different content) |

The review report is very lengthy (342 pages) and very detailed (eg, authors’ categorisations of the interventions, descriptions of the interventions). There are other results that may be of use for BODE³ modelling, such as weight regain estimates. **For the purposes of further BODE³ modelling, only behavioural weight loss interventions are of relevance.**

Modelling options

This review is one of the few meta-analyses that presents *subgroup analysis* according to different intervention characteristics (Table 7). The authors provide detailed comments on these subgroup analyses on pages 33-34 of their report.²³⁶ Within the review, the *main analysis* uses studies where the outcome was weight change measured between 12-18 months. There are *alternate outcomes* that are of relevance: weight change measured at 24 months and BMI change measured between 12-18 months. There are several *subgroup analyses* using the outcome of weight change at 12-18 months.

Proposed modelling approach

This review presents intervention effect sizes of high relevance for BODE³ updated health economic modelling. The aim of the proposed modelling is to compare different expressions and versions of dietary counselling for weight loss. There are four different types of subgroup analyses that would be useful for BODE³ modelling purposes: intervention intensity, main mode of intervention delivery, any group sessions, PCP involvement. Note that while the effect sizes for a specific characteristic’s subgroups may not be significantly different (ie, there is no significant difference in the effectiveness of, for example, different intervention intensities). The *cost* of delivering different versions of the intervention will influence the outcomes with respect to cost-effectiveness.

Table 7. Relevant pooled effect sizes from LeBlanc et al (2018) review

| ESTIMATE | ANALYSIS | MEAN DIFFERENCE IN CHANGE (95% CI) | NUMBER OF STUDIES | SOURCE ²³⁶ |
|---|-------------------|--|--|-----------------------|
| Weight (12-18 mo) | Main analysis | -2.39 (-2.86 to -1.93) | 67 | Table 11 |
| Weight (24 mo) | Alternate outcome | -1.45 (-2.03 to -0.87) | 21 | Table 11 |
| BMI (12-18 mo) | Alternate outcome | -1.01 (-1.29 to -0.74) | 40 | Table 11 |
| Intervention intensity: weight (12-18 mo)* | Subgroup analysis | High: -3.06 (-3.85 to -2.28) Medium: -2.47 (-3.35 to -1.61) Low: -1.73 (-2.32 to -1.13) | High: 18 Medium: 26 Low: 23 | Figure 11 |
| Main mode of intervention delivery: weight (12-18 mo) | Subgroup analysis | Group: -3.05 (-3.80 to -2.30) Individual: -2.05 (-3.04 to -1.05) Tech: -1.14 (-1.59 to -0.70) Mixed: -2.99 (-3.74 to -2.24) | Group: 18 Individual: 25 Tech: 12 Mixed: 13 | Figure 11 |
| Any group sessions (yes, no): weight (12-18 mo) | Subgroup analysis | Yes: -3.03 (-3.65 to -2.42) No: -1.46 (-1.84 to -1.09) | Yes: 35 No: 32 | Figure 11 |
| PCP involvement (yes, no): weight (12-18 mo) | Subgroup analysis | Yes: -1.45 (-2.16 to -0.74) No: -2.67 (-3.18 to -2.15) | Yes: 15 No: 52 | Figure 11 |
| Population risk status (at-risk, low risk/unselected): weight (12-18 mo) | Subgroup analysis | At-risk: -2.98 (-3.58 to -2.39) Low risk/unselected: -1.82 (-2.35 to -1.30) | At-risk: 33 Low risk/unselected: 34 | Figure 11 |
| Self-selected recruitment (yes, no): weight (12-18 mo) | Subgroup analysis | Yes: -2.97 (-3.87 to -2.07) No: -2.02 (-2.47 to -1.56) | Yes: 28 No: 39 | Figure 11 |
| Mean baseline BMI (25-29.9, 30-34.9, 35-39.9): weight (12-18 mo) | Subgroup analysis | 25-29.9: -2.13 (-3.80 to -0.46) 30-34.9: -2.68 (-3.26 to -2.09) 35-39.9: -2.06 (-2.91 to -1.20) | 25-29.9: 4 30-34.9: 41 35-39.9: 20 | Figure 11 |

*High (>26 sessions), Medium (12-26 sessions), Low (0-11 sessions)

Review 2

The second review is Hartmann-Boyce et al's 'Effect of behavioural techniques and delivery mode on effectiveness of weight management: systematic review, meta-analysis and meta-regression' (2014).⁵ The review includes a supplementary file.

Study overview

This review examined studies of behavioural weight management programmes (BWMPs) among adults with overweight or obesity. Additionally, the authors were interested in understanding what, if any, characteristics increased the programme effectiveness. These characteristics related to delivery of diet components, delivery of physical activity components, intervention format, and behavioural change techniques. The authors do not report any particular criteria pertaining to setting and it appears that they included studies that were conducted in a wide range of settings, including communities.

In their selection of comparator interventions, the authors included some comparative-effectiveness trials, and undertook comparisons between trials arms that differed based on characteristics of interest (eg, participants were randomised to supervised physical activity or activity counselling only). There were 10 studies that could be directly compared in this manner. Due to the limited number of direct comparisons, the authors also undertook meta-regression. The authors note that, ‘findings from direct comparisons are more robust as they are less prone to detecting spurious associations’ (pg 606).

The authors’ conclusion on their study, as reported in the abstract, was (pg 598):

Most but not all behavioural weight management programmes are effective. Programmes that support participants to count calories or include a dietitian may be more effective, but the programme characteristics explaining success are mainly unknown.⁵

An overview of other characteristics for this review is found in Table 8.

Table 8. Characteristics of Hartmann-Boyce et al (2014) review⁵

| REVIEW CHARACTERISTIC | DESCRIPTION |
|------------------------------|--|
| Study designs | Randomised and quasi-randomised controlled trials with a follow-up of 12 months or greater |
| Population | Adults with overweight or obesity. Excluded studies where weight loss was to address a particular medication condition (eg, diabetes) |
| Setting | No particular criteria found |
| Intervention | Interventions that were clearly defined as behaviour weight management programmes with multiple components (ie, contain diet, physical activity, and behaviour change techniques with a sufficiently detailed description of each component). There had to be multiple contacts with the provider or multiple web sessions if an online intervention |
| Comparators | Any of: non-BWMP control arm (eg, self-help material, contact with someone without specific training in weight management); direct comparison of multicomponent BWMPs based on a variable that the authors planned to investigate |

Modelling options

The outcome of the *main analysis* was change in weight at 12 months or later (-2.84 [-3.61 to -2.07]; 40 intervention comparisons; see authors’ Figure 2). Where possible, the authors performed *meta-analyses of direct comparisons* on intervention characteristics (authors’ Figure 3), as well as *meta-regressions* based on other characteristics (authors’ Table 3). The authors do not report change in BMI as an alternative outcome.

Proposed modelling approach

For BODE³ modelling purposes, which is to examine the relative cost-effectiveness based on differing intervention characteristics, the LeBlanc et al²³⁶ subgroup pooled analyses better meets our

requirements. The strengths of LeBlanc et al is that it is a more recent review, and it was very careful in the selection of the population and of interventions that were relevant to the primary care setting. While Hartmann-Boyce’s direct comparison is a methodological strength for their particular research question, this analysis compared one BWMP to another BWMP rather than a control group. With some additional modelling steps, this type of comparison could be accommodated within the BODE³ model structure.

Review 3

The third review is Williams et al’s ‘How effective are dietitians in weight management? A systematic review and meta-analysis of randomized controlled trials’ (2019).¹⁰ This study is a follow-up to this research group’s previous review, ‘Effectiveness of dietetic consultations in primary health care: a systematic review of randomized controlled trials’ (Mitchell et al, 2017),²²⁵ which contains useful methodological details relevant to the Williams et al meta-analysis.

Study overview

This study examined a very specific type of intervention – individualised nutrition care for weight management delivered exclusively by dietitians in a primary care setting. The included studies were randomised controlled trials, and examined populations with a range of medical conditions and motivations (eg, T2DM, T2DM prevention, hyperlipidaemia, hypertension, overweight and obesity, limiting weight gain during pregnancy, preventing weight gain during chemotherapy, psoriasis). The type of dietary advice was described for each study. The researchers conducted meta-analysis on two different outcomes (weight and BMI) and also organised the studies according to whether the intervention aimed at preventing weight gain or focused on weight loss. There was no explicit subgroup analysis or meta-regression. The authors reported low heterogeneity. An overview of other characteristics for this review is found in Table 9.

Table 9. Characteristics of Williams et al (2019) review¹⁰

| REVIEW CHARACTERISTIC | DESCRIPTION |
|-----------------------|---|
| Study designs | Randomised controlled trials |
| Population | Adults |
| Setting | Primary health care setting |
| Intervention | Individualised nutrition care exclusively provided by dietitians for weight control (weight loss or weight gain prevention) |
| Comparators | No intervention; usual care (from another health professional or health programme); or minimal care (eg, print material, one-off general nutrition seminar) |

Modelling options

The pooled mean difference in *weight* due to the dietetic consultations for weight loss was -1.03 kg (-1.40 to -0.66), based on n=5 studies. The pooled mean difference for *BMI* was -0.43 kg/m² (-0.59 to -0.26) based on n=4 studies.

