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Effective behaviour change techniques in the prevention and management of childhood
obesity

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Abstract

Rates of childhood obesity are increasing, and it is essential to identify the active components of interventions aiming to prevent and manage obesity in children. A systematic review of behaviour change interventions was conducted to find evidence of behaviour change techniques (BCTs) that are most effective in changing physical activity and/or eating behaviour for the prevention or management of childhood obesity. An electronic search was conducted for Randomised Controlled Trials (RCTs) published between January 1990 and December 2009. Of 4,309 titles and abstracts screened, full texts of 135 articles were assessed, of which 17 published articles were included in this review. Intervention descriptions were coded according to the behaviour-specific CALO-RE taxonomy of BCTs (1). BCTs were identified and compared across obesity management ($n = 9$) vs. prevention ($n = 8$) trials. To assess the effectiveness of individual BCTs, trials were further divided into those that were effective (defined as either a group reduction of at least 0.13 BMI units or a significant difference in BMI between intervention and control groups at follow-up) vs. non-effective (reported no significant differences between groups).

We reliably identified BCTs utilised in effective and non-effective prevention and management trials. To illustrate the relative effectiveness of each BCT, effectiveness ratios were calculated as the ratio of the number of times each BCT was a component of an intervention in an effective trial divided by the number of times they were a component of all trials. Results indicated six BCTs that may be effective components of future management interventions (provide information on the consequences of behaviour to the individual, environmental restructuring, prompt practice, prompt identification as role model/position advocate, stress management/emotional control training, and general communication skills training), and one that may be effective in prevention interventions (prompting generalisation of a target behaviour). We identified that for management trials, providing information on the

50 consequences of behaviour in general was a feature of non-effective interventions and for
51 prevention trials, providing information on the consequences of behaviour in general,
52 providing rewards contingent on successful behaviour and facilitating social comparison
53 were non-effective.

54 To design effective behaviour change programmes for the prevention and
55 management of childhood obesity, we would recommend utilising the BCTs identified as
56 effective in this review. The impact on intervention effectiveness of combining BCTs should
57 be the topic of further research.

58

59	<i>Key words</i>
60	Childhood Obesity
61	Prevention
62	Management
63	Behaviour Change Techniques
64	Taxonomy
65	Effectiveness

66 Effective behaviour change techniques in the prevention and management of childhood
67 obesity
68

69 Introduction

70 Given the dramatic rise in childhood obesity over the last decade (2-4), it is essential to
71 design interventions that are effective in preventing and managing childhood obesity.
72 Behaviour modification or lifestyle change has become a burgeoning avenue of investigation
73 in this area. Systematic reviews of interventions and clinical guidelines clearly indicate that
74 successful interventions for preventing and managing obesity in children are complex and
75 multi-component - aimed at changing both physical (or sedentary) activity and diet or healthy
76 eating (e.g., 5-9) and comprise multiple, potentially interacting methods of changing
77 behaviour. Despite the vast amount of active investigation in this area, little research has
78 deconstructed interventions and identified which individual components are most successful
79 in changing obesity-related health behaviour in children. A lack of consistent terminology for
80 defining intervention components has also hindered interpretation and replication. It is
81 currently unclear what the active ingredients for bringing about obesity-related behavioural
82 change are and thus, evidence to support the content of effective obesity prevention and
83 management interventions in children is still relatively weak (5, 10-12).

84 There is no lack of evidence that positive changes in behaviours linked to obesity can
85 be effective in preventing and managing obesity in children. Hill, Wyatt, Reed and Peters
86 (13) report that even small changes in behaviour that amount to a decrease in calorie intake of
87 only 100Kcal per day can effectively prevent weight gain. Randomised Controlled Trials
88 (RCTs) of lifestyle interventions have reported moderate success in changing obesity-related
89 behaviour in prevention trials (5) and produce potentially clinically significant reductions in

90 overweight in management trials (7, 14). It is important that these positive findings can be
91 replicated, thus, there is clear value in identifying the specific behaviour change techniques
92 (BCTs) used in such interventions that are effective in achieving and sustaining behavioural
93 change. The complex and multi-component nature of such interventions further underlines
94 the need for developing methods to systematically deconstruct intervention content. This is a
95 particularly imperative task for the successful prevention and management of obesity in
96 childhood and adolescence, as it is important to identify specific BCTs that are particularly
97 effective for this age group that may be distinct from those used in adult interventions. There
98 may also be an important distinction between BCTs that are effective in preventing childhood
99 obesity and those that manage obesity in children who are already overweight or obese.

