




REVIEW

Weight management / Intervention

Obesity intervention evidence synthesis: Where are the gaps and which should we address first?

Michelle Blaxall¹  | Rachel Richardson² | Anel Schoonees³ |
 Maria-Inti Metzendorf⁴ | Solange Durão⁵ | Celeste Naude⁶  | Lisa Bero⁷ |
 Cindy Farquhar⁸ 

¹School of Medicine, University of Auckland, Auckland, New Zealand

²Evidence Production and Methods Directorate, Cochrane, London, UK

³Centre for Evidence-based Healthcare, Division of Epidemiology and Biostatistics, Faculty of Medicine and Health Sciences, Stellenbosch University, Cape Town, South Africa

⁴Institute of General Practice, Medical Faculty of the Heinrich-Heine University, Düsseldorf, Germany

⁵South African Medical Research Council, Capetown, South Africa

⁶Centre for Evidence-based Health Care, Division of Epidemiology and Biostatistics, Faculty of Medicine and Health Sciences, Stellenbosch University, Cape Town, South Africa

⁷School of Medicine and Public Health, Center for Bioethics and Humanities, University of Colorado Anschutz Medical Center, Aurora, Colorado, USA

⁸School of Medicine, University of Auckland; National Women's Health Services, Auckland Hospital, Auckland, New Zealand

Correspondence

Professor Cindy Farquhar, Faculty of Medical and Health Sciences, University of Auckland, Private Bag 92019, Auckland Mail Centre 1142, Auckland, New Zealand.
 Email: c.farquhar@auckland.ac.nz

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Summary

Health professionals and policymakers rely on evidence synthesized from high quality research studies. Yet, there remain unanswered questions about how to prevent and treat obesity. In this research project, international practice guidelines and Cochrane systematic reviews were examined in order to identify gaps in the synthesized obesity intervention evidence base. One hundred and forty-two partial or complete gaps were found. Systematic review questions to address these gaps were formulated and subjected to a prioritization consultation process with 36 international obesity expert stakeholders. Forty-three review questions were priority-assessed. The top 10 ranked review questions received support from at least 75.0% of stakeholders. The leading questions focused on preventive and community-based approaches, including those delivered through primary-care. Children within the context of their families were a highly-prioritized target group, as were persons with diabetes or disabilities. Experts also prioritized reviews to determine which elements of programs are the most effective, and by which mode they are best delivered. Experts recommended that negative, psycho-social, and longer-term outcomes be captured in reviews. We request reviewers and funders to strongly consider addressing the top 10 leading prioritized review questions presented here.

KEYWORDS

gap analysis, obesity, practice guidelines, prioritization, systematic review

1 | INTRODUCTION

The World Health Organization highlights obesity as a significant yet potentially modifiable noncommunicable disease that currently compromises health and health care systems in almost every country.¹ Overall, successful population management of the obesity epidemic eludes us. It is important to take stock and ask ourselves if we are making the most of the existing synthesized knowledge about what is effective, and what gaps may remain.

A systematic review seeks to answer a well-formulated and specific question according to pre-stated and transparent methods, synthesizing the totality and certainty of evidence from research that meets sufficiently high standards.² A large number of obesity-related reviews can be found in the published literature; however, there remain problems in the synthesized evidence base. Inconsistent terminology, assumptions, and treatment of the data are apparent in the primary research,³ sometimes arising from the differing scientific background of the researchers, making it difficult for reviewers to synthesize results from all relevant studies. Reviews can become dated, lagging behind emerging primary research. Nor are all systematic reviews of a high standard.⁴ Reviews sometimes overlap in scope with other reviews, which can be a result of author-generated topics in isolation from each other. Despite possible duplications in the obesity evidence base, it is likely that gaps remain in review coverage of obesity interventions.

Cochrane, an international independent non-profit collaborative network, has taken a leading role since 1993 in the promulgation of systematic reviews in healthcare, in particular in the development of methods, standards and software.^{2,5} Cochrane maintains an online library database on which high quality reviews are published, and which can be updated as fresh primary research emerges.⁶ A range of review types are published, including reviews of diagnostic test accuracy, prognosis, methodologies, and qualitative evidence synthesis.⁶

For this study, intervention reviews were of interest, with intervention defined as spanning the gamut from prevention to treatment, and from individual-level to population-level delivery.

Systematic reviews play a key role in knowledge translation, forming the evidence base underpinning clinical practice and public health guideline recommendations. International guideline development standards emphasize the importance of including an assessment of the certainty of evidence from systematic reviews, translating the evidence into recommendations, and grading the strength of the recommendations.^{7,8} However, this process is lacking in many guidelines.⁹

Cochrane reviews are often cited in guidelines, although Lunny et al found as few as 20% of clinical practice guidelines examined cited Cochrane reviews, and that 79% of the remaining guidelines could have in fact used at least one relevant available Cochrane review to inform recommendations.⁹ Thus, many guidelines are missing available high quality evidence.^{9,10}

In recent years, there has been increasing recognition that stakeholder input has the potential to improve the equity and translation of research, as well as the quality of consumer experience

of healthcare.¹¹⁻¹³ International colleagues in public health, nutrition, metabolic, and endocrine fields associated with Cochrane saw possibilities for synergies in working with each other to set an agenda for future systematic reviews of obesity intervention research using a structured and consultative process. The objective was to determine leading obesity intervention questions that should be prioritized for systematic review.

2 | METHODS

There were two research phases: in Phase I (Gap Analysis), we analyzed guideline documents and Cochrane systematic reviews to identify gaps in the evidence base, and formulated draft systematic review questions to address the gaps; and in Phase II (Consultation and Prioritisation), we consulted with experts to prioritize the review questions. A flow chart summarizing study method processes and outputs for each phase is presented in Table 1.