Proposed modelling approach

This study provides a robust estimate of the effectiveness of a very specific version of dietary counselling for weight loss based on a relatively homogenous set of articles. The populations' mixed health status may reflect the health status of the New Zealand general population. However, it is not possible to differentiate whether underlying health status influenced the effectiveness of the intervention. The authors provided relatively detailed descriptions of the included studies, which would be useful for costing each study's intervention (authors' Table 2). The authors' discussion also has helpful notes that may be relevant to costing. This is a good modelling option if there is interest in modelling this specific type of intervention. Yet, the study does not provide the comparisons of different variations of interventions that would be necessary for BODE³'s health economic modelling objectives, and thus would not be suitable on its own.

Review 4

Sherrington et al (2016) are the authors of the fourth review that may be relevant for modelling *mhealth weight loss interventions*.²⁴⁷ There is a supplementary file that accompanies this study.

Study overview

This review focused on internet-delivered weight loss interventions that provided personalised feedback. The 12 included studies were published between 2001-2012. Participants accessed the feedback via website (n=4 studies), emails containing feedback (n=6 studies), or unclear mode (n=2 studies). The authors performed sub-group analyses based on the type of control group, and outcomes at different time points. An overview of other characteristics for this review is found in Table 10.

The authors report the following conclusions:

Findings from this systematic review suggest that incorporating personalized feedback may be an important [behaviour change technique] for effective weight loss interventions delivered via the internet. Participants within the [internet-delivered weight loss interventions providing personalized feedback; IWLPF] were identified as twice more likely to achieve 5% weight loss than those in control groups. Shorter term data collection, 3 or 6 months, produced significant differences between the IWLPF and the control groups receiving no personalized feedback for all outcomes (weight loss, 5% weight loss, BMI and waist circumference change). In contrast, interventions lasting 12 months or longer did not produce significant differences between IWLPF and control groups receiving no personalized feedback for weight loss or 5% weight loss outcomes. Subgroup analysis identified significantly greater weight loss for the IWLPF irrespective of the comparator used, whether wait list/minimal face-to-face interventions or control internet-delivered interventions receiving no personalized feedback.

Modelling options

The pooled results for Sherrington et al are presented in Table 11. See the review's supplementary file for further analysis according to comparator subgroup.

Table 10. Characteristics of Sherrington et al (2018) review²⁴⁷

| REVIEW CHARACTERISTIC | DESCRIPTION |
|-----------------------|--|
| Study designs | Randomised controlled trials |
| Population | Adults with overweight or obesity |
| Setting | Online |
| Intervention | Interventions that provided individualised feedback for weight loss (via diet and/or physical activity) delivered at least in part through the internet. The feedback had to meet the definition of: 'Provide feedback on performance - This involves providing the participant with data about their own recorded behaviour or commenting on a person's behavioural performance (e.g. identifying a discrepancy between behavioural performance and a set goal or a discrepancy between one's own performance in relation to others). |
| Comparators | Wait list; minimal face-to-face intervention; internet-delivered weight loss interventions without personalised feedback |

Table 11. Relevant pooled effect sizes from Sherrington et al (2016) review²⁴⁷

| ESTIMATE | ANALYSIS | MEAN DIFFERENCE IN CHANGE (95% CI) | NUMBER OF STUDIES | SOURCE |
|-------------------------------------|-------------------|------------------------------------|-------------------|---------|
| Weight (end of intervention) | Main analysis | -2.39 (-2.86 to -1.93) | 12 | Table 4 |
| Weight (3 months) | Subgroup analysis | -2.62 (-3.14 to -2.09) | 7 | Table 4 |
| Weight (6 months) | Subgroup analysis | -1.82 (-3.32 to -0.32) | 7 | Table 4 |
| Weight (12 months) | Subgroup analysis | -2.18 (-5.80 to -1.44) | 4 | Table 4 |
| BMI (end of intervention) | Alternate outcome | -0.99 (-1.28 to -0.70) | 8 | Table 4 |
| BMI (3 months) | Subgroup analysis | -1.02 (-1.23 to -0.81) | 5 | Table 4 |
| BMI (6 months) | Subgroup analysis | -0.95 (-1.79 to -0.11) | 4 | Table 4 |
| BMI (12 months) | Subgroup analysis | -1.20 (-1.74 to -0.66) | 2 | Table 4 |

Proposed modelling approach

This study examines a relatively focused intervention; however heterogeneity was still high. The authors appear to have sound inclusion and exclusion criteria for defining the type of intervention to include and have considered and investigated the potential role of different comparator groups on the relative effectiveness. The authors provided both weight and BMI outcomes. There are trade-offs between using these two different outcomes for modelling. Whether to use weight or BMI outcomes, and for what duration, depends on which modelling assumptions will be made.

Review 5

The fifth review is by Fakh El Khoury et al (2019) 'The effects of dietary mobile apps on nutritional outcomes in adults with chronic diseases'.²³⁹

Study overview

The aim of this review is to assess the effects of dietary mobile apps on diet-related outcomes in adults with chronic diseases. A specific concept within this review was 'app usage'. The inclusion and exclusion criteria are described in the authors' Figure 1. A wide range of nutritional outcomes were considered. The included studies (n=22) were published between 2007-2017. The population was 'adults with chronic disease', of which the majority of studies targeted obesity and diabetes (type 1 and type 2).

One of the authors' conclusions is:

Pooled estimates derived from the random-effects meta-analysis show a clear positive effect of self-monitoring dietary apps on weight loss compared to other self-monitoring tools (such as paper-based diaries), other technologies (bite counter), or no self-monitoring tools. The heterogeneity of data does not allow strong conclusions to be drawn. The results still need to be interpreted with caution because of the differences in comparators, duration of the interventions, and inclusion or absence of counseling.

An overview of other characteristics for this review is found in Table 12.

Table 12. Characteristics of Fakh El Khoury (2019) review²³⁹

| REVIEW CHARACTERISTIC | DESCRIPTION |
|-----------------------|---|
| Study designs | Randomised controlled trials |
| Population | Adults with chronic disease |
| Setting | Virtual |
| Intervention | Use of a smartphone app that has a dietary or nutrition intervention |
| Comparators | A wide range of comparisons or controls, so long as there was no app usage. This included waitlist controls, usual care, a different technology (eg, wearable bite counter, self-monitoring website), traditional tools (eg, paper journals), or no self-monitoring |

Modelling options

The pooled mean difference in *weight* was -2.45 kg (-3.33 to -1.58), based on 11 studies. The pooled mean difference in *BMI* was -0.32 (-0.78 to 0.13), based on 5 studies. The difference in *energy intake* was -149.52 kcal/day (-215.78 to -1.73), based on 3 studies.

Proposed modelling approach

The benefit of this study is that it is recent and examined a focused intervention that had a very specific mode of delivery. Throughout the article, the authors are quite detailed in their reporting, which is

useful for understanding the health status of the examined populations, among other considerations. The comparator group criteria should be considered carefully.

Review 6

The sixth review is by Flores Mateo et al (2015) 'Mobile phone apps to promote weight loss and increase physical activity: a systematic review and meta-analysis'.²⁴⁰ There is an appendix to this study.

Study overview

The authors describe this as the first meta-analysis on this particular type of intervention – mobile phone apps to promote weight loss and increase physical activity. Despite a wider range of relevant outcomes, only 12 studies met the inclusion criteria.

An overview of other characteristics for this review is found in Table 13.

Table 13. Characteristics of Flores Mateo et al (2015) review²⁴⁰

| REVIEW CHARACTERISTIC | DESCRIPTION |
|-----------------------|---|
| Study designs | Controlled studies |
| Population | Adults without any disease, except obesity |
| Setting | Virtual |
| Intervention | Mobile phone apps that promote weight loss and increase physical activity |
| Comparators | No stated criteria except that a control group was required |

Modelling options

The change in *weight* was -1.04 kg (-1.75 to -0.34), based on 9 studies. The change in *BMI* was -0.43 (-0.74 to -0.13), based on 8 studies.

Proposed modelling approach

Given the age of this study and how much mobile app technology has advanced in recent years, this is probably not an ideal study for modelling. Additionally, the control groups involved 'traditional' interventions or intensive counselling, which is not as useful as a control group that received no intervention.

Review 7

The last review is by Schippers et al (2017) 'A meta-analysis of RCTs assessing the efficacy of weight loss interventions delivered via mobile phones.'²⁴⁶

Study overview

The aim of this review was to assess whether weight loss interventions delivered via mobile phones reduce body weight, and what characteristics of the interventions contribute to this impact. To examine this latter question, subgroup analyses were conducted based on delivery mode, inclusion of personal contact, duration, and interaction frequency. An overview of other characteristics for this review is found in Table 14.