100 Formally evaluating the content of interventions is inherently difficult. Recent
101 guidelines in the field of health psychology aim to establish more open and detailed reporting
102 of interventions to aid the scientific development of behaviour change interventions
103 (CONSORT, 15; Workgroup for Intervention Development and Evaluation Research:
104 WIDER, 16), though these are not universally adhered to and current reporting of
105 intervention content is generally poor and inconsistent (17), thus limiting what we can learn
106 about behaviour change (18).

107 Categorising the components of behaviour change interventions in the field of
108 childhood obesity is complex and attempts to define BCTs are generally idiosyncratic (and
109 potentially non-replicable). For example, some authors have developed their own
110 classifications for extracting such data: Kamath et al. (5) extracted data concerning
111 “informational, cognitive, behavioural, environmental and social support components”
112 (p4607) of interventions, and Sargent, Pilotto and Baur (19) extracted information on
113 “strategies to achieve behaviour change” (p4). Such classifications lack the benefit of precise
114 and standard definitions that allow authentic replication and useful comparisons of BCTs

across intervention trials. More wholesome descriptions of common behaviour change methods in obesity interventions do exist (see e.g., 6, 20, 21) but it is not always clear how (or if) these descriptions apply to interventions aimed at children.

As part of the advancement of a science of behaviour change, Abraham and Michie (22) developed a taxonomy of 26 conceptually distinct component BCTs, which are described using consistent terminology and standard definitions. This taxonomy has been reliably applied to identify and categorise BCTs featured in obesity prevention programmes involving parents and children (23) and in healthy eating and physical activity interventions with adults (24). More recently, the original taxonomy (22) has been revised and extended into a behaviour specific taxonomy of 40 BCTs for physical activity and healthy eating behaviours (CALO-RE: 1). The CALO-RE taxonomy was developed by three teams of researchers to provide standard definitions to reliably identify techniques used for 1) increasing physical activity and healthy eating in obese adults with additional risk factors for morbidity, and 2) increasing self-efficacy to promote lifestyle and recreational physical activity. A total of 72 studies across a variety of populations, behaviours and settings were used as a basis of developing the taxonomy. The authors argue that the CALO-RE taxonomy is more comprehensive than the original, with fewer conceptual problems and less overlap between items, as well as clearer labels and definitions. This taxonomy can be used to analyse the content of behaviour change interventions in depth and also provides a means of improving reporting and aiding replication attempts by specifying BCTs. For the purposes of this review, this taxonomy was used to identify BCTs in physical activity and healthy eating interventions for the prevention and management of childhood obesity. To our knowledge, this taxonomy has not yet been applied to obesity-related behaviour change interventions with children and adolescents.

We conducted a systematic review to select RCTs of childhood obesity interventions that utilised BCTs as a means to prevent or manage obesity in children and adolescents. From this, we coded intervention descriptions using the CALO-RE taxonomy to identify BCTs that were used in such interventions. In order to work towards aiding intervention designers in the field to build effective BCTs into childhood obesity interventions, this paper aims to 1) identify and code BCTs used in a sample of prevention and management interventions for childhood obesity using the CALO-RE taxonomy, and 2) establish which individual BCTs are components of effective interventions to manage and prevent childhood obesity.

Method

Study selection

A systematic review was conducted of RCTs of obesity management or prevention conducted with children and adolescents (aged 2-18 years) that assessed the impact of interventions including at least one BCT from the CALO-RE taxonomy compared with a no-treatment control group. Interventions that solely tested the impact of physical activity, education, and/or calorie controlled diets with no behaviour change element were excluded, as were interventions that combined drug treatment or surgery with BCTs. Interventions could be carried out in any setting (e.g., school, clinic, community) and be delivered by any professional (e.g., health professional, teacher, therapist) over any length of time. It is important that desired health outcomes are maintained over time therefore to assess the maintenance of intervention effects; we selected only interventions that reported results 6 months beyond the point when active intervention ended. The Transtheoretical Model (TTM: 25) argues that long term changes in behaviour may be assessed only after this time period has elapsed. The primary outcome measure was Body Mass Index (BMI). BMI is the only indirect measure of adiposity in childhood that has been shown to be associated with future

risk of mortality from Coronary Heart Disease (CHD) in adulthood (11) and can be used as a physiological proxy measure of later health outcomes (26-28). BMI was also the only single comparative outcome reported across trials.