2.1 | Phase I method

2.1.1 | Guidelines data

Identifying guidelines

Eligible documents included Clinical Practice Guidelines, Consensus Statements, Scientific Position Papers, and Public Health Guidelines, where the primary focus was the prevention, treatment, or management of overweight and obesity. We will refer to these as 'Guidelines' hereafter. Guidelines could have been developed and issued by intergovernmental organizations (e.g., World Health Organization), governmental agencies (e.g., health departments), professional healthcare practitioner bodies, non-governmental organizations, and expert groups. A search for guidelines published in 2014 and beyond was conducted (by MIM) using the TRIP database, ECRI Institute Guidelines Trust, and the GIN International Guideline Library. Nine websites of relevant international organizations were also searched, namely: World Obesity Federation, European Association for the Study of Obesity, Australian and New Zealand Obesity Society, Asia Oceania Association for the Study of Obesity, The Obesity Society, Association for the Study of Obesity, International Federation for the Surgery of Obesity and Metabolic Disorders, WHO Guidelines via PubMed Bookshelf, and NICE. Details of the search are available in the [Supporting Information](#). Further, international Cochrane networks were consulted informally to source any guidelines not already retrieved.

Eligibility criteria

Guidelines were included if they had the following: a systematic literature search, graded recommendations (either Grade of Recommendation or Level of Evidence reported); and recommendations directly or indirectly linked to citations. Overweight and obesity definitions had to be consistent with Body Mass Index ≥ 25 and ≥ 30 kg/m²,

TABLE 1 Flow chart of study processes.

PHASE ONE		PHASE TWO	
> Process >	> Process >	> Process >	> Process >
Search for international evidence-based obesity guidelines	Gap analysis of 22 eligible guidelines	Formulation of review questions to address gaps	Search of Cochrane Database
Output	Output	Output	Output
57 guidelines found	142 evidence gaps identified	49 questions formulated	36 reviews 7 protocols identified
			Mapping of review evidence to gap questions
			Development of consultation process
			Identification of expert stakeholder pool
			Prioritization by obesity expert stakeholders (n = 36)
			Output
			43 review questions ranked in order of priority

respectively. A number of pragmatic criteria were also applied, such as full text being available with formatted and easily identifiable research recommendations.

Identification of evidence gaps

Gaps were identified by a minimum of two researchers (RR, AS) examining the text of the guidelines. Gaps were identified from guidelines, including recommendations when there was an acknowledgment that the evidence was weak, when explicit suggestions for research were made, and also from statements in the text pointing to areas of concern, unmet needs, and information paucity. Gaps in knowledge about non-modifiable risk factors, such as genetic causes of obesity, were not included, as were any considered too vague or general.

Draft review question development

Using the gap information extracted from the guidelines, draft review questions to address up to 50 specific gaps were formulated. Each question was formulated to be operationalizable for systematic review, using the PICO framework of Population, Intervention, Comparator, and Outcome² as indicated by the guidelines. These draft review questions were put forward for gap mapping, as described in Section 2.1.3.

2.1.2 | Cochrane systematic reviews data

Search

The search was limited to only those titles published on the Cochrane Database of Systematic Reviews (CDSR), in order to use reviews which were highly likely to meet quality and reporting standards necessary for our analyses. The search terms “obes*” and “overweight” were searched for in the title, abstract and keywords of CDSR publications published from Jan 2006 through to Nov 2020, spanning an approximate 15-year period. Retrieved titles were screened in duplicate to identify only those directly relevant to overweight and/or obesity intervention. Protocols, which are published specifications for reviews underway, were included. Non-intervention reviews, such as reviews of tests and methods, were excluded.

Data extraction

Data extraction from the included reviews were performed by two reviewers (RR and AS), cross-checking any disagreements to achieve resolution. Comprehensive data was extracted from each study, with PICO data being the most relevant for our purposes. Specifically target population(s) and settings, intervention approaches including level of intervention delivery, comparators, and outcomes, including timing of outcome measurement.

2.1.3 | Gap analysis method

New draft review questions were developed, paying particular attention to the populations, interventions, comparators, and outcomes (PICO) called for in the Guidelines where specified. Identified existing

Cochrane reviews and protocols were mapped to the new drafted review questions if they were considered to fully or partially address the terms in the draft review question. For example, if a draft review question asked for a comparison among lifestyle intervention programs to determine the optimal one, a review that looked at a single type of lifestyle program would have been regarded as partially addressing the question. Reviews were also categorized according to currency of the most recent CDSR published version using a Red Amber Green (RAG) color-coding system.

Refinement of draft review questions

Draft review questions were revised a final time, combining or eliminating overlapping questions, ensuring that both content and wording was clearly distinct from each other. This was important because expert stakeholders would be prompted to assess draft review questions in relation to each other. Very minor edits were made to improve readability before presentation to expert stakeholders as described in Phase II.

2.2 | Phase II method

2.2.1 | Development of prioritization consultation questionnaire

An online questionnaire was chosen as the most appropriate vehicle for international consultation and prioritization, taking into account COVID pandemic restrictions. The questionnaire was developed using the Qualtrics™ software platform. The systematic review questions were grouped into six topic sections: preventive interventions for infants, children and adolescents; treatment interventions for infants, children, and adolescents; treatment interventions for adults excluding surgery; surgical treatments; preventive interventions; and interventions for defined at-risk groups. Through the questionnaire menu, respondents could select topic sections, as well as the order in which they chose to answer them. Of the 43 distinct review questions, five were presented twice in the questionnaire as they fitted into more than one topic section; thus, 48 items in total were presented for assessment. For example, a review question about bariatric surgery for Type 2 diabetes patients was presented in both the Surgical and the Defined At-Risk Groups topic sections of the questionnaire. Experts were not expected to complete every section, because we predicted that not all would want to contribute outside their personal sphere of expertise.

Each topic section was headed with the banner question “What are the most important questions that should be reviewed now?” Experts were asked to make a binary choice for each item, consisting of either “Prioritise” or “De-prioritise.” They were asked to make their choices in comparison to “other reviews that could be done.” In a free text field, experts were prompted to comment or suggest modifications to each question. At the end of the topic section, experts were prompted in an open-ended manner to suggest other related reviews. A similar prompt and free-text-field was provided at the end of the

questionnaire upon exiting. Free text comments fields throughout were intended to generate qualitative feedback to be examined for themes raised across experts. As a service to experts and to improve the quality of contributions, hyperlinks to any related existing reviews identified on the Cochrane database were provided throughout the questionnaire where relevant.