Proposed modelling approach

This study was well-reported in terms of whether and how mobile phone interventions were combined with other modes, and numerous other features. This could be an option for modelling.

Table 14. Characteristics of Schippers et al (2017) review²⁴⁶

| REVIEW CHARACTERISTIC | DESCRIPTION |
|-----------------------|--|
| Study designs | Randomised controlled trials |
| Population | 16+ years |
| Setting | Virtual |
| Intervention | Intervention elements delivered by mobile phones technologies (text messages, mobile sensors used to transmit relevant data, mobile phone applications), aiming to reduce body weight |
| Comparators | A wide range of comparisons or controls, so long as there was no health communication via mobile phone technology. This included 'no intervention controls' or traditional tools (eg, paper diaries) |

Modelling options

Table 15. Relevant pooled effect sizes from Schippers et al (2017) review

| ESTIMATE | ANALYSIS | MEAN DIFFERENCE IN CHANGE (95% CI) | NUMBER OF STUDIES | SOURCE |
|---|-------------------|--|-------------------|---------|
| Weight | Main analysis | -0.23 (-0.38 to -0.08) | Not reported | In-text |
| Delivery mode | Subgroup analysis | Mixed: -0.59 (-1.147 to -0.038) Mostly/only by mobile phone: -0.13 (-0.27 to -0.01) | Not reported | In-text |
| Personal contact | Subgroup analysis | Yes: -0.36 (-0.59 to -0.13) No: -0.08 (-0.26 to -0.09) | Not reported | In-text |
| Intervention duration | Subgroup analysis | <90 d: -0.04 (-0.28 to 0.19) ≥90 d: -0.31 (-0.50 to -0.12) | Not reported | In-text |
| Number of daily intervention-initiated interactions | Subgroup analysis | 0-0.6/d: -0.07 (-0.26 to 0.13) 1-4.03/d: -0.36 (-0.59 to -0.12) | Not reported | In-text |
| Total number of interactions | Subgroup analysis | 2-91: -0.10 (-0.28 to 0.08) 168-1,471: -0.35 (-0.61 to -0.10) | Not reported | In-text |

CONCLUSION

In this section, we examined three different approaches toward identifying dietary counselling weight loss interventions for health economic modelling by the BODE³ Programme. For the first option (Part 1), none of the six intervention studies conducted in NZ aligned closely with BODE³ modelling objectives. Specifically, the NZ intervention studies examined populations and interventions that were quite specific and did not represent the type of population or intervention that would be considered through modelling. For the second option (Part 2), conducting a novel meta-analysis of identified studies would be a substantial undertaking, necessitating first that the scope of potential studies for inclusion be narrowed.

The third option (Part 3) of using existing published meta-analyses is the recommended option for BODE³'s health economic modelling purposes. There is a suitable existing meta-analysis that would permit a comparison of different types of dietary counselling for weight loss. LeBlanc and colleagues' review is recent, highly comprehensive, and closely aligns with the desired modelling scope and objectives.²³⁶ For examining weight loss interventions delivered via apps, the Schippers et al study from 2017 has the best scope and design for modelling objectives.²⁴⁶

Appendix

OECD AND WORLD BANK CLASSIFICATION OF HIGH INCOME COUNTRIES

Appendix Figure 1. OECD¹ and World Bank² classifications of high income countries

| | | |
|--|--|--|
| A Andorra ² Antigua and Barbuda ² Argentina ² Aruba ² Australia ^{1,2} Austria ^{1,2} | G Germany ^{1,2} Gibraltar ² Greece ^{1,2} Greenland ² Guam ² | O Oman ² |
| B Bahamas, The ² Bahrain ² Barbados ² Belgium ^{1,2} Bermuda ² British Virgin Islands ² Brunei Darussalam ² | H Hong Kong SAR, China ² Hungary ^{1,2} | P Palau ² Panama ² Poland ^{1,2} Portugal ^{1,2} Puerto Rico ² |
| C Canada ^{1,2} Cayman Islands ² Channel Islands ² Chile ^{1,2} Croatia ² Curaçao ² Cyprus ² Czech Republic ^{1,2} | I Iceland ^{1,2} Ireland ^{1,2} Isle of Man ² Israel ^{1,2} Italy ^{1,2} | Q Qatar ² |
| D Denmark ^{1,2} | J Japan ^{1,2} | S San Marino ² Saudi Arabia ² Seychelles ² Singapore ² Sint Maarten (Dutch part) ² Slovak Republic ^{1,2} Slovenia ^{1,2} Spain ^{1,2} St. Kitts and Nevis ² St. Martin (French part) ² Sweden ^{1,2} Switzerland ² |
| E Estonia ^{1,2} | K Korea, Rep. ^{1,2} Kuwait ² | T Taiwan, China ² Trinidad and Tobago ² Turkey ¹ Turks and Caicos Islands ² |
| F Faroe Islands ² Finland ^{1,2} France ^{1,2} French Polynesia ² | L Latvia ^{1,2} Liechtenstein ² Lithuania ² Luxembourg ^{1,2} | U United Arab Emirates ² United Kingdom ^{1,2} United States ^{1,2} Uruguay ² |
| | M Macao SAR, China ² Malta ² Mexico ¹ Monaco ² | V Virgin Islands (U.S.) ² |
| | N Netherlands ^{1,2} New Caledonia ² New Zealand ^{1,2} Northern Mariana Islands ² Norway ^{1,2} | |

¹ OECD member state

² World Bank classification of high income country

Sources:

List of OECD Member countries (accessed July 2018) <http://www.oecd.org/about/membersandpartners/list-oecd-member-countries.htm>

World Bank list of economies (June 2018) <http://databank.worldbank.org/data/download/site-content/CLASS.xls>