Search Strategy and results

An electronic search was conducted in the following electronic databases: MEDLINE, EMBASE, PsycINFO, Cochrane library (Cochrane Central Register of Controlled Trials), HMIC (Health Management Information Consortium), AMED (Allied and Complementary Medicine Database), and CINAHL (Cumulative Index to Nursing and Allied Health Literature) for Randomised Controlled Trials published between January 1990 and December 2009. Search terms (available as a supplementary electronic file) covered the concepts of ‘obesity’ ‘children’ ‘behaviour change interventions’ and ‘BMI’ and closely followed the search strategies of similar reviews (e.g., 5, 7) and published guidelines for identifying randomised controlled trials (29).

One reviewer (JM) screened 4,333 unique titles and abstracts for eligibility and a second reviewer (AC) screened a random (10%) sample of records, yielding 100% agreement between reviewers. After initial screening of title and abstract, full texts of 135 potentially relevant studies were screened for eligibility independently by the two reviewers. Three unpublished dissertations were unavailable for further screening and were excluded. We explored unpublished literature and received a good response from experts, but no further studies were included in the review from these avenues. Agreement regarding inclusion between reviewers was 70%, and disagreements were resolved through careful discussion. Seventeen published manuscripts were included in this review (30-46). The selection process for studies is presented in Figure 1.

Coding of Behaviour Change Techniques

To obtain more complete intervention descriptions and assist data extraction for BCTs, where intervention protocols were published or available elsewhere, the manuscript was located ($n = 11$; 47-57) and the intervention characteristics were coded from both sources. The authors of the further 6 intervention studies were contacted (on up to two occasions) with a request for copies of the corresponding intervention protocol or any additional documents detailing the intervention content. Three authors did not reply; one author could not locate the original protocol; one author informed us that the protocol was available in Finnish language only, and another author provided further details of the intervention mechanisms, published elsewhere on which the intervention characteristics were coded.

The content of interventions was assessed by two reviewers (JM & AC) who independently coded the descriptions of each intervention using the CALO-RE taxonomy (1) for inclusion of BCTs. Intervention descriptions were read line-by-line and assigned a BCT label from the taxonomy where appropriate. A stringent coding method was applied so that in cases where further information was required to assess whether a BCT was present or absent, it was coded as absent. We chose not to seek further clarification from the authors, as we wanted to assess published information only.

The two coders practised coding on eight intervention studies not selected for the review, and discussed disagreements. All interventions were then coded independently and inter-rater reliability, assessed using percent agreement, was high (93%). Disagreements between the coders were discussed at length and a final decision on which BCTs were assigned to interventions was agreed. Based on the nature of disagreements, we refined BCTs in the taxonomy (see electronic supplementary material, Table 1 for a summary of our revisions to the CALO-RE taxonomy). To summarise the revision process, we took the

following steps: 1) we revised descriptions of techniques where agreement was reduced due to misapplication of the code; 2) we added examples specific to our sample of childhood obesity trials within technique definitions; 3) we clarified the difference between similar codes where we had encountered disagreements; and 4) one additional technique was identified and defined. We verified that the revised taxonomy was also effective in categorising BCTs in the same set of papers by having a third independent coder (FL) repeat the coding task using the revised taxonomy. Agreement remained high (88%) showing that these constructs exist independently in the selected set of papers.

Assessing intervention and BCT effectiveness

We divided coded interventions into those that aimed to prevent ($N = 8$) vs. manage ($N = 9$) childhood obesity. Prevention trials included both overweight and normal weight participants and management trials included overweight participants only.

We then divided up prevention and management trials into effective vs. non-effective using BMI outcome data. Effective management trials ($N = 6$) were defined as trials in which the standardised difference in the mean value of BMI between groups at follow-up was at least ≥ -0.13 (this was the average effect size demonstrated from meta-analysis data, 58). Less stringent criteria were applied to prevention studies to take into consideration that not all of these trials targeted weight loss measured by a reduction in BMI. The criteria for assessing effectiveness in prevention trials was defined as a significant difference ($p < .05$) in BMI at follow-up between groups ($N = 4$).

To assess the effectiveness of BCTs, and to illustrate the relative weight of each BCT taking into consideration it potentially being a component of both effective and non-effective trials, a percentage effectiveness ‘ratio’ was calculated as the ratio of the number of times

each BCT was a component of an intervention in an effective trial divided by the number of times they were a component of all trials, including non-effective trials.