Alpha and beta testing took place with staff based at Cochrane Headquarters in London, United Kingdom and at the University of Auckland, New Zealand. A copy of the questionnaire is available in the [Supporting Information](#) attached to this article.

2.2.2 | Identification of expert stakeholders

Expert stakeholders (referred to as experts hereafter) in the field of obesity intervention research and practice were identified using both reviews and guidelines extracted during Phase 1 to identify lead agencies and authors. Additional internet research was required in some cases to determine email addresses, and to supplement with additional expertise such as in indigenous health and consumer representation. A total of 103 agencies and individuals were identified, comprising: issuing agencies of professional practice guidelines as well as lead authors of guidelines where known ($n = 40$); corresponding authors of Cochrane obesity-related systematic reviews ($n = 38$); and other valuable expert stakeholders ($n = 25$). The other valuable expert stakeholders category consisted of: consumer organizations or representatives found via online search; selected published researchers; and prominent Māori and Pacific experts in nutrition, bariatric surgery, policy, and indigenous health. The latter group was included to better meet the conditions of the study's ethical approval as described above.

2.2.3 | Recruitment of expert stakeholders

A total of 103 invitations to participate were sent by email containing a hyperlink to the online questionnaire. A snowball recruitment strategy was employed, whereby experts were encouraged in the emailed invitation to forward to a co-author or other suitable expert if necessary. Where an email non-delivery notification was received, a follow-up attempt was made to invite a review co-author. The consultation period was open for a 1 month duration beginning 19 December 2021.

The sequence of processes throughout this study are presented in Table 1, along with the outputs at each step.

3 | RESULTS

3.1 | Phase I results

3.1.1 | Guidelines results

The search identified 56 guidelines dating from Jan 2014 to Jan 2019, supplemented by one additional guideline sourced from Cochrane

TABLE 2 Selected professional guidelines for obesity treatment and prevention.

Agencies	Guideline title
American College of Cardiology American Heart Association The Obesity Society	Guideline for the management of overweight and obesity in adults 2014 ¹⁴
American College of Obstetricians and Gynecologists	ACOG Practice Bulletin No 156: Obesity in Pregnancy 2015 ¹⁵
Canadian Task Force on Preventive Health Care	Recommendations for growth monitoring, and prevention and management of overweight and obesity in children and youth in primary care 2015 ¹⁶
Canadian Task Force on Preventive Health Care	Recommendations for prevention of weight gain and use of behavioral and pharmacologic interventions to manage overweight and obesity in adults in primary care 2015 ¹⁷
Danish Health Authority	National Klinisk Retningslinje for Fedmekirurgi [National clinical guideline on bariatric surgery] 2017 ¹⁸
German Society of General and Visceral Surgery	Clinical Practice Guideline: Obesity Surgery and the Treatment of Metabolic Diseases 2018 ¹⁹
French National Authority for Health	Performance criteria for bariatric surgery procedures in children under 18 years of age 2016 ²⁰
Italian Society for Pediatric Endocrinology & Diabetology Italian Society of Pediatrics	Diagnosis, treatment and prevention of pediatric obesity: consensus position statement 2018 ²¹
Korean Society of Pediatric Gastroenterology, Hepatology & Nutrition	Clinical Practice Guideline for the Diagnosis and Treatment of Pediatric Obesity 2019 ²²
NICE UK	Preventing excess weight gain: NICE guideline NG7 2015 ²³
NICE UK	Obesity: identification, assessment and management: NICE clinical guideline CG189 2014 ²⁴
NICE UK	Weight management: lifestyle services for overweight or obese adults: NICE Public Health Guideline PH53 2014 ²⁵
NICE UK	Obesity: working with local communities: Public health guideline PH42 2017 ²⁶
Queensland Health Department Australia	Maternity and Neonatal Clinical Guideline: Obesity in Pregnancy 2015 ²⁷
Royal College of Obstetricians and Gynaecologists	Care of Women with Obesity in Pregnancy: Green-top Guideline No. 722018 ²⁸
Society of Obstetricians and Gynaecologists of Canada	Obesity in Pregnancy 2018 ²⁹
US Department of Veterans Affairs US Department of Defense	Clinical Practice Guideline for Screening and Management of Overweight and Obesity 2014 ³⁰
US Preventive Services Task Force	Final recommendation statement: Obesity in Children and Adolescents: Screening 2017 ³¹
US Preventive Services Task Force	Final recommendation statement: Weight Loss to Prevent Obesity-Related Morbidity and Mortality in Adults: Behavioral Interventions 2018 ³²
WHO	Assessing and managing children at primary health-care facilities to prevent overweight and obesity in the context of the double burden of malnutrition 2017 ³³
WHO	Guideline: Sugars intake for adults and children 2015 ³⁴
WHO	Guidelines on physical activity, sedentary behavior and sleep for children under 5 years of age 2019 ³⁵

Abbreviations: NICE, National Institute for Health and Care Excellence; UK: United Kingdom; US or USA, United States of America; WHO, World Health Organization.

networks, yielding a total of 57 guidelines. Twenty two guidelines, as listed in Table 2, met the inclusion eligibility criteria specified above in Section 2.1.1 and were progressed to gap analysis. A total of 142 gaps were extracted from the included guidelines. Forty-nine new review questions were drafted to address at least one third of the identified gaps, presented in Table 3.

3.1.2 | Systematic reviews search results

An initial search of the CDSR returned over 200 titles which were screened in duplicate (by RR and AS) to limit to those only directly relevant to obesity prevention or treatment interventions. The total yield of unique titles identified was 43, comprising 36 reviews and 7 protocols.

TABLE 3 Cochrane review evidence mapped to drafted intervention questions (gap map).