SEARCH STRINGS FOR JOURNAL DATABASES

Scopus

The Scopus search string is:

```
TITLE-ABS-KEY ( bodyweight OR weight OR bmi OR "body mass index" OR obes* OR overweight OR anthropome* OR "body composition" ) AND TITLE-ABS-KEY ( trial OR experiment* ) AND TITLE-ABS-KEY ( "clinical trial" OR "primary care" OR "primary medical care" OR outpatient OR "general practice" OR "practice-based" OR commercial OR community OR "phone call" OR telehealth OR "tele-health" OR teleconsultation OR "tele-consultation*" OR app OR mobile OR web OR internet OR online OR "text messaging" OR "social media" OR remote OR e-mail OR "cell phone" OR smartphone OR ( ( university OR college OR undergraduate ) W/3 student ) ) AND ( TITLE-ABS-KEY ( "diet program*" ) OR TITLE-ABS-KEY ( "weight loss intervention" OR "behavior* therapy" OR "obesity management" ) OR ( TITLE-ABS-KEY ( counsel* OR consult* OR visit OR advice OR session OR meeting ) AND TITLE-ABS-KEY ( diet* OR nutrition* OR "weight loss"))) AND ( EXCLUDE ( DOCTYPE,"re " ) OR EXCLUDE ( DOCTYPE,"no " ) OR EXCLUDE ( DOCTYPE,"bz " ) OR EXCLUDE ( DOCTYPE,"pr " ) OR EXCLUDE ( DOCTYPE,"rp " ) OR EXCLUDE ( DOCTYPE,"sh " ) OR EXCLUDE ( DOCTYPE,"ed " ) OR EXCLUDE ( DOCTYPE,"le " ) OR EXCLUDE ( DOCTYPE,"ch " ) ) AND ( LIMIT-TO ( PUBYEAR,2018 ) OR LIMIT-TO ( PUBYEAR,2017 ) OR LIMIT-TO ( PUBYEAR,2016 ) OR LIMIT-TO ( PUBYEAR,2015 ) OR LIMIT-TO ( PUBYEAR,2014 ) OR LIMIT-TO ( PUBYEAR,2013 ) OR LIMIT-TO ( PUBYEAR,2012 ) OR LIMIT-TO ( PUBYEAR,2011 ) OR LIMIT-TO ( PUBYEAR,2010 ) OR LIMIT-TO ( PUBYEAR,2009 ) OR LIMIT-TO ( PUBYEAR,2008 ) OR LIMIT-TO ( PUBYEAR,2007 ) OR LIMIT-TO ( PUBYEAR,2006 ) OR LIMIT-TO ( PUBYEAR,2005 ) OR LIMIT-TO ( PUBYEAR,2004 ) OR LIMIT-TO ( PUBYEAR,2003 ) OR LIMIT-TO ( PUBYEAR,2002 ) OR LIMIT-TO ( PUBYEAR,2001 ) OR LIMIT-TO ( PUBYEAR,2000 ) OR LIMIT-TO ( PUBYEAR,1999 ) OR LIMIT-TO ( PUBYEAR,1998 ) OR LIMIT-TO ( PUBYEAR,1997 ) OR LIMIT-TO ( PUBYEAR,1996 ) OR LIMIT-TO ( PUBYEAR,1995 ) OR LIMIT-TO ( PUBYEAR,1994 ) OR LIMIT-TO ( PUBYEAR,1993 ) OR LIMIT-TO ( PUBYEAR,1992 ) OR LIMIT-TO ( PUBYEAR,1991 ) OR LIMIT-TO ( PUBYEAR,1990 ) ) AND ( LIMIT-TO ( LANGUAGE,"English " ) )
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Additional comments

Scopus has extensive coverage. It is a database of databases, including 100% of Medline, other health sciences databases, and databases from social sciences, physical sciences, and life sciences. The University of Otago (Wellington) library experts recommended that the database be used in our project. The search terms targeted each article's title, abstract, and keywords.

Scopus only allows the first 2,000 results to be viewed, which is a challenge for exporting the results. The above search string was modified to conduct the searches in batches by date (2014-2018, yield: 1834; 2008-2013, yield: 1834; 1990-2007, yield: 1702). This permitted the results to be viewed and exported.

Cochrane Central Register of Controlled Trials (CENTRAL)

The search string for CENTRAL is:

((diet next program*) or (weight next loss next intervention*) or (behavio*r* next therap*) or "obesity management"):ti,ab,kw or ((counsel* or consult* or visit* or advice or session* or meeting*):ti,ab,kw and (diet* or nutrition* or "weight loss"):ti,ab,kw)) and (bodyweight or weight or bmi or "body mass index" or obes* or overweight or anthropome* or "body composition"):ti,ab,kw AND ((clinical next trial*) or "primary care" or "primary medical care" or outpatient* or "general practice" or "practice-based" or commercial or communit* or (phone next call*) or telehealth or "telehealth" or teleconsultation* or tele-consultation* or app* or mobile or web or internet or online or (text next messag*) or "social media" or remote or e-mail* or (cell next phone*) or smartphone* or ((universit* or college* or undergraduate*) near/3 student*)):ti,ab,kw

Enter the search string into the box under 'Search Manager'. Click on the icon for search limits, then manually select the type of publications (Trials), Publication Year from 1990 to 2018, and uncheck 'Word variations will not be searched'.

Additional comments

CENTRAL is a highly concentrated source of randomised and quasi-randomised controlled trials. The majority of records are also found in MEDLINE and Embase, but there are also records from other published and unpublished sources. The search string for CENTRAL was adapted from the Scopus search string. There is no way to limit to English language in the Wiley Cochrane platform.

The TXT format that can be exported from CENTRAL does not work in Zotero. To make the files compatible with Zotero, the records were first imported into EndNote. To export the records from CENTRAL, under 'Choose your export options', select 'PC' and then 'File type' as 'Citation and Abstract'. Import into EndNote and export the records from EndNote using EndNote XML format; import into Zotero.

CINAHL Plus with Full Text (EBSCOhost)

The CINAHL Plus search string is:

(TI ("diet program*" OR "weight loss intervention*" OR "behavior#r* therap*" OR "obesity management") OR AB ("diet program*" OR "weight loss intervention*" OR "behavior#r* therap*" OR "obesity management") OR SU ("diet program*" OR "weight loss intervention*" OR "behavior#r* therap*" OR "obesity management")) OR (TI (counsel* OR consult* OR visit* OR advice OR session* OR meeting*) AND TI (diet* OR nutrition* OR "weight loss")) OR (AB (counsel* OR consult* OR visit* OR advice OR session* OR meeting*) AND AB (diet* OR nutrition* OR "weight loss")) OR (SU (counsel* OR consult* OR visit* OR advice OR session* OR meeting*) AND SU (diet* OR nutrition* OR "weight loss")) AND (TI (bodyweight OR weight OR bmi OR "body mass index" OR obes* OR overweight OR anthropome* OR "body composition") OR AB (bodyweight OR weight OR bmi OR "body mass index" OR obes* OR overweight OR anthropome* OR "body composition") OR SU (bodyweight OR weight OR bmi OR "body mass index" OR obes* OR overweight OR anthropome* OR "body composition")) AND (TI (trial* OR experiment*) OR AB (trial* OR experiment*) OR SU (trial* OR experiment*)) AND (TI ("clinical trial*" OR "primary care" OR "primary medical care" OR outpatient* OR "general practice" OR "practice-based" OR commercial OR communit* OR "phone call*" OR telehealth OR "tele-health" OR teleconsultation* OR tele-consultation* OR app* OR mobile OR web OR internet OR online OR "text messag*" OR "social media" OR remote OR e-mail* OR "cell phone*" OR smartphone* OR ((universit* OR college* OR undergraduate*) N3 student*)) OR AB ("clinical trial*" OR "primary care" OR "primary medical care" OR outpatient* OR "general practice" OR "practice-based" OR commercial OR communit* OR "phone call*" OR telehealth OR "tele-health" OR teleconsultation* OR tele-consultation* OR app* OR mobile OR web OR internet OR online OR "text messag*" OR "social media" OR remote OR e-mail* OR "cell phone*" OR smartphone* OR ((universit* OR college* OR undergraduate*) N3 student*)) OR SU ("clinical trial*" OR "primary care" OR "primary medical care" OR outpatient* OR "general practice" OR "practice-based" OR commercial OR communit* OR "phone call*" OR telehealth OR "tele-health" OR teleconsultation* OR tele-consultation* OR app* OR mobile OR web OR internet OR online OR "text messag*" OR "social media" OR remote OR e-mail* OR "cell phone*" OR smartphone* OR ((universit* OR college* OR undergraduate*) N3 student*)) AND (DT 19900101-) AND (LA English) AND (PT (clinical trial OR corrected article OR journal article OR other OR overall OR proceedings OR research))

Additional comments

CINAHL Plus indexes nursing and applied health literature. Scopus includes some of CINAHL Plus, but not all. The search string was adapted from the Scopus search string, with modifications for the scope covered by CINAHL Plus. To run the search, enter the search string in the box 'Basic Search'.

To export from CINAHL, add all the records to 'Add to Folder'. Then export from the folder in RIS format. This search platform can only export 500 or less files. Thus, multiple batches of exports were necessary.

Nutrition and Food Sciences (hosted by CABI)

The search string for Nutrition and Food Sciences is:

```
(title:(("diet program*" or "weight loss intervention*" or "behavior?r* therap*" or "obesity management")) OR ab:(("diet program*" or "weight loss intervention*" or "behavior?r* therap*" or "obesity management")) OR subject:(("diet program*" or "weight loss intervention*" or "behavior?r* therap*" or "obesity management")) OR title:((counsel* or consult* or visit* or advice or session* or meeting*) and (diet* or nutrition* or "weight loss")) OR ab:((counsel* or consult* or visit* or advice or session* or meeting*) and (diet* or nutrition* or "weight loss")) OR subject:((counsel* or consult* or visit* or advice or session* or meeting*) and (diet* or nutrition* or "weight loss"))) AND (title:(bodyweight or weight or bmi or "body mass index" or obes* or overweight or anthropome* or "body composition") OR ab:(bodyweight or weight or bmi or "body mass index" or obes* or overweight or anthropome* or "body composition") OR subject:(bodyweight or weight or bmi or "body mass index" or obes* or overweight or anthropome* or "body composition")) AND (title:(trial* or experiment*) OR ab:(trial* or experiment*) OR subject:(trial* or experiment*)) AND (title:(("clinical trial*" or "primary care" or "primary medical care" or outpatient* or "general practice" or "practice-based" or commercial or communit* or "phone call*" or telehealth or "tele-health" or teleconsultation* or tele-consultation* or app* or mobile or web or internet or online or "text messag*" or "social media" or remote or e-mail* or "cell phone*" or smartphone* or ((universit* or college* or undergraduate*) AND student*)) OR ab:(("clinical trial*" or "primary care" or "primary medical care" or outpatient* or "general practice" or "practice-based" or commercial or communit* or "phone call*" or telehealth or "tele-health" or teleconsultation* or tele-consultation* or app* or mobile or web or internet or online or "text messag*" or "social media" or remote or e-mail* or "cell phone*" or smartphone* or ((universit* or college* or undergraduate*) AND student*)) OR subject:(("clinical trial*" or "primary care" or "primary medical care" or outpatient* or "general practice" or "practice-based" or commercial or communit* or "phone call*" or telehealth or "tele-health" or teleconsultation* or tele-consultation* or app* or mobile or web or internet or online or "text messag*" or "social media" or remote or e-mail* or "cell phone*" or smartphone* or ((universit* or college* or undergraduate*) AND student*))) AND LA:english AND YR:[1990 TO 2019]
```

Additional comments

Nutrition and Food Sciences is a specialist database on human nutrition, food science, and food technology. This search string was adapted from Scopus, specifically excluding news, conference abstracts, and bulletins. In developing the search string, we looked into detailed keyword (metadata) tagging and examined their 'smart searches.' There is no way to do proximity searching in CABI. To run the search, enter the string into the basic search box. There is not a way to integrate 'Item Type' syntax into the search string. When refining the search results, it is not possible to select multiple 'Item Type'. For this search, most of the hits are 'Journal article'. This search string will not be able to limit by Item Type.

To export, click 'Mark All'. This will add whatever is on that page. We did this for batches of 500 to avoid any issues with large file size. Click on the download icon beside 'My Nutrition'. From here, an export is possible under the 'Selected records' tab.

Medline Pending

The Medline Pending search string is:

```
((("diet program" or "weight loss intervention" or "behavioral therapy" or "obesity management" or ((counsel or consult or visit or advice or session or meeting) and (diet or nutrition or "weight loss")))) and (bodyweight or weight or bmi or "body mass index" or obese or overweight or anthropometry or "body composition") and (trial or experiment) and ("clinical trial" or "primary care" or "primary medical care" or outpatient or "general practice" or "practice-based" or commercial or community or "phone call" or telehealth or "tele-health" or teleconsultation or teleconsultation or app or mobile or web or internet or online or "text message" or "social media" or remote or e-mail or "cell phone" or smartphone or ((university or college or undergraduate) adj3 student)).ti,ab,kf.
```

Additional comments

Medline Pending catches results that have not yet been indexed or checked for inclusion into Medline, thus yielding very recent results. To run the search, paste the search string into the 'Advanced Search' box. Manually select 'Publication year' and 'English Language' limits. When searched, this should appear as 'limit 1 to (English language and yr="1990 -Current")'. The results can be filtered by Publication Type, but this feature was not used since only one document type can be selected. Since most of the hits from this search are journal articles, the publication type filter was not applied.

When exporting, only 200 results can be exported at a time. Thus, the yields must be broken into batches by year: (1990-2015, yield: 154; 2016-2017, yield: 110; 2018-Current, yield: 183). Export using format RIS, fields 'Complete Reference', and include 'Link to External Resolver' and URL.

HIERARCHY FOR EXCLUDING STUDIES

Appendix Table 1. Hierarchy for excluding studies

| | Category | Study criteria | Action if don't meet study criteria & exclusion reason |
|----|--------------|---|--|
| 1 | Study design | Year: published in January 1, 1990 to present | Exclude → 1. Date |
| 2 | Study design | Document type: original data (eg, not a review, editorial, comment) | Exclude → 2. Document type |
| 3 | Study design | Full text: studies published in full text, and not abstract only | Exclude → 3. No full text |
| 4 | Study design | Peer-reviewed: peer-reviewed study published in a journal | Exclude → 4. Not peer-reviewed |
| 5 | Study design | Language: published in English | Exclude → 5. Language |
| 6 | Participants | Humans adults ≥18 years old | Exclude → 6. Not humans/age |
| 7 | Setting | Country: conducted in a high income country, as defined by the OECD or the World Bank | Exclude → 7. Country |
| 8 | Study design | Refers to the design used the publication's analysis; if the publication is a sub-study or secondary analysis of a larger study, 'study design' does not refer this larger study. Study designs: <ul style="list-style-type: none"> • Experimental studies or randomised controlled studies, including cluster • Quasi-experimental studies or non-randomised control studies <i>only if</i> this non-randomisation occurs at a <i>group level</i> | Exclude → 8. Study design |
| 9 | Participants | General population: General population but including large population groupings such as "women with pre-diabetes" or "African American men with high blood pressure" etc. Includes individuals who have completed treatment (eg, cancer survivors) or surgery (eg, coronary artery bypass graft) <ul style="list-style-type: none"> • Not targeting special populations with limited applicability to the general population (eg, pregnant women, individuals with schizophrenia who have obesity, people currently undergoing cancer treatment) | Exclude → 9. Special population |
| 10 | Comparator | Study must compare the intervention to no intervention (control), usual care, minimum care, or nominal intervention (ie, group exposed to intervention activities unrelated to weight loss such as watching a film on recycling) | Exclude → 10. Comparator |

| Category | Study criteria | Action if don't meet study criteria & exclusion reason | |
|----------|--|---|----------------------------|
| | | <ul style="list-style-type: none"> • Usual care and minimum care are <i>not</i> in reference to usual or minimum dietary counselling. • Any provided care must <i>not include</i> any activities that would meet the review's definition of dietary counselling • A comparison group may only have a physical activity aspect if this component was intended by the study investigators to be <i>non-effective or minimally effective at promoting weight loss</i> (eg, vouchers for free access to a fitness facility, information pamphlets, other basic information) • A comparison group may consist of a group taking a placebo drug • The comparison group did not receive a pharmacological intervention • The comparison group did not receive other types of interventions intended to promote weight loss | |
| 11 | Participants | <p>Studies targeting (or reporting as a sub-group) individuals with overweight or obesity based on <i>one or more</i>:</p> <ul style="list-style-type: none"> • BMI ≥ 25 kg/m² • Weight-related eligibility criteria that does not state a specific BMI, but that limits study participants to persons with 'overweight' or 'obesity' • Baseline sample characteristics where mean BMI minus 1 standard deviation ≥ 25 kg/m² [eg, for mean BMI of 30 ± 2.1, $30 - 2.1 = 27.9$] | Exclude → 11. BMI |
| 12 | Primary outcome | Outcome: pre- and post-intervention change in weight or BMI must be reported | Exclude → 12. Outcome |
| 13 | Dietary counselling for weight loss intervention | <p>Intervention: dietary counselling for weight loss meeting <i>all of these criteria</i>:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Aims to achieve weight loss <input type="checkbox"/> Provides nutrition recommendations that are responsive to the individual's or group's health status (eg, high BMI), current diet, or nutrition-related goals <input type="checkbox"/> Not focused on pharmacological interventions (eg, weight loss drug), a specific nutrient of food (eg, flaxseed), or specific supplement (eg, magnesium), or interventions where provision of meals or meal replacement products is a substantial part of the intervention, even if some dietary counselling is provided | Exclude → 13. Intervention |

| Category | Study criteria | Action if don't meet study criteria & exclusion reason |
|----------|--|--|
| | <ul style="list-style-type: none"> <li data-bbox="647 309 1139 465">❑ Not a pre-surgical lifestyle intervention before any type of surgery. This includes weight-loss surgeries such as bariatric or gastric bypass and also other procedures such as organ transplants <li data-bbox="647 472 1139 560">❑ Not a post-surgical lifestyle counselling following weight-loss surgeries such as bariatric or gastric bypass | |

DEFINITIONS OF STUDY CHARACTERISTICS

Appendix Table 2. Definitions of study characteristics

| TERM | DEFINITION |
|---------------------------------------|---|
| Identification | |
| First author, year | The first author's last name and year of publication. |
| Full reference | The publication's full reference. |
| Publication year | The year of publication. |
| Data extraction status | For this study, the current stage of data extraction (select one of: Brief, Full, Not complete; Secondary). 'Secondary' indicates that this study is a secondary study, and therefore will not be extracted. |
| Exclusion reason | The hierarchy of reasons for excluding a study from brief data extraction [select first relevant option from: Publication year, Setting, Study design, Intervention aim, Risk or Disease category, N/A (included)]. |
| Country | The country where the intervention was conducted. |
| Study (trial) name | If provided, the trial's name. If no trial name is provided, but the study's intervention has a specific name that may be a helpful identifier, use the intervention name and indicate that this an intervention, not a trial name. If neither is mentioned, add 'None mentioned'. |
| Consulted additional materials | Whether or not the authors cited additional materials on the study's methods (eg, protocol, previous studies, etc), and whether or not these were consulted during data extraction (select one of: none cited; cited, not consulted; cited, consulted). Make sure that consulted materials are attached within Covidence record. If the publication provided sufficient detail to conduct data extraction, then additional materials do not need to be consulted. |
| Corresponding secondary study | For publications where this is the main study and there is one or more secondary studies (select one of: no; yes). Add information to the tab 'Secondary studies'. |
| Multiple interventions | For publications where the study has more than one intervention that meets the review's definition of dietary counselling for weight loss (select one of: no; yes). |

| TERM | DEFINITION |
|---|---|
| Methods | |
| Study design (reported) | The study design type, as reported by the authors. Refers to the general design of the study for understanding the relationship between independent and dependent variables. |
| *Study design (category) | <p>Based on the review's definitions of different study design types, what is the study design (select one of: RCT; Cluster randomised controlled trial; quasi-experimental study). Definitions adapted from Guest & Namey (2015) Public Health Research Methods.</p> <p><i>RCT</i>: Individuals are assigned to the intervention or control based on randomisation.</p> <p><i>Cluster randomised controlled trial</i>: The unit of randomisation is at a level higher than the individual (eg, hospital or facility, or geographic unit such as district). Based on randomisation, the unit is assigned to the intervention or control.</p> <p><i>Quasi-experimental study</i>: Involves an intervention group and a comparison group, but this assignment is determined by means other than randomisation. The only included quasi-experimental studies are those in which non-randomisation occurs at a group level (eg, a family health practice, community centre, city). This study design may also be referred to as a 'natural experiment' or 'non-equivalent control group'.</p> |
| *Describe any stratification or matching used | Authors' descriptions of what characteristics (if any) were stratified or matched. If nothing mentioned, add 'None mentioned'. This information is later used when deciding how much any group differences were controlled for. |
| Number assigned | The total number of people that were assigned to a group. |
| Small sample size | A study with a small sample size is when 60 or fewer people were assigned to a group. This is auto-populated based on the number in 'Number assigned'. |
| *Withdrawals and dropouts: described the numbers AND reasons | Whether the authors described the numbers <i>and</i> the reasons for withdrawals and dropouts (select one of: 1 Yes; 2 No). |