Results

First, we present the BCTs coded in effective and non-effective prevention and management interventions. Second, we present differences in BCTs and effectiveness ratios between effective and non-effective interventions for prevention and management trials.

BCTs in effective and non-effective prevention and management interventions

Out of the 40 BCTs in the taxonomy, we agreed that there was no (or insufficient) evidence that 11 of them were present in any of the interventions (representing 100% agreement between coders). For the remaining 29 BCTs, inter-rater reliability was good (59) for 17 (average kappa value = 0.71 [range = .485 to 1.00], average percentage agreement = 92% [range = 71% to 100%]) and sub-optimal for the remaining 12 due to missing data and low counts of instances of BCTs across the studies. In the light of this, disagreements were discussed at length between the coders before final codes were applied. The coders also agreed a new code which was added to the CALO-RE taxonomy (Exposure to healthy choices) from our revisions ($n = 41$ BCTs in total in revised CALO-RE taxonomy). This BCT was encountered as an additional method of achieving behaviour change within the pool of studies (see the supplementary file). The coding exercise did not identify any BCTs in any of the control groups.

Table 1 presents BCTs (and their frequency) coded in effective and non-effective prevention and management trials. BCTs that were unique features of management trials (i.e., were not used in prevention trials) were: Prompt review of behavioural goals, relapse prevention/coping planning, shaping, provide information on where and when to perform the behaviour, environmental restructuring, prompt self-talk and motivational interviewing. BCTs that were unique to prevention trials were: Provide normative information about

others' behaviour, prompt rewards contingent on effort or progress towards behaviour, action planning, provide feedback on performance, teach to use prompts/cues, and facilitate social comparison.

Effective BCTs in obesity management

All but three out of the nine obesity management interventions selected for review were effective according to our criteria (30-32, 40, 42, and 43). An average of 7.5 (range = 3-15) BCTs from the CALO-RE taxonomy were identified at least once across these interventions (effective and non-effective) and there was little difference in mean number of BCTs coded in effective ($M = 8$) vs. non-effective ($M = 7$) interventions. Twenty-four out of 41 (59%) BCTs were identified in at least one of the interventions. Thirteen of these techniques were unique to effective trials, two were unique to non-effective interventions and nine appeared at least once in both effective and non-effective trials. Figure 2 presents the ratio of effectiveness for BCTs appearing two or more times in trials. In order that the ratio was meaningful and to be satisfied that there was 'evidence' of effectiveness for individual BCTs, we required that a BCT must be a feature of two or more trials, therefore the five unique BCTs appearing only once in effective trials were excluded. These criteria have been used in previous studies assessing BCT effectiveness (60, 61). Six BCTs achieved 100% effectiveness ratios (Provide information on consequences of behaviour to the individual, Environmental restructuring, Prompt identification as role model/position advocate, Stress management/Emotional control training, General communication skills training and Prompt practice) and one BCT (Provide information on consequences of behaviour in general) had a 100% non-effective ratio.

Effective BCTs in obesity prevention

According to our effectiveness criteria, four trials reported in favour of the intervention (33-35, 46) and four trials reported no difference between groups (36-39). An average of 8 BCTs (range = 1-12) from the CALO-RE taxonomy were identified at least once across these interventions and there was again little difference in the mean number of BCTs coded between effective ($M = 8.5$) vs. non-effective ($M = 7.5$) trials. Twenty-four out of 41 (59%) BCTs were identified in at least one of the effective and non-effective interventions. Only one of these BCTs (prompt generalization of a target behaviour) was unique to effective trials, seven were unique to non-effective interventions and 16 appeared at least once in both effective and non-effective trials. Again, an effectiveness ratio was calculated to illustrate the relative weight of each BCT appearing in two or more trials (Figure 3). Only prompt generalization of a target behaviour achieved a 100% effectiveness ratio. Three BCTs were shown to be 100% non-effective (provide information on the consequences of behaviour in general, provide rewards contingent on successful behaviour and facilitate social comparison).

Discussion

This review is the first to utilise a behaviour specific taxonomy of BCTs to formally and systematically identify the components of childhood obesity interventions. We linked individual BCTs with positive health and behavioural outcomes, by assessing effectiveness ratios, thus providing some evidence for the inclusion of particular BCTs as active agents of change in interventions aiming to prevent and manage childhood obesity in the long term. We reliably identified BCTs utilised in prevention and management trials and identified BCTs that were unique features of each. Effectiveness ratios demonstrated an evidence base for the inclusion of BCTs that were unique features of effective interventions. Six BCTs were

identified as uniquely effective (i.e., achieved 100% effectiveness ratios) in obesity management interventions and one BCT for obesity prevention interventions. Effectiveness ratios also demonstrated BCTs that were components of non-effective trials. One BCT was identified as uniquely non-effective for obesity management interventions and three BCTs for prevention interventions.