Participants and setting	Intervention(s)	Comparator(s)	Outcome(s) and time indication	Cochrane review ^a Author, date, numeric ID ^b	
				Partially addresses question	Fully Addresses question
Concerning infants, children and adolescents with overweight or obesity: the focus is on treating obesity					
What are the long-term effects of referring children younger than 5 years with obesity from primary healthcare facilities for specialist care?					
Children younger than 5 years with obesity	Referring from primary healthcare facilities to specialist care	NS	Long-term		
In infants and children with overweight or obesity, what is the optimal management strategies in primary health-care facilities for desired long-term outcomes?					
Infants and children with overweight or obesity	Management strategies	Other management strategies	Long-term	Flodgren 2017 (CD000984)	Wolfenden 2020 (CD011779)
Primary health care facilities					
What are the effects of different communication strategies for caregivers of infants and children who are overweight or obese?					
Caregivers of infants and children with overweight or obesity	Different communication strategies	NS	NS		
Multi-sector linkage to continuation of care for caregivers of infants and children with overweight or obesity					
Infants and children with overweight or obesity	Multi-sector linkage to continuation of care	NS	NS		
Effects and safety of different weight loss medications for pediatric populations with obesity					
Children with obesity	Different weight loss medications		Harms		Axon 2016 (CD012436)
Effectiveness of different behavioral and pharmacologic interventions for weight management in children and youth					
Children and youth	Different behavioral and pharmacologic interventions for weight management		NS	Martin 2018 (CD009728)	Morgan 2020 (CD012547)
				Mead 2016 (CD012436)	Al-Khudairy 2017 (CD012691)
				Mead 2017 (CD012651)	Colquitt 2016 (CD012105)
				Naude 2018 (CD012960)	

TABLE 3 (Continued)

Cochrane review ^a Author, date, numeric ID ^b		Partially addresses question	Fully Addresses question
Participants and setting	Intervention(s)	Comparator(s)	Outcome(s) and time indication
In children 5 years and younger with obesity, what are the effects of different behavior interventions on weight management?	Different behavior interventions	Weight management	NS
Children 5 years and younger with obesity			Wolfenden 2020 (CD011779) Colquitt 2016 (CD012105)
In children and adolescents with obesity, what are the effects of different behavioral intervention components on short- and long-term weight management and maintenance, quality of life and other patient-important outcomes?	Different behavioral intervention components		Short- and long-term weight management, weight maintenance, quality of life and other patient-important outcomes
Children and adolescents with obesity			Vanden Brink 2020 (protocol CD013688) Dobbins 2013 (CD007651) Martin 2018 (CD009728) Loveman 2015 (CD012008) Al-Khudairy 2017 (CD012691) Mead 2017 (CD012651) Colquitt 2016 (CD012105)
In children and young people with obesity, what are the long-term effects of bariatric surgery compared to lifestyle/behavior interventions ?			
Children and young people with obesity	Bariatric surgery	Lifestyle and behavior interventions	Long-term
Concerning infants, children and adolescents without overweight or obesity: the focus is on preventing obesity			Ellis 2015 (CD011740)
In a low-resource setting where there is high prevalence of child undernutrition, what are the most effective ways for nutrition counseling for catch-up growth to prevent obesity in adolescence and adulthood?			
Children with undernutrition and their caregivers	Different ways of nutrition counseling		Prevent obesity in adolescence and adulthood
Low-resource setting with high prevalence of child undernutrition			
In children with stunting, what are the most effective interventions to manage stunting without increasing the risk of obesity?			
Children with stunting	Different interventions to manage stunting		Risk of obesity

(Continues)

TABLE 3 (Continued)

Cochrane review ^a Author, date, numeric ID ^b		Partially addresses question	Fully Addresses question
Participants and setting	Intervention(s)	Comparator(s)	Outcome(s) and time indication
What are the effects of different interventions in the primary care setting for children and youth with a healthy weight status to maintain their healthy weight status, and are there any potential harms or unintended consequences of such preventative interventions?			
Children and youth with a healthy weight status Primary healthcare	Different interventions		Maintain healthy weight status, potential harms, unintended consequences
What are the long-term effects of different interventions delivered in a school-based setting for obesity prevention in children?			
Children School setting	Different interventions aimed at obesity prevention		Long-term Morgan 2020 (CD009728) Naude 2018 (CD012960) Martin 2018 (CD009728) Brown 2019 (CD001871)
What are the effects of using BMI as a screening practice for growth monitoring in children and youth in primary care?			
Children and youth Primary healthcare	BMI as screening practice	NS	Growth monitoring
Intervention strategies for multi-sectoral approaches to improve diet and physical activity for younger children and their families			
Younger children and their families	Multi-sectoral approach strategies aiming to improve diet and physical activity	NS	NS
What are the effects of physical activity in infants and young children to prevent overweight and obesity?			
Infants and young children	Physical activity aimed at preventing overweight and obesity	NS	NS Dobbins 2013 (CD007651) Wolfenden 2020 (CD011779) Brown 2019 (CD001871)
What are the effects of different physical activity intensity and dose in young children on development and growth?			
Young children	Different physical activity intensity and dose		Development and growth Martin 2018 (CD009728) Morgan 2020 (CD012547) Mead 2017 (CD012651) Colquhitt 2014 (CD003641) Loveman 2015 (CD012008) Dobbins 2013 (CD007651) Brown 2019 (CD001871)

TABLE 3 (Continued)