| *% completion (each described group) | For each described group (ie, intervention groups, control groups), the percentage of participants that completed the study. If nothing mentioned, add 'None mentioned'. |

| TERM | DEFINITION |
|---|---|
| *Lowest % completion | Based on the '% completion (each described group)', select the lowest value of % completed (select one of: 1 80 - 100%; 2 60 - 79%; 3 less than 60%; 4 Can't tell). 'None mentioned' equates to '4 Can't tell'. |
| Study duration (months) | The total duration of the study, in months. |
| *Outcome assessor aware of exposure status | Whether or not the person assessing weight and height was aware of which group the participant was assigned to (select one of: 1 Yes; 2 No; 3 Can't tell). |
| *Participants aware of research question | Whether or not the study participants were aware of the study's research question (select one of: 1 Yes; 2 No; 3 Can't tell). |
| *Weight data assessment | How weight was assessed within the study (select one of: 1 Measured; 2 Self-reported; 3 Can't tell). |
| *Height data assessment | How height was assessed within the study, if it was assessed (select one of: 1 Measured, 2 Self-reported, 3 Can't tell, 4 Height not reported) |

| Population Characteristics | |
|--|--|
| Inclusion criteria | What the authors describe as the study's inclusion criteria. Exclude any comments on weight or BMI. If the authors frame criteria as only exclusion criteria, add 'See exclusion criteria'. |
| Exclusion criteria | What the authors describe as the study's exclusion criteria. Exclude any comments on weight or BMI. If the authors frame criteria as only inclusion criteria, add 'See inclusion criteria'. |
| Eligible BMI (kg/m²) | The authors' inclusion and exclusion criteria pertaining to BMI (or weight, if BMI is not used). If nothing mentioned, add 'None mentioned'. |
| Risk or disease category | Based on criteria used by the study's authors and the objectives of the study and intervention, identify which risk or disease category best describes the study's participants at baseline. The health of the population will influence the nature of the intervention and the study's outcomes, including BMI. Select one of: <i>Risk of CVD:</i> Includes individuals with raised blood pressure (hypertension) or raised blood cholesterol, or at risk of one of these conditions. Other characteristics may have been used to identify risk of CVD, such as weight status, |

| TERM | DEFINITION |
|--|---|
| | <p>family history, gender, physical activity level, tobacco use, or type 2 diabetes. Excludes individuals who meet the criteria for 'Have CVD'.</p> <p><i>Have CVD:</i> More severe than 'Risk of CVD'. Consists of individuals who have some type of CVD, including: coronary artery diseases (CAD) such as angina and myocardial infarction (commonly known as a heart attack); stroke; heart failure; hypertensive heart disease; rheumatic heart disease; cardiomyopathy; abnormal heart rhythms; congenital heart disease; valvular heart disease; carditis; aortic aneurysms; peripheral artery disease; thromboembolic disease; and venous thrombosis.</p> <p><i>Risk of T2DM:</i> Includes individuals with pre-diabetes or at risk of pre-diabetes. Other characteristics may have been used to identify risk of T2DM, such as diet, weight status, family history, physical activity level, tobacco use, or history of gestational diabetes. Excludes individuals who meet the criteria for 'Have T2DM'.</p> <p><i>Have T2DM:</i> More severe than 'Risk of T2DM'. Consists of individuals who have T2DM.</p> <p><i>Cancer survivors:</i> Individuals who have completed cancer treatment.</p> <p><i>Have other known chronic condition:</i> The study's participants are characterised as having some other known chronic condition, such as sleep apnea, infertility, or mild depression.</p> <p><i>General or unspecified:</i> The authors do not have specific criteria pertaining to disease risk or disease status, nor is the intervention designed to specifically reduce risk around one of these conditions. This category will encompass studies that target individuals with overweight or obesity, studies that target the general population, or studies that aim to improve general wellbeing, so long as the study does not meet the definition of one of the above categories.</p> |
| Risk or disease category: notes | If necessary, add any explanatory notes for the decision made on 'Risk or disease category'. If none are necessary, add 'None'. |
| *Sample representative of target population | <p>The potential for selection bias is considered and how likely the study's participants are to be representative of the target population. Based on the following definitions, select one of:</p> <p><i>1 Very likely:</i> participants were selected from a comprehensive list of individuals in the target population</p> <p><i>2 Somewhat likely:</i> participants were referred from a source (eg, clinic) in a systematic manner</p> <p><i>3 Not likely:</i> participants self-referred</p> |

| TERM | DEFINITION |
|---|---|
| % agreed to participate: calculation notes | <p>4 <i>Can't tell</i>: the authors do not provide enough information to confidently identify one of the above categories.</p> <p>Record information for the study on number of people who were invited (eligible) and the number of people who agreed to participate (enrolled). Calculate the % agreed to participate.</p> |
| *% agreed to participate | <p>Based on the calculation notes, identify the percentage of invited individuals who agreed to participate in the study (select one of: 1 80 - 100% agreement; 2 60 – 79% agreement; 3 less than 60% agreement; 4 Can't tell).</p> |
| Mean age per group | <p>For each group, the mean age, with measures of variance.</p> |
| Female (%) per group | <p>For each group, the percentage that was female. If the study uses non-binary measures of sex, include additional information.</p> |
| Baseline mean BMI (kg/m2) per group | <p>For each group, the mean baseline BMI, with measures of variance.</p> |
| *Different characteristics | <p>When comparing the groups, the characteristics that the authors identify as being notably different between the groups. List the characteristic and how it compares to another group, for example: Controls higher % females (61% v 50%). If nothing is notable, add 'nothing notable'. If so unclear that an assessment can't be reached, add 'can't tell'.</p> |
| *Baseline differences between groups | <p>Based on the information provided in '*Different characteristics'. Select one of:</p> <p>1 <i>Yes</i>: There were noted different characteristics.</p> <p>2 <i>No</i>: Nothing notable.</p> <p>3 <i>Can't tell</i>: Can't tell.</p> |
| Primarily Asian | <p>Based on the study's setting and participant characteristics, whether or not the participants were primarily of Asian ethnicity (select one of: No; Yes).</p> |

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| Intervention Characteristics | |
| Intervention | If a study has one intervention that meets the review's criteria, use 'Intervention 1'. If a study has more than one intervention that meets the review's criteria, use one row for each intervention and use the additional intervention options (ie, 'Intervention 2', 'Intervention 3', etc). |
| Authors' name for intervention | The name that authors use to refer to the study's intervention group (eg, Behavioural Group). |
| Brief description of ACTIVE phase intervention | A brief description of the active phase intervention to provide a clear overview of what happened. This description may be used to populate subsequent fields. |
| Brief description of MAINTENANCE phase intervention | A brief description of the maintenance phase intervention, which is the time period following the active phase during which a milder form of dietary counselling is offered. The maintenance dietary counselling must be less 'potent' than the active phase, but is not nothing. This description may be used to populate subsequent fields. Not all studies may have a maintenance phase. If there wasn't one, add 'none'. |
| Duration (months) of ACTIVE phase | The time period over which the active phase intervention was delivered, in the unit of time months. If unknown, add 'unknown'. |
| Duration (months) of MAINTENANCE phase | If there was a maintenance phase, the time period over which the maintenance intervention was delivered, in the unit of time months. If unknown, add 'unknown'. If there was not a maintenance phase, add 'N/A'. |
| Total duration (months) of intervention phases | The sum of the active phase duration and the maintenance phase duration, in the unit of time months. Auto-populated using previous two variables, but must manually add 'unknown' if the duration of both phases are unknown. |
| Total frequency: calculation notes | A calculation of the number of discrete interactions between the agent of delivery and the participant for delivery of the intervention (number of intervention contacts), with the total calculated. A single counselling session counts as one. Three text messages per day, over 10 days counts as 30. This will be used in quantification of the intervention's frequency and intensity. Note any interactions where assumptions must be made. |
| Total frequency | Based on the previous variable, the total frequency (total number of intervention contacts). |

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| Total intensity (mins): calculation notes | <p>A calculation of the time of interaction between the agent of delivery and the participant through which the intervention is delivered, with the total calculated (in minutes). In this calculation, the number of interactions is multiplied by the length of the respective interaction. This will be used in quantification and categorisation of the intervention's intensity. Note any interactions where assumptions must be made. We adapted the following decision rules from Patnode et al. 2017 for when interaction length was not reported:</p> <p>Telephone session: 5 min</p> <p>Mailing or print material: 5 min</p> <p>Session described as 'brief': 15 min</p> <p>Individual face-to-face session (not described as 'brief'): 30 min</p> <p>Individual web-based session (not described as 'brief'): 30 min</p> <p>Group session: 60 min</p> |
| Total intensity (mins) | Based on the previous variable, the total intensity (mins). |
| Intensity category | <p>Categorical assignment based on the total intensity. Auto-populated using previous variable. Adapted from Patnode et al. 2017, categories are defined based on:</p> <p>≤30 min: low intensity</p> <p>31-360 min: medium intensity</p> <p>>360 min: high intensity</p> |
| Setting (reported) | What the authors say the intervention setting is – the general environment in which the intervention is delivered (eg, 'tertiary hospitals'). It may be different from the means used to recruit participants. If nothing mentioned, add 'none mentioned', along with what the setting might be interpreted as. |