There is currently little evidence supporting the inclusion (or not) of BCTs in childhood obesity programmes. It is unknown in particular, 1) whether individual BCTs are more effective in the prevention or management of obesity, 2) whether (and how) the content of programmes may differ to those applied to adults, and 3) if particular BCTs may be more or less effective when applied to specific target groups (e.g., parents vs. children) or intervention modes (e.g., delivered in school vs. hospital). The only general guidance of this nature we have identified was included in the UK National Institute for Health and Clinical Excellence (NICE) guidance on the prevention, identification, assessment and management of overweight and obesity in adults and children (9). BCTs such as self-monitoring, goal setting and providing rewards are recommended in this guidance and no further information is offered in relation to the above issues. In our sample of papers, we found inconclusive evidence that self-monitoring and goal setting were consistently effective techniques in both prevention and management trials. Our findings suggest that providing rewards was actually ineffective for obesity prevention. The potential difference in content between programmes aimed at adults vs. children, and the effectiveness of BCTs applied to particular groups or modes of intervention delivery are important topics of further research in this area. From our work here however, we would recommend intervention designers in the field build into interventions the BCTs shown here in relation to specific prevention and management programmes for children and adolescents.

There are a number of issues we would like to highlight from this review. First, formally defining the content of trials is inherently problematic due to reporting inconsistencies and differences in terminology which may have resulted in providing an incomplete picture of some interventions and potentially led to exclusion of eligible studies in the selection stages of this review. We applied a stringent coding strategy where BCTs were not coded as present if there was insufficient description, therefore it may be the case that we coded as absent techniques that the authors of the intervention would argue were present. This issue has been identified in previous attempts to categorise intervention content (21). To advance and implement a science of behaviour change in the field of childhood obesity, we would echo calls for improving the quality of reporting of trials (15-18). Likewise, given that only a small pool of studies reached our stringent criteria, we would acknowledge the need for more studies in this field that are conducted as RCTs, contain control conditions, and report data at least 6 months after the intervention has ended.

Second, this is the first time to our knowledge that the CALO-RE taxonomy has been applied to interventions for children, and we made a number of revisions to the descriptions of BCTs. The authors of the original taxonomy themselves identify that the development of behaviour-specific taxonomies is an iterative process and revisions are inevitable and indeed welcome (1). However, we would stress that, even with our revisions, the CALO-RE taxonomy may not characterise every strategy used in childhood obesity interventions. In a larger sample, we would anticipate that the CALO-RE taxonomy may be revised further, and new BCTs added. For this reason, we would not recommend discarding BCTs in the CALO-RE taxonomy that we agreed were not present in any of the interventions in this review.

The third issue relates to the ability to isolate and assess the effect of individual BCTs in interventions. Our findings are limited to the impact of individual BCTs and we did not assess the effect of combinations of BCTs. We therefore cannot assess whether BCTs

demonstrated to be individually effective did not contribute to effective outcomes only as a combination, or whether, when combined differently, their effectiveness would alter. It is worth noting that the BCTs we have shown to be non-effective may well prove to be effective in (alternative) specific combinations, or applied to specific populations or different modes of intervention delivery. Dumbrowski et al. (62) assessed the effect of combining theory-congruent clusters of BCTs on outcomes of behaviour change interventions with obese adults and found that interventions that included BCTs congruent with Control Theory were associated with an increase in weight loss. Exploring combinations of BCTs according to other theories of behaviour change may also prove fruitful, for example, goal setting might be more effectively paired with action planning to enable the initiation and enactment of behavioural change according to the theory of implementation intentions (63). Our findings demonstrate the BCTs we have the best available evidence possible for, but this should not be at the expense of investigating other BCTs, individually or in combination. Evidence demonstrates that the most successful interventions contain combinations of BCTs therefore addressing these issues is of prime importance.