Participants and setting		Intervention(s)	Comparator(s)	Outcome(s) and time indication	Cochrane review ^a Author, date, numeric ID ^b
					Partially addresses question
					Fully Addresses question
What are the effects of screen-based activities compared to interactive sedentary activities (e.g., storytelling) on health indicators of children under 5 years old?					
Children under 5 years old	Screen-based activities	Interactive sedentary activities such as storytelling	Child health indicators		
Concerning adults with overweight or obesity: the focus is on treating obesity					
In adults with obesity, what are the effects of tailoring choice of dietary intervention (to the individual's ability to adhere in the long-term) versus not tailoring choice for weight loss sustainability over the long term?					
Adults with obesity	Tailoring choice of intervention for best chance to adhere	No tailoring	Long-term weight-loss sustainability		Mastellos 2014 (CD008066)
In patients with a BMI of 40 kg/m ² or more, what are the long-term effects of using very-low-calorie diets (VLCDs) versus low-calorie diets (LCDs) on weight loss, weight maintenance, weight cycling and quality of life?					
Patients with a BMI ≥ 40 m ²	Very-low-calorie diets	Low-calorie diets	Long-term weight loss, weight maintenance, weight cycling, quality of life		
Less intensive lifestyle interventions versus comprehensive high-intensity lifestyle interventions (defined as 14 or more contacts in the first 6 months) for weight loss in adults with overweight and obesity					
Adults with overweight or obesity	Less intensive versus comprehensive high-intensity lifestyle interventions	Weight loss			Shaw 2006 (CD003817)
In adults with overweight or obesity, what are the effects of different lifestyle management programs on adherence, weight loss, weight regain?					
Adults with overweight or obesity	Different lifestyle management programs	Adherence, weight loss, weight regain			Nauade 2019 (protocol CD013334)
Effects of different remote lifestyle interventions for weight loss in adults with overweight or obesity					
Adults with overweight or obesity	Different remote lifestyle interventions	Weight loss			
Effects of different ways of delivering lifestyle modification interventions (such as face-to-face, remotely, or hybrid delivery) that are aimed to manage overweight and obesity in adults					
Adults with overweight or obesity	Different ways of delivering lifestyle modification interventions (e.g., face-to-face, remotely, hybrid delivery)	Weight management			
Different intensity/frequency of lifestyle interventions in primary care settings or paired with pharmacotherapy for maintaining weight loss in adults with obesity					
Adults with obesity Primary care setting	Different intensity and frequency of lifestyle interventions, or paired with pharmacotherapy	Maintenance of weight loss			Wieand 2012 (CD007675) Padwal 2003 (CD004094) Curioni 2006 (CD006162)

(Continues)

TABLE 3 (Continued)

Cochrane review ^a Author, date, numeric ID ^b		Partially addresses question	Fully Addresses question
Participants and setting	Intervention(s)	Comparator(s)	Outcome(s) and time indication
			Serralde-Zuñiga 2020 (CD011688) Jull 2008 (CD003892) Shaw 2006 (CD003817) Tian 2013 (CD010063) Teng 2020 (Protocol CD013576)
In adults with overweight or obesity and who have completed a lifestyle weight management program, what are the effects of different referral services compared to each other for weight management?			
Adults with overweight or obesity and who have completed a lifestyle intervention program	Different referral services		Weight management
In adults with overweight or obesity and who have before attempted to lose weight, are there unintended or adverse effects from re-referral (i.e., repeated attempts to lose weight) compared to no or another intervention?			
Adults with overweight or obesity and who have before attempted to lose weight	Re-referral (repeated attempts) to weight loss interventions	No or another intervention	Unintended or adverse effects
In adults with overweight or obesity, are there any adverse or unintended effects when long-term weight management programs are compared to each other or compared to shorter-term weight management programs , and what are the effects of these programs on weight cycling?			
Adults with overweight or obesity	Different long weight management programs compared to each other or compared to shorter weight management programs		Long-term adverse or unintended effects, weight cycling
In adults with overweight or obesity, what are the effects of 12-week (or shorter) weight loss interventions versus longer term weight loss interventions for sustaining weight loss in the long term?			
Adults with overweight or obesity	12-week or shorter weight loss interventions	Longer term weight loss interventions	Sustaining weight loss in the long-term
Effects of different strategies to promote additional weight loss beyond the first six months (of weight loss) in adults with overweight and obesity			
Adults with overweight or obesity	Different strategies to promote additional weight loss		Beyond the first six months of weight loss

TABLE 3 (Continued)

Participants and setting	Intervention(s)	Comparator(s)	Outcome(s) and time indication	Cochrane review ^a Author, date, numeric ID ^b	
				Partially addresses question	Fully Addresses question
What are the effects of different lifestyle weight management training for health professionals and lifestyle weight management staff, with the aim of improving lifestyle weight management interventions to adults with overweight or obesity , on patients' weight loss, prevention of weight gain, adherence to the intervention?					
Healthcare professionals and lifestyle weight management staff	Different lifestyle weight management training with the aim of improving lifestyle weight management interventions		Adult patients' weight loss, prevention of weight gain, adherence		Floodgren 2017 (CD000984)
In patients with obesity, what are the long-term effects of bariatric surgery compared to lifestyle interventions on weight loss, weight maintenance and quality of life?					
Patients with obesity	Bariatric surgery	Lifestyle interventions only	Weight loss, weight maintenance, quality of life Long-term		Fernandes 2007 (CD004931) Ellis 2015 (CD011740) Colquitt 2014 (CD003641)
In patients with obesity, what are the effects of bariatric surgery in academic versus non-academic settings in terms of weight loss, quality of life and complications?					
Patients with obesity	Bariatric surgery in academic setting	Bariatric surgery in non-academic setting	Weight loss, quality of life, complications		
In adults with obesity who had bariatric surgery , what are the effects of different post-operative lifestyle intervention programs (exercise, behavioral, dietary) on weight loss and weight loss maintenance?					
Adults with obesity who had bariatric surgery	Different post-operative lifestyle intervention programs (exercise, behavioral, dietary)		Weight loss, weight maintenance		
In the long-term, in patients with type 2 diabetes, what are the effects of bariatric surgery versus optimal medical treatment on diabetes-related complications and quality of life?					
Patients with type 2 diabetes	Bariatric surgery	Optimal medical treatment	Long-term effects on diabetes-related complications, quality of life		Colquitt 2014 (CD003641)
What are the effects of different surgery techniques for treating adults with obesity on short-term and long-term outcomes (e.g., complications, mortality)?					
Adults with obesity	Different surgery techniques		Short- and long-term complications, mortality		Fernandes 2007 (CD004931) Colquitt 2014 (CD003641)
What is the effect of follow-up DXA scanning of patients after obesity surgery on fracture prevention and incidence of GERD symptoms?					
Patients who underwent obesity surgery	Follow-up DXA scanning	NS	Fracture prevention, incidence of GERD symptoms		
What are the effects of closing defects in the peritoneum during primary RYGB surgery when compared to not closing defects?					
-	Closing defects in the peritoneum during primary RYGB surgery	Not closing defects	NS		
In adults with obesity, what are the effects of obesity surgery on long-term outcomes (e.g., quality of life, non-alcoholic fatty liver disease), cardiovascular morbidity (MI, ischemic stroke) and all-cause mortality?					