| Setting (category) | Based on the review's definitions of different settings, what is the setting (select one of: Primary care; Commercial; Community; Other). |

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| | <p><i>Primary care:</i> Dietary counselling is delivered in a setting that is relevant to primary care. In NZ, primary health care covers a broad range of health services, including diagnosis and treatment, health education, counselling, disease prevention, and screening.</p> <p><i>Commercial:</i> Dietary counselling is delivered in a ‘business’ context (eg, commercial weight loss programs, gyms). While the research participants may not be paying for the services (due to research design), typically the dietary counselling would involve some type of fee paid to the business. This does not include fees that individuals may pay for general primary care services.</p> <p><i>Community:</i> Dietary counselling is delivered in a setting within the neighbourhoods where participants live, work, study, or engage in leisure. Alternatively, a community setting may be based on culture, ethnicity, age, or other connecting points. A community setting is intentionally distinct from primary care or commercial.</p> <p><i>Other:</i> Dietary counselling is delivered in a setting that is not primary care, commercial, or community. Includes settings where specialist health care is delivered (eg, medically-based weight-loss clinics) and at-home interventions.</p> |
| Setting: notes | Additional details related to the setting (eg, ‘two hospitals, public and private’, ‘self-help at home’). |
| Name of commercial programme | If the intervention was delivered in a commercial setting, give the name of the commercial programme. If unknown, add ‘unknown’. If not relevant, add ‘N/A’. |
| Physical activity component in ACTIVE phase (unsupervised) | <p>Whether or not the authors describe the intervention as containing some type of physical activity consideration (select one of: no, yes). Excludes a supervised physical activity session. The physical activity component is very broad and may be:</p> <p>Recommendations: participants were recommended to engage in physical activity.</p> <p>Education: participants are provided with physical activity education or a workout programme, or linked to resources such as physical activity monitoring apps as part of the intervention; may include provision of pedometer.</p> <p>Physical activity supports (excluding a supervised physical activity session): participants are provided with access to fitness facilities or equipment, such as group fitness activities or a (discounted) gym membership as part of the intervention.</p> |

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| | Required physical activity (excluding a supervised physical activity session): physical activity is required as part of the intervention, but the participant conducts a physical activity programme without supervision by a physical activity specialist. |
| Physical activity supervised session in ACTIVE phase | Whether or not the authors describe the intervention as providing a physical activity session that was supervised by someone such as a physical activity specialist (select one of: no, yes) |
| Physical activity supervised session in ACTIVE phase: details | If there was a physical activity supervised session, details on the session(s) (eg, frequency, duration, content, supervisor, etc). If no session was provided, add 'N/A'. |
| Agent of delivery in ACTIVE phase (select all) | <p>Who or what provides the dietary counselling. This is distinctly different from the 'mode of delivery'. Dietary counselling may be provided by a human coach or through automated coaching (eg, websites, smartphone apps)</p> <p>Based on the following definitions, select all that apply:</p> <p><i>Dietitian:</i> Dietary counselling is delivered by an individual who has a professional designation of 'dietitian'. This designation signifies specialised training in foods, diet, and nutrition, as well as practical training in settings such as hospitals or communities.</p> <p><i>Nutritionist:</i> Dietary counselling is delivered by an individual referred to as a 'nutritionist'.</p> <p><i>General practitioner (GP):</i> Dietary counselling is delivered by an individual who has a professional designation of 'general practitioner', 'family doctor', or 'primary care physician' or similar terms.</p> <p><i>Registered nurse:</i> Dietary counselling is delivered by an individual who has a professional designation equivalent to the NZ definition of 'registered nurse'. This includes 'practice nurses' but does not include student nurses (eg, enrolled nurses) or advanced training nurses (eg, Nurse Practitioner).</p> <p><i>Lay health worker:</i> Dietary counselling is delivered by an individual who has no advanced health professional designation, nor educator designation; may also be referred to as a 'trainer community worker' or 'coach'. Individuals in this category are commonly considered community members or peers, and have likely been provided with some degree of relevant training. This category does not include the study's researchers.</p> <p><i>Other human agent of delivery:</i> Dietary counselling is delivered by an individual who is not a dietitian, GP, registered nurse, or lay health worker (eg, pharmacists, personal trainers, researchers). This includes studies where the authors do not specify the profession of who delivered the intervention (ie, unknown).</p> |

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| | <p><i>Automated text messaging, emails, or audio communication:</i> Dietary counselling is delivered through automated means using text messaging, emails, or audio communication (eg, telephone or Google Voice). ‘Automated means’ is pre-recorded, pre-programmed, or pre-written; there is not a real person providing real-time responses or content.</p> <p><i>Automated website, social media, or other smartphone app:</i> Dietary counselling is delivered through automated means using a website, social media, or other smartphone app. ‘Automated means’ is pre-recorded, pre-programmed, or pre-written (eg, website content); there is not a real person providing real-time responses or content.</p> <p><i>Other</i></p> |
| Main provider in ACTIVE phase | Selecting from the responses to the previous variable, reason out who/what the main provider was (the main agent of delivery) during the active phase (select one of: Dietitian; Nutritionist; General practitioner; Registered nurse; Lay health worker; Other human agent of delivery; Automated text messaging, emails, or audio communication; Automated website, social media, or other smartphone app; Other). If it is not apparent, select the lesser qualified person/method. |
| Additional training provided through study to agent(s) of delivery | If the authors mention additional training that was provided through the study to the agent(s) of delivery, briefly describe it. If nothing was mentioned, add ‘none mentioned’. |
| Mode of delivery – CORE components in ACTIVE phase (select all) | <p>For <i>core components</i> of the active phase intervention, this is the mode(s) of interaction through which the dietary counselling intervention is delivered. The intervention component may use any mode of delivery, or a combination of modes. This is distinctly different from the ‘agent of delivery’. Based on the following definitions, select all that apply:</p> <p><i>In-person individual format:</i> Dietary counselling occurs through face-to-face interaction with a person who is the agent of delivery and it is directed at an individual. The individual’s spouse or partner may be present.</p> <p><i>In-person group format:</i> Dietary counselling occurs through face-to-face interaction with a person who is the agent of delivery and it is directed at a group of people.</p> <p><i>Telephone, app-based, or web-based audio communication:</i> Dietary counselling occurs through mobile or landline telephones, app-based software, or web-based software applications designed to enable two-way (or multi-way) audio communication (eg, audio-only Google Voice, Viber). This includes conversations, the use of pre-programmed</p> |

| TERM | DEFINITION |
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| | <p>(pre-recorded) voice/audio messages, pre-programmed telephone interfaces that included interactions via telephone keypad or speech interaction, or other actions pertaining to the telephone. The agent of delivery may be human or automated.</p> <p><i>App-based or web-based video call:</i> Dietary counselling occurs through app-based software or web-based software applications designed to enable two-way (or multi-way) video communication (eg, video-activated FaceTime, Skype). This includes conversations, or other actions pertaining to the app-based or web-based video communication software. The agent of delivery will probably be entirely human, but may be automated. This category does not include pre-recorded videos that are accessed through a website, social media app, or other smartphone app.</p> <p><i>Text messaging:</i> Dietary counselling occurs through text messages that consist of only text and icons. Text messaging may occur through mobile phone or app-based messaging services (eg, WhatsApp, Facebook Messenger). The agent of delivery may be human or automated.</p> <p><i>Email:</i> Dietary counselling occurs through email messages. The agent of delivery may be human or automated.</p> <p><i>Intervention or dietary-counselling website:</i> Dietary counselling occurs through websites designed for the intervention or existing websites that provide dietary counselling or nutrition information. The website may have content that uses multiple mediums (eg, video content) and interactive spaces (eg, chat features). The agent of delivery may be human or automated.</p> <p><i>Social media:</i> Dietary counselling occurs through use of existing social media platforms (eg, Facebook, Twitter, Instagram). Audio calls, voice calls, text messaging, and emails through these platforms should be classified in the above categories. The agent of delivery may be human or automated.</p> <p><i>Other smartphone app:</i> Dietary counselling occurs through other smartphone apps. This includes apps designed for the intervention or existing apps. This category excludes apps used primarily for audio calls, voice calls, text messaging, emails, web browsers, and social media. The agent of delivery may be human or automated.</p> <p><i>Other</i></p> |
| <p>Mode of delivery – SUPPORT components in ACTIVE phase (select all)</p> | <p>For active phase interventions with <i>support components</i>, this is the mode(s) of interaction through which the dietary counselling intervention is delivered. The intervention component may use any mode of delivery, or a combination of modes. This is distinctly different from the ‘agent of delivery’. Based on the following definitions, select all that apply:</p> |