Finally, we would like to comment on the clinical value of using BCTs as components of childhood obesity interventions, since the effects of our sample of studies reviewed here were variable and there is currently little consensus on the clinical reductions that may reasonably be expected from behavioural modification. Unfortunately, evidence suggests that the effects of interventions to promote healthy eating are variable (18), and this variability was reflected in our sample of trials, potentially limiting our findings in relation to effective vs. non-effective BCTs. Smaller effect sizes may be explained by our measurement time frame (i.e., at least 6 months after the intervention had ended) as we would anticipate that differences between intervention and control groups would diminish over this time period, after initial weight loss in intervention groups had stabilised. However, we would argue that

this pattern of weight loss (and subsequent gain or stabilising) represents an accurate picture of weight loss maintenance and it is essential to be clear about the impact of behaviour change interventions over time. Observed effect sizes for trials in this review were small, and our method of classifying trials as effective vs. ineffective may have limitations compared to other methods of assessing effectiveness. However, our findings clearly illustrate that the effectiveness of interventions is currently being hampered by the inclusion of BCTs that are ineffective in achieving clinically valuable reductions in BMI, and this may explain why such interventions fare so poorly in achieving (and maintaining) larger reductions in BMI over time. We have reflected on the clinical meaning of our observed effect sizes and concluded that although small, such unit reductions in BMI can be related to reduced risks of adverse health outcomes. A linear relationship between BMI in childhood and risk of CHD (64) and diabetes (65) in adulthood has been demonstrated, for example, and reductions in BMI also impact upon ‘secondary’ health outcomes such as cholesterol levels, blood pressure, and psychological well-being that exist along with obesity (66).

There is currently no clear evidence upon which to include (or not include) BCTs in successful childhood obesity prevention and management programmes. It is absolutely essential to develop such knowledge so that intervention designers in the field can apply these findings to practice. We outline here a novel approach for establishing the effectiveness of BCTs in childhood obesity interventions: this is the first study of its kind (to our knowledge) in this behavioural domain to relate BMI outcomes at 6 months to intervention content.

We have outlined a number of issues remaining to be addressed; however, the methods used in this review represent an important first step towards establishing a method by which it is possible to distinguish between effective and non-effective components of interventions. The results of this study offer the first evidence for the inclusion of effective

412 BCTs in childhood obesity prevention and management programmes, and may contribute to
413 our theoretical understanding of the mechanisms under-pinning obesity-related behaviour
414 change. Identifying and utilising effective BCTs for childhood obesity interventions will aid
415 the development of potentially more effective, replicable and targeted interventions, policies
416 and guidelines for health professionals in the field, thus building a strong evidence-base to
417 support obesity prevention and management in children.

418 Supplementary information is available at the journal's website

419 Conflict of interest statement: The authors have no conflicts of interest to declare

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615

616 *Table 1 Frequency of Behaviour Change Techniques coded in effective and non-effective*
617 *obesity prevention and management trials*

Behaviour Change Techniques	Prevention		Management	
	Effective	Non-effective	Effective	Non-effective
Provide information on consequences of behaviour in general	0	2	0	1
Provide information on consequences of behaviour to the individual	3	2	5	0
Provide normative information about others' behaviour	0	1	0	0
Goal setting (behaviour)	2	3	4	3
Action planning	0	1	0	0
Barrier identification	1	1	2	3
Set graded tasks	1	0	1	0
Prompt review of behavioural goals	0	0	3	1
Prompt rewards contingent on effort or progress towards behaviour	1	1	0	0
Provide rewards contingent on successful behaviour	0	2	3	3
Shaping	0	0	1	0
Prompting generalization of a target behaviour	2	0	1	0
Prompt self-monitoring of behaviour	4	3	3	1
Provide feedback on performance	1	1	0	0
Provide information on where and when to perform the behaviour	0	0	1	0
Provide instruction on how to perform the behaviour	1	2	3	2
Model/Demonstrate the behaviour	2	1	1	0
Teach to use prompts/cues	0	1	0	0
Environmental restructuring	0	0	3	0
Agree behavioural contract	1	0	1	3
Prompt practice	3	1	2	0
Facilitate social comparison	0	2	0	0
Plan social support/social change	2	3	2	1
Prompt identification as role model/position advocate	1	0	3	0
Prompt Self talk	0	0	1	0
Relapse prevention/coping planning	0	0	3	1
Stress management/Emotional control training	1	0	2	0
Motivational interviewing	0	0	0	1
General communication skills training	2	2	2	0
Exposure to healthy choices	1	1	1	0

618 Figure captions

619 *Figure 1 Flow chart of trials selected for review*

620

621 *Figure 2 Percentage effectiveness of Behaviour Change Techniques in obesity*

622 *management trials*

623

624 *Figure 3 Percentage effectiveness of Behaviour Change Techniques in obesity*

625 *prevention trials*