(Continues)

TABLE 3 (Continued)

Participants and setting		Intervention(s)	Comparator(s)	Outcome(s) and time indication	Cochrane review ^a Author, date, numeric ID ^b
					Partially addresses question
					Fully Addresses question
Adults with obesity	Obesity surgery	NS	Long-term quality of life, non-alcoholic fatty liver disease, cardiovascular morbidity (myocardial infarction, ischemic stroke), all-cause mortality	Fernandes 2007 (CD004931) Colquitt 2014 (CD003641)	
Concerning adults without overweight or obesity: the focus is on prevention					
What are the effects of different interventions for adults with normal weight and with or without specific health risks to maintain a healthy body weight?					
Adults with normal weight and with or without specific health risks	Different interventions		Maintain a healthy body weight	Heise 2016 (protocol) CD012319) Lhachimi 2020 (CD012415) Pfinder 2020 (CD012333) von Philipsborn 2019 (CD012292) Hooper 2020 (CD013636) Freak-Polli 2020 (CD009209)	
Concerning pregnant women with obesity					
What are the effects and safety of different anti-obesity drugs compared to no such drugs in pregnant women with obesity?					
Pregnant women with obesity	Different anti-obesity drugs compared to no such drugs		Harms		
What are the effects of different surgical techniques at cesarean birth in women who are obese?					
Women in labor	Different surgical techniques at cesarean section birth		NS		
Concerning various population groups including wider communities: the focus is on preventing obesity					
In various population groups with a healthy weight, what are the effects of more frequent versus less frequent self-monitoring of body weight and associated behaviors on preventing excess weight gain?					
Healthy weight population groups	Frequent versus less frequent self-monitoring of body weight		Preventing excess weight gain		
In various population groups with a healthy weight, what are the effects of various innovative technological interventions (including apps) on preventing excess weight gain and on transferability of data?					
Healthy weight populations	Different innovative technological interventions		Preventing excess weight gain, transferability of data	Metzendorf 2020 (protocol) CD013591)	

TABLE 3 (Continued)

Cochrane review ^a Author, date, numeric ID ^b		Partially addresses question	Fully Addresses question
Participants and setting	Intervention(s)	Comparator(s)	Outcome(s) and time indication
What is the best way to deliver obesity management interventions to people with particular conditions associated with increased risk of obesity (such as those with a physical disability that limits mobility, a learning disability or enduring mental health difficulties)?			
People with conditions associated with increased risk of obesity, including disabilities and mental health conditions	Different ways of delivering obesity management interventions		NS
Effectiveness of community-based obesity prevention programs in adults and children with disabilities			
Adults and children with disabilities	Different community-based prevention programs		NS
What are the effects of different behavior change approaches for the reduction of free sugar intake in especially children?			
Especially children	Different behavior change approaches for the reduction of free sugar intake		NS
		Pfänder 2020 (CD012333)	von Philipsborn 2019 (CD012292)
Effects of different interventions for the monitoring and evaluation of community-wide obesity approaches			
NS	Different interventions for the monitoring and evaluation of community-wide obesity approaches		NS
What are the effects of different incentives or techniques to encourage community-wide partnerships in preventing obesity in communities?			
Communities	Different incentives or techniques to encourage community-wide partnerships		Preventing obesity
		Freak-Poli 2020 (CD009209)	

Note: NS, not specified. Color-coded date of most recently published version on CDSR at the time of search: published before 2016 (red), published 2016–2017 (amber), and published 2018–2020 (green). Existing published systematic reviews. Relevant published protocols for forthcoming reviews are noted in brackets. This is a unique searchable number accessible on the Cochrane Database of Systematic Reviews (CDSR).

3.1.3 | Gap analysis

The mapping of the 49 draft review questions (formulated by examining gaps in the 22 included guidelines), against the 43 included Cochrane titles including the protocols, is presented in Table 3, referred to hereafter as the Gap Map. Some reviews had not been updated recently, denoted in the Gap Map by an amber (published 2016–18) or red color (published before 2016). Reviews published after 2018, including updated versions of previously published reviews, were considered adequately recent (green) in the Gap Map at the time of search.

As can be seen on the Gap Map, relevant Cochrane reviews or protocols that either fully or partially addressed the draft review questions were able to be mapped to approximately half (25 out of 49) of the questions. For the remaining draft review questions, no relevant title was identified, as indicated by blank cells in the designated columns in Table 3.

Eight titles were considered to fully address the draft review question, including one forthcoming review noted as a protocol title. Of these, only two reviews, Brown et al (2019)³⁶ and Von Phillipsborn et al (2019),³⁷ were considered both up-to-date and to fully address the question.

Note that fully addressing the question should not be conflated with answering the question completely and definitively. For example, for the draft review question “What are the effects of different behaviour change approaches for the reduction of free sugar intake in especially children?,” the von Phillipsborn review was considered to fully address this question in that it assessed the effect of environmental interventions, such as taxation and labeling, on the consumption of sugar-sweetened beverages by populations including children. While it can be seen that this review fully addresses the question, it is not necessarily a direct corresponding match in scope. In this case, the von Phillipsborn review does not comprehensively include a full range of consumable sugar-products, nor the full range of behavior change approaches. It was for this reason that all of the drafted review questions were put forward to refinement for presentation to experts.

3.2 | Phase II results

3.2.1 | Expert stakeholder participants

3.2.2 | Exclusions

Of the 49 of questionnaires submitted, nine were excluded because respondents had not completed the consent to participate, and a further four had not completed any of the prioritization items, resulting in responses from 36 experts being included for analysis.