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| | <p><i>In-person individual format:</i> Dietary counselling occurs through face-to-face interaction with a person who is the agent of delivery and it is directed at an individual. The individual's spouse or partner may be present.</p> |
| | <p><i>In-person group format:</i> Dietary counselling occurs through face-to-face interaction with a person who is the agent of delivery and it is directed at a group of people.</p> |
| | <p><i>Telephone, app-based, or web-based audio communication:</i> Dietary counselling occurs through mobile or landline telephones, app-based software, or web-based software applications designed to enable two-way (or multi-way) audio communication (eg, audio-only Google Voice, Viber). This includes conversations, the use of pre-programmed (pre-recorded) voice/audio messages, pre-programmed telephone interfaces that included interactions via telephone keypad or speech interaction, or other actions pertaining to the telephone. The agent of delivery may be human or automated.</p> |
| | <p><i>App-based or web-based video call:</i> Dietary counselling occurs through app-based software or web-based software applications designed to enable two-way (or multi-way) video communication (eg, video-activated FaceTime, Skype). This includes conversations, or other actions pertaining to the app-based or web-based video communication software. The agent of delivery will probably be entirely human, but may be automated. This category does not include pre-recorded videos that are accessed through a website, social media app, or other smartphone app.</p> |
| | <p><i>Text messaging:</i> Dietary counselling occurs through text messages that consist of only text and icons. Text messaging may occur through mobile phone or app-based messaging services (eg, WhatsApp, Facebook Messenger). The agent of delivery may be human or automated.</p> |
| | <p><i>Email:</i> Dietary counselling occurs through email messages. The agent of delivery may be human or automated.</p> |
| | <p><i>Intervention or dietary-counselling website:</i> Dietary counselling occurs through websites designed for the intervention or existing websites that provide dietary counselling or nutrition information. The website may have content that uses multiple mediums (eg, video content) and interactive spaces (eg, chat features). The agent of delivery may be human or automated.</p> |
| | <p><i>Social media:</i> Dietary counselling occurs through use of existing social media platforms (eg, Facebook, Twitter, Instagram). Audio calls, voice calls, text messaging, and emails through these platforms should be classified in the above categories. The agent of delivery may be human or automated.</p> |

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| | <p><i>Other smartphone app:</i> Dietary counselling occurs through other smartphone apps. This includes apps designed for the intervention or existing apps. This category excludes apps used primarily for audio calls, voice calls, text messaging, emails, web browsers, and social media. The agent of delivery may be human or automated.</p> <p><i>Other</i></p> <p><i>None mentioned</i></p> |
| Main mode of delivery in ACTIVE phase (select 1-2) | <p>Selecting from the responses to the previous variables, reason out what were the main modes of delivery during the active phase (select 1-2 of: In-person individual format; In-person group format; Telephone, app-based, or web-based audio communication; App-based or web-based video call; Text messaging; Email; Intervention or dietary-counselling website; Social media; Other smartphone app; Other).</p> |
| Main mode: in-person support or remote support | <p>Whether the main mode(s) of delivery involved in-person support, remote support, or both (select one of: in-person; remote; both).</p> |
| Main mode: individual-level or group-level | <p>Whether the main mode(s) of delivery was individual-level, group-level, or both (select one of: individual; group; both), based on the following definitions:</p> <p>Individual: the dietary counselling delivery interactions were between the participant and the agent of delivery, and did not actively involve interactions with other research participants.</p> <p>Group: the dietary counselling delivery interactions involved engagement between the participant, the agent of delivery, and other participants.</p> <p>Both: the study used both individual-level and group-level engagement in the delivery of dietary counselling.</p> |
| Main mode: technology-based (excludes phone calls) | <p>Whether the main mode(s) of delivery was or wasn't technology-based (select one of: yes; no; both). Technology excludes phone calls.</p> |
| Intervention aim in ACTIVE phase | <p>What the intervention in the ACTIVE phase was aiming to achieve (select one of: primarily weight loss; multiple risk factors, including weight). These categories are defined as follows:</p> <p><i>Primarily weight loss:</i> the intervention is primarily focused on reducing weight. The study is most likely framed as being about a weight loss intervention.</p> |

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| | <p><i>Multiple risk factors, including weight:</i> the intervention aims to improve multiple risk factors, including weight. The study is most likely framed at addressing a non-weight risk factor (eg, reducing CVD risk), or a combination of risk factors.</p> |
| Intervention aim in ACTIVE phase: notes | <p>If necessary, add any clarifying notes to explain why the previous variable's answer was selected. If nothing to mention, add 'None'.</p> |
| Medication provision | <p>If the <i>study</i> involved the provision of medication, provide some details. If no medication was provided, add 'None'.</p> |
| Brief description of COMPARATOR | <p>A brief description of the comparator to provide a clear overview of what happened. This description may be used to populate the subsequent field.</p> |
| Comparator category | <p>Based on the below definitions, select what best describes the group that the intervention group was compared to (select one of: usual care; minimum care; control; nominal intervention; other). The comparison group cannot be a retrospective control or created by matching the intervention group to existing datasets. The comparison group cannot be other types of interventions intended to promote weight loss. However, a comparison group may have a physical activity aspect only if this component is intended by the study investigators to be non-effective or minimally effective at promoting weight loss (eg, vouchers for free access to a fitness facility, information pamphlets, other basic information). Comparison groups with a substantial physical activity intervention are ineligible (eg, tailored guidance, coaching or personal trainer, required physical activity). In addition, the comparison group cannot include any type of pharmacological intervention, regardless of whether or not it is a weight loss drug or some other type of drug (eg, insulin). However, a comparison group that receives a placebo is eligible.</p> <p><i>Usual care:</i> Participants are provided with usual health care by a health professional or health programme, which does not include dietary counselling for weight loss (as defined by the study). However, usual care may include brief information about nutrition or weight loss. This is often delivered within the context of an existing primary care provider.</p> <p><i>Minimum care:</i> Participants are provided with some type of brief information about nutrition or weight loss (eg, nutrition-related print material, referral to website that does not provide tailored nutrition advice, a brief information session). Any provided care must not include any activities that would meet the review's definition of dietary counselling.</p> |

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| | <p><i>Control:</i> Participants receive no intervention, such as a wait list intervention.</p> <p><i>Nominal intervention:</i> Participants are exposed to nominal intervention activities unrelated to weight loss (eg, watching a film on recycling). Any provided care must not include any activities that would meet the review's definition of dietary counselling.</p> <p><i>Other</i></p> |
| Physical activity component in COMPARATOR | Whether or not the authors describe the intervention as containing some type of physical activity consideration (select one of: no, yes). Excludes a supervised physical activity session. A comparison group may have a physical activity aspect only if this component is intended by the study investigators to be non-effective or minimally effective at promoting weight loss (eg, vouchers for free access to a fitness facility, information pamphlets, other basic information). Comparison groups with a substantial physical activity intervention are ineligible (eg, tailored guidance, coaching or personal trainer, required physical activity). |
| Outcomes | |
| *Describe any adjustment for characteristics | Based on the analysis methods, describe any adjustment for characteristics that were different at baseline. This may consist of including baseline values for dependent variables in each regression model, sensitivity analysis for gender and race. If nothing mentioned, add 'None mentioned'. |
| *% group differences controlled for: calculations | Write out the calculations taken to answer the next question and include any relevant notes. Take into consideration the answers to '*Different characteristics', '*Describe any stratification or matching used', and 'Describe any adjustment for characteristics'. |
| *% group differences controlled for | Based on the above, select a category (select one of: 1 80-100% (most); 2 60-79% (some); 3 Less than 60% (few or none); 4 Can't tell; 5 Not applicable). |
| Adjusted for clustering effect | For studies with a cluster sample, whether or not the analysis adjusted for a clustering effect (select one of: No; Yes; N/A). |
| *Analysis by allocation rather than actual intervention | Whether or not the analysis was by allocation rather than only the participants who ended up receiving the intervention (select one of: 1 Yes; 2 No; 3 Can't tell). |

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| Data to be extracted from graphical form | Flag whether or not there is data that needs to be extracted from a graphical format (select one of: no, yes). If yes, add location information, such as the figure number (eg, Figure 2). |
| Notes | Add any useful brief notes about the analysis, especially as pertains to the question about 'analysis by allocation rather than actual intervention'. |

*Denotes characteristic for use in critical appraisal

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