3.2.3 | Characteristics of expert participants

The 36 experts hailed from 10 different countries across five continents. There was an approximate 60%/40% split between original

named invitees and referred respondents. In response to the question “In what capacity are you basing your judgements about obesity intervention review priorities? (select all that apply),” respondents nominated their spheres of expertise (Table 4). Most nominated more than one sphere of expertise, with an average of 2.6 spheres per participant.

Only three of the 36 experts chose to remain anonymous. A list of named participating experts can be found in the [Supporting Information](#), and they are also acknowledged on the Cochrane website.³³

3.2.4 | Quantitative prioritization results

Every draft review question presented was assessed as either “prioritise” or “de-prioritise” by an average of 30 experts, with a minimum of 25 experts assessing each question. Overall support for each draft review question was measured by calculating percentages as follows: [number of prioritizations/number of prioritizations + deprioritizations]. Percentages ranged from a low of 14.8% to a high of 89.5%, a divergent spread of support, indicating clear preference for the prioritization of some draft review questions above others. The average support rating across all questions was 63%. Seven of the proposed draft review questions achieved a prioritized support percentage of 80% or more, indicating that four out of five experts rating the question chose to prioritize it. In Table 5, the 10 most highly prioritized draft review questions are listed in rank order, with all having received support from three quarters (75%) or more of the experts.

In the case of the five draft review questions presented twice within the questionnaire, under different topic sections, the median support percentage between questionnaire sections is reported. Prioritization assessments were relatively consistent for the double-appearing review questions across the questionnaire regardless of the section in which they were presented, with variance of under 10% (range 2.9%–8.6%). This indicates reasonably consistent assessments throughout the questionnaire. The remaining complete ranked list of all 43 review questions may be found in the [Supporting Information](#) (Table S1).

TABLE 4 Participating stakeholder expertise.

Sphere of expertise	Number	Percentage
Researcher/Academic	27	75%
Guidelines Author	21	58%
Cochrane Author	13	36%
Clinician	13	36%
Community/Public Health Professional	10	28%
Research Funder	5	14%
Polymaker	4	11%
Consumer	2	6%

TABLE 5 Highly prioritized obesity intervention questions for systematic review.

Ranking	Draft review question	Support %
1	What are the effects of intervention strategies for multi-sectoral approaches to improve diet and physical activity for younger children and their families?	89.5
2	In infants and children with overweight or obesity, what are the optimal management strategies in primary health-care for desired long-term outcomes?	87.1
3	In adults with obesity, what are the effects of obesity surgery on longer-term outcomes, for example, all-cause mortality, quality of life, cardiovascular morbidity (myocardial infarction, ischemic stroke) and non-alcoholic fatty liver disease?	85.7
4	What is the best way to deliver tailored individualized obesity treatment and management interventions to people with particular conditions and disabilities associated with increased risk of obesity (such mobility limitations, learning disabilities, or enduring mental health difficulties)?	83.3
5	What methods can be used to monitor and evaluate the effectiveness of community-wide obesity prevention approaches?	81.8
6	In people with type 2 diabetes, what are the long-term effects of bariatric surgery versus optimal medical treatment on diabetes-related complications and quality of life?	80.1
7	What is the comparative effectiveness of community-based obesity prevention programs in adults and children with disabilities?	80.0
8	In adults with overweight or obesity, what are the effects of different elements of lifestyle management programs on adherence, weight loss, weight regain? For example: nutrition education, communication and support, and specific behavior change therapies such as cognitive behavior therapy.	79.3
9	What are the effects of lifestyle intervention delivery modes including face-to-face, remote, and hybrid delivery for weight management and weight loss in adults with overweight and obesity?	75.9
10	In adults with obesity who had bariatric surgery, what are the effects of different post-operative lifestyle intervention programs (exercise, behavioral, dietary) on weight loss and weight loss maintenance?	75.0

3.2.5 | Qualitative consultation results

Free-text fields throughout the questionnaire gave an opportunity for experts to express their views about the focus and direction of review questions. Experts took the opportunity to address the broader picture, contributing ideas and insights on the drivers of population obesity, describing promising intervention programs, and discussing obesity research in general. Six themes emerging from expert contributions are summarized below.

Theme 1. Real world applications

Experts expressed support for reviews of interventions in everyday community settings. For example, children and adults within the context of their families, primary care, and multi-sectoral cooperation such as with schools and workplaces. Several experts described indigenous community initiatives as needing evaluation and review. Experts also supported more reviews of evaluation methods and measures to capture the seemingly diffuse effects of larger scale interventions. One contributing expert summed up as follows “The most valuable interventions for obesity prevention are the multi-faceted, structural/policy, long-term studies but these are the least attractive to review and have the least number of studies. However, they do point to a big gap in the research, rather than a gap in the reviews.”

Theme 2. In-depth questions

Experts requested greater examination of which particular program elements were potent and durable, and by which mode they are best delivered, that is, remote versus face-to-face.

Theme 3. Sustainability

Experts were less interested in the short-term “easy wins” as measured in kilograms of weight lost. Instead, there was a demand for a focus on longer-term outcomes. How durable are program effects, and do they translate into improved longevity, and quality of life in its widest sense for individuals and populations? For example, the most highly prioritized review questions in one section were not to do with surgical techniques, but with post-operative lifestyle on weight maintenance, and a range of long-term cardiometabolic outcomes many years later.

Theme 4. Social bias and mental health

Mental health appears to be inextricably bound up with obesity, due to both the stigma suffered from being obese, and the potential for compounding stigma through well-intended prevention and treatment interventions. Hence a number of experts elevated the importance of considering psycho-social effects in reviews. Experts suggested the following mental health effects be included: eating disorders, depression, anxiety, and suicide risk. The potential of heightened stigma arising from poorly-framed public campaign messages was flagged. The delivery of weight management interventions targeted to individuals by healthcare professionals, who may be biased or lack scientific understanding, was seen as potentially harmful. Thus the training of healthcare professionals was seen as an area worthy of systematic review. One expert suggested that healthcare professional training component measures of

interest include pre-existing beliefs and attitudes and communication techniques. In fact, a draft review question related to this achieved a quantitative percentage support rating of 72.4%, and was ranked 14th out of the 43 review questions (refer to Table S1).

Theme 5. Unintended negative consequences of interventions

As well as mental health concerns above, experts recommended that systematic reviews should include negative and unintended outcomes arising from obesity interventions, such as nutritional deficiencies post-bariatric surgery. Longer-term outcomes were desired, such as the effect on individuals in adulthood after receiving weight intervention as a child. One expert expressed the view that all Cochrane reviews should capture negative as well as positive outcomes as a matter of course.

Theme 6. Equity and addressing underserved groups

There is thought to be an urgent need for systematic reviews to address factors related to how to develop better interventions for groups traditionally seen as vulnerable or hard-to-reach. In other words, people who may face various constraints and barriers within an obesogenic environment, and who are not being effectively served by current obesity treatment and prevention programs. Culturally-specific interventions for indigenous communities, often originating from within those communities, were seen as promising and in need of evaluation and review. Some experts highlighted poverty and food insecurity as drivers of obesity. Disparities in access to bariatric surgery was seen as a glaring example of inequity. This theme is reflected in the quantitative results, with two of the top 10 questions being about evaluating programs for persons with disabilities.

Feedback on draft review question wording

Although there was a prompt in the questionnaire for experts to propose modifications or alternative wording to draft review questions, this option was not often taken up. What was received was quite mixed, with some experts wanting to tighten the scope of the proposed reviews, while others wanted to broaden them. Experts made helpful suggestions for a variety of specific elements of the programs and outcomes to be measured.

Contributed suggestions for new review topics

New topics for review were suggested, with some raising them as general ideas, and a few framed into review question format using the PICO approach. The population in late-adolescence and early-adulthood was considered an “especially difficult period.” Reviews of sleep interventions targeted at this age group were suggested, such as modifying school start times and sleep hygiene practices. Examples of community initiated programs were described as needing evaluation and review, particularly indigenous family-oriented programs. There was interest in reviewing large scale policy and economic interventions to secure reliable access to healthy foods, as well as consideration of disincentives (such as surtaxes) to selected unhealthy foods. More in-depth review examining the utility of various measurement tools for diagnostic and prognostic purposes was suggested, which may in turn benefit other obesity studies, reviews, and clinical practice.

The existing Cochrane Review on exercise was highlighted as being due for updating in light of recently emerging published literature.

4 | DISCUSSION

This project has reported the top ten research review priorities for new systematic reviews on the topic of prevention and treatment of obesity after a careful mapping exercise of 22 international guidelines with 43 Cochrane reviews and protocols. The results have the potential to guide and influence funder and reviewer choices in this field.

This project has a number of strengths. It was wide-ranging, inclusive, and employed robust methods. While a variety of approaches are useful in identifying high priority topics,^{38,39} a point of difference for this study is that we used international evidence-based practice guidelines as our starting point. This allowed us to hone in on information needs as identified by practitioners in the field, providing depth of detail allowing formulation of well-designed review questions that have the possibility of closing research review gaps. Potential questions were scrutinized and assessed by a range of international stakeholders with various spheres of expertise in the field of obesity.

The extensive feedback generously contributed by the expert stakeholders was also a strength of this study. Experts commented on the need for systematic reviews to be framed to take into account real-world realities, sustainability of positive outcomes, and to capture any negative outcomes of obesity interventions. Experts also wanted to elevate the needs of traditionally under-served and vulnerable groups. The current research also highlighted the need for review priorities to be responsive to changing circumstances. With the consultation prioritization phase being conducted 2021–22 following peak COVID pandemic restrictions, it is not surprising that there is new interest in the comparative effectiveness of remote delivery modes, with a draft review question examining such modes emerging as one of the top 10 rated questions.

There were several study limitations. The scope of this study included only Cochrane reviews and protocols until 2020. The COVID pandemic generated staffing issues which resulted in the project progressing more slowly than planned before the pandemic. Another limitation was that the method employed were unlikely to identify any entirely novel emerging approaches currently being trialed in the primary research literature. We sought to address this limitation by asking for fresh suggestions for review topics during the consultation and prioritization phase. Further analyses could have been done to examine whether priorities varied according to expert roles, for example, clinicians versus policymakers. This project was limited to Cochrane reviews and we acknowledge that there are many other reviews on the topic that could have been included. Finally, it may have been ideal if the draft review question had been subjected to an iterative Delphi-style process to incorporate new and evolving expert ideas and to potentially create broad consensus. However the results of a single round of prioritization assessments as used here were well-delineated, providing a clear indication for an agenda for reviews to be conducted in the immediate future.

It is critical that systematic reviewers ask the right questions. The current research project serves as a vehicle to update the direction of systematic review priorities, to bolster the evidence base for successfully intervening in obesity. This type of research should be repeated periodically to ensure that we are on track, and that no population group is overlooked. It is through greater collaboration between the myriad of stakeholders that we may make strides in defeating the obesity epidemic.

5 | CONCLUSION

We recommend reviewers and funders address with some urgency the top 10 leading prioritized review questions presented.

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CONFLICT OF INTEREST STATEMENT

RR, AS, MIM, SD, CN, LB, and CF have been contributors to Cochrane reviews, including some of the reviews included in this project. AS, MIM, and CF were included among the 36 expert stakeholders who submitted the questionnaire. SD, CN, LB, and CF hold various unpaid editorial or directorship roles with various Cochrane research and locality groups. MIM, LB and CF and have served in Cochrane governance in in a voluntary capacity. LB declares that the University of Colorado receives remuneration for her current role as Senior Editor, Research Integrity. The authors declare no competing interests.

ORCID

Michelle Blaxall  <https://orcid.org/0000-0002-4954-9972>

Celeste Naude  <https://orcid.org/0000-0002-9114-1452>

Cindy Farquhar  <https://orcid.org/0000-0002-3685-3553>

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